Abstract Book for

International Agriculture Conference

"Current Innovations and Technological Advances in Agriculture and Allied Sciences (CITAAS 2024)"

Organized by:

Faculty of Agriculture, GKU, Talwandi Sabo

in collaboration with

Dept. of Agriculture & Farmer's Welfare,

Horticulture Dept., Govt. of Punjab

ISASTR, Noida & Just Agriculture Edu. Group

on 29th-31st August, 2024

at GKU, Talwandi Sabo, Bathinda (Punjab)

Editors

Dr. D.P.S. Badwal

Dr. Sushila Hooda

Dr. Mohit Bharadwaj

Dr. Piyush Choudhary

JUST AGRICULTURE PUBLICATIONS

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BOOK OF ABSTRACTS

International Conference
on
Current Innovations and Technological Advances in Agriculture and Allied Sciences (CITAAS-2024)

29th- 31st August, 2024

रवनीत सिंह
RAVNEET SINGH

राज्य मंत्री
खाद्य प्रसंस्करण उद्योग एवं
रेल मंत्रालय
भारत सरकार
MINISTER OF STATE
FOOD PROCESSING INDUSTRIES
AND RAILWAYS
GOVERNMENT OF INDIA

MESSAGE

It is a privilege to address you at the International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences", organized by Guru Kashi University, Talwandi Sabo. This conference is a significant opportunity to delve into the latest advancements and explore how they can revolutionize the agricultural and food processing sectors.

In India, agriculture and food processing are vital pillars of our economy, contributing significantly to our nation's growth and food security. As we navigate the complexities of the modern world, including climate change, resource constraints, and the need for sustainable practices, it is crucial that we embrace innovation and technological progress. The theme of this conference highlights the transformative potential of new research and technologies in enhancing productivity, sustainability, and resilience in agriculture and allied sciences.

I congratulate Guru Kashi University for its commitment to fostering an environment of learning and innovation. By bringing together experts, researchers, and industry leaders from around the globe, this conference will facilitate invaluable exchanges of knowledge and collaborative efforts that can lead to ground-breaking solutions.

I am confident that the insights and discussions generated here will play a pivotal role in shaping the future of agriculture and food processing, not only in India but worldwide. Together, let us work towards a more sustainable and prosperous future for all.

Thank you, and I wish you all a successful and inspiring conference.

(Ravneet Singh)

Date - 12th August, 2024

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आज़ादी का अमृत महोत्सव

भारत सरकार
कृषि एवं किसान कल्याण मंत्रालय
कृषि एवं किसान कल्याण विभाग
कृषि भवन, नई दिल्ली-110001
Government of India
Ministry of Agriculture & Farmers Welfare
Department of Agriculture & Farmers Welfare
Krishi Bhawan, New Delhi-110001

Dated: 22nd August, 2024

Message

I am delighted to extend my warm greetings to all participants of the International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences," organized by Guru Kashi University.

In today's rapidly evolving agricultural landscape, innovation and technology have become the cornerstones of sustainable growth and development. The role of science and research in transforming agricultural practices cannot be overstated. This conference is a timely initiative that brings together experts, academicians, and practitioners to share their insights and advancements in the field.

Guru Kashi University's dedication to fostering knowledge and promoting research in agriculture is commendable. This event serves as a platform for exchanging ideas and exploring new methodologies that can significantly enhance productivity, ensure food security and address the challenges posed by climate change.

I am confident that the deliberations at this conference will inspire innovative approaches and collaborations that will contribute to the progress of Indian agriculture. My best wishes to all participants for a fruitful and engaging experience.

(P.K. Singh)

सत्यमेव जयते

डॉ. हिमांशु पाठक
DR. HIMANSHU PATHAK
सचिव (डेयर) एवं महानिदेशक (आईसीएआर)
Secretary (DARE) &
Director General (ICAR)

भारत सरकार
कृषि अनुसंधान और शिक्षा विभाग एवं
भारतीय कृषि अनुसंधान परिषद
कृषि एवं किसान कल्याण मंत्रालय, कृषि भवन, नई दिल्ली–110 001

GOVERNMENT OF INDIA
DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION (DARE)
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MESSAGE

I am happy to know that the Guru Kashi University is organizing the International Conference on 'Current Innovations and Technological Advances in Agriculture and Allied sciences' (CITAAAS-2024) during August 29-31, 2024 at Talwandi Sabo, Bathinda, Punjab. This conference serves as a critical forum for the exchange of ground-breaking ideas and transformative technologies that are poised to shape the future of agriculture.

Agriculture today stands at a transformative juncture, driven by remarkable technological advancements and innovative practices. Technological options are not only enhancing productivity and sustainability but also addressing the challenges of food security, climate change, and resource management. Therefore, it is crucial to recognize the pivotal role of research and development in driving these transformative changes. Our commitment to integrate advanced technologies such as artificial intelligence, biotechnology, and precision farming into mainstream agricultural practices has produced significant results. These innovations empower our farmers, ensure efficient resource utilization, and promote environmental sustainability.

I congratulate the Guru Kashi University for organizing the International conference. I hope the event will provide the opportunity to inspire change, drive innovation, and build a resilient sustainable agricultural ecosystem.

I wish the International conference a grand success.

(Himanshu Pathak)

Dated the 02nd, August, 2024
New Delhi

Dear Esteemed Delegates, Respected Colleagues, and Honored Guests,

It is with great pleasure that I welcome you to our International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences". This gathering marks a significant milestone in our collective pursuit of knowledge and progress in these critical fields.

Agriculture has always been the backbone of our societies, providing the essentials for human sustenance and economic stability. As we face unprecedented global challenges, from climate change to food security, it is imperative that we harness the power of innovation and technology to ensure sustainable and resilient agricultural practices. Our conference theme highlights the transformative potential of cutting-edge research and technological advancements to address these pressing issues.

This event brings together leading experts, researchers, practitioners, and policymakers from around the world. It serves as a platform for the exchange of ideas, the dissemination of groundbreaking research, and the fostering of collaborations that can drive meaningful change. Over the coming days, we will explore a diverse array of topics, including precision agriculture, biotechnological advancements, sustainable farming practices, and the integration of artificial intelligence and machine learning in agriculture.

Our university is committed to nurture an environment that encourages scientific inquiry and innovation. We are proud to host this conference, which embodies our dedication to advancing knowledge and addressing global challenges through interdisciplinary collaboration. I am confident that the discussions and insights generated during this conference will inspire new ideas and lead to practical solutions that can be implemented worldwide.

I extend my heartfelt gratitude to the organizing committee, sponsors, and all participants for their contributions to making this conference a success. Together, let us pave the way for a future where agricultural practices are more efficient, sustainable, and equitable.

Thank you, and I wish you all a fruitful and inspiring conference.

S. Gurjabh Singh Sidhu
Chancellor
Guru Kashi University

MESSAGE FROM CONFERENCE DIRECTOR

The development and adoption of innovative technologies have been instrumental in improving the lives of millions of farmers across the country by increasing their income, reducing their costs, and minimizing losses. As agriculture continues to evolve, the role of innovation will become even more critical in enhancing sustainability, resilience, and competitiveness in the sector. Keeping these facts in mind International Conference on "Current Innovations and Technological Advances in Agriculture and Allied Sciences" (CITAAS-2024) was planned by Just Agriculture Education Group & ISASTR, Noida in collaboration with Faculty of Agriculture, Guru Kashi University, Talwandi Sabo, Department of Agriculture and Farmer's Welfare and Horticulture Department, Govt. of Punjab during 29th- 31st August, 2024. The conference was embellished by the presence of Chief Guest, Dr. P. K. Singh, Agriculture Commissioner, Ministry of Agriculture & Farmers Welfare, GOI, New Delhi.

The conference was a great platform for professionals and experts from different industries to come together, exchange ideas, and explore new opportunities. The keynote speakers and panelists provided valuable insights on a range of topics, from the latest developments in technology and innovation to the challenges facing businesses in a rapidly changing world. The success of this conference would not have been possible without the hard work and dedication of our organizing committee and volunteers. We are grateful for their support and contributions towards making this event such a huge success. Thank you to all the attendees for making this a memorable and enriching experience. We look forward to seeing you again at our future events, where we will continue to bring together the best minds in the industry and create valuable opportunities for learning and growth.

Dr. DPS Badwal
Founder & CEO,
Just Agriculture Education Group

MESSAGE FROM SOCIETY PRESIDENT

It gives me immense pleasure to share that **ISASTR, Noida** and **Just Agriculture Education Group** in collaboration with **Faculty of Agriculture, Guru Kashi University, Talwandi Sabo, Department of Agriculture and Farmer's Welfare and Horticulture Department, Govt. of Punjab** have successfully organized the International Conference on **"Current Innovations and Technological Advances in Agriculture and Allied Sciences" (CITAAS-2024)** at **Guru Kashi University, Talwandi Sabo** during 29th- 31st August, 2024 in a hybrid mode. I believe that this conference has played an important role in bringing together experts, researchers and practitioners from across the world to exchange ideas, share their experiences and contribute towards the development of the agriculture sector. We have witnessed several innovative approaches, emerging technologies and sustainable practices that have the potential to revolutionize the agriculture sector and create a positive impact on our environment and economy.

The conference has also highlighted the significance of collaboration among different stakeholders including government, academia, industry and farmers. Through constructive discussions, we have identified the key challenges faced by the agriculture sector and the possible solutions to address them. In conclusion, I would like to congratulate the organizing team for the successful organization of the International Conference (CITAAS - 2024). We look forward to the next edition of this conference and hope to witness more innovative ideas and practices in the field of agriculture. Thank you all for your participation and support.

Dr. Sushila Hooda
President,
ISASTR, Noida

MESSAGE FROM ORGANIZING SECRETARY

I am very glad that Just Agriculture Education Group and **ISASTR, Noida** in collaboration with **Faculty of Agriculture, Guru Kashi University, Talwandi Sabo, Department of Agriculture and Farmer's Welfare and Horticulture Department, Govt. of Punjab** has successfully organized three days international conference on **"Current Innovations and Technological Advances in Agriculture and Allied Sciences" (CITAAS-2024)** at **Guru Kashi University, Talwandi Sabo** during 29th- 31st August, 2024 in a hybrid mode. The efforts made by the organizing committee are truly commendable, and I congratulate all of them on the successful organization of this conference. I am confident that the deliberations held during the conference would pave the way for future growth and prosperity of the agriculture sector.

I would like to extend my sincere gratitude to the organizers and all the stakeholders who had contributed to making this conference a grand success. I hope that the knowledge and insights gained from the conference would empower all of us to contribute more effectively towards the development of sustainable agriculture practices that are environmentally friendly and socially responsible. I once again express my heartfelt appreciation to all the stakeholders who had participated in the conference, and I look forward to seeing the outcomes and recommendations of the conference being put into practice.

Dr. Mohit Bharadwaj

Chief Editor,
Just Agriculture- the Magazine

MESSAGE FROM CHIEF ORGANIZING SECRETARY

I am delighted to announce that Just Agriculture Education Group and **ISASTR, Noida** in collaboration with Faculty of Agriculture, Guru Kashi University, Talwandi Sabo, Department of Agriculture and Farmer's Welfare and Horticulture Department, Govt. of Punjab has successfully organized three days international conference on **"Current Innovations and Technological Advances in Agriculture and Allied Sciences" (CITAAS-2024)** at **Guru Kashi University, Talwandi Sabo** during 29th- 31st August, 2024. The conference witnessed an impressive gathering of delegates, researchers and practitioners from across the globe, actively engaging in diverse discussion and presentations aligned with the conference theme. The keynote speakers delivered outstanding and thought-provoking speeches, inspiring attendees and sparking new ideas. The presentations were both informative and engaging, fostering lively discussions and constructive debates. Delegates had valuable networking opportunities, forging connections with colleagues from diverse geographical backgrounds, exchanging innovative ideas and exploring potential avenues for collaboration.

The organizing committee deserves tremendous praise for orchestrating a flawlessly organized and impactful event. Their exemplary efforts in planning, coordinating, and executing the conference ensured seamless operations from start to finish. In conclusion, the conference achieved remarkable success, leaving us eagerly anticipating the next edition in the future. We extend our heartfelt gratitude to all those who contributed to making this event possible and for their unwavering dedication and enthusiasm, ensuring a resounding triumph.

Piyush

Dr. Piyush Chaudhary
Vice- President (Branding & Marketing)
Just Agriculture Education Group

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Lead Papers/ Invited Papers

Millets- a Sustainable Ancient Superfood for the Modern World

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Millets are frequently referred to as "superfoods" or "nutricereals" because of their high nutritional content, ability to withstand climatic change, and reduced resource requirements when compared to other common grains. Millets have historically been consumed in larger quantities and are beneficial to diets worldwide, but both their cultivation and consumption are drastically reducing. To provide food and nutrition security, resource sustainability, and economic development, millet may be essential. Therefore, it is imperative to develop strategies aimed at reversing the global trends of declining millet production and consumption and raising consumer knowledge of the dietary and health benefits of millets. For thousands of years, millets, a class of small-seeded, nutrient-rich grains have been an essential part of human existence, particularly in Asia and Africa. finger millet, foxtail millet, Indian barnyard millet, kodo millet, let, and Proso millet are the millets that are produced most widely around the world, especially in India. In Ayurveda, millets are explained under the Dhanya Varga and are known by the names Trina Dhanya, Kudhanya, and Kshudra Dhanya in different Semites. Furthermore, millets have long been employed by indigenous people as an ethnomedical and hunger-reduction tool. Since millets are usually grown on degraded, nutrient-deficient soil with little rainfall, they are an extremely resilient crop. Instead millets are high in dietary fibre, proteins, vitamins, minerals, antioxidants, phytochemicals, and other nutrients, they are a cure-all for a wide range of illnesses. Due to shifting agro-climatic conditions that have resulted in a decrease in the yield of major staple grains, millets have emerged as a viable solution to address current issues in agriculture, food security, and public health. Millets have demonstrated excellent nutritional makeup and great adaptability. In light of government and civil society initiatives to promote millet farming in India, this review paper offers a succinct overview of millets, emphasising their historical significance, use in cultivation techniques, health benefits, and potential to contribute to sustainable farming systems and food security.

Keywords: Millets, foxtail millet, finger millet, proso millet, food security

INTRODUCTION

Globally, the number of diabetics is predicted to rise by 51% by 2045, from 463 million in 2019 to 700 million , with type 2 diabetes making up almost 90% of the total. The majority of diabetes-related deaths-87 percent occur in low- and middle-income nations where the variety of staple foods is lower. It's vital to remember that, in addition to obesity and a sedentary lifestyle, the kind of food ingested has a significant impact on diabetes. Approximately 80% of the energy consumed in developing nations comes from main staples including maize, refined wheat, and refined rice “Climate change, global warming” are the most chanting words nowadays, among the environmentalists and scientific community. Climate change, is the change in the weather parameters viz. temperature, rainfall-amount and distribution, wind velocity, etc., in a manner that

is not favourable to both plant and animals on earth. Climate change has deleterious effect on both human welfare and agriculture production. Humans however can escape those effects through their intelligence, while crops suffer a lot by climate change, resulting in lower yields and reduced quality of the produce (Theerthankar et al., 2017). This results in increased malnutrition and insufficiency of food for the increasing population. Researchers are looking for novel ways to combat the adverse climatic effect on agriculture sector, which has to feed the whole world.

Major cereals viz., rice, maize, wheat, etc., have dominated the agriculture sector with their capability of meeting rising food demands due to their high potential yields, but fail to ~~yield~~ sustain~~ably~~ under changing climate (Cheng et al., 2017). India ranks second in the incidences of malnutrition among children and more than one third of the world's malnourished children live in India (Nainwalet al., 2018).The major cereals are deficient in many of the nutritional factors, hence cannot check the nutritional balance that are essential components of one's daily diet for being healthy. Scientists/researchers have concluded that cultivation of alternate crops that can potentially meet nutritional security and can yield sustainably even under variable climate is the only best option to overcome the dominance of the major cereals. Millets are one of the oldest foods known to humans & possibly the first cereal grain to be used for domestic purposes. Millets are the small-seeded grasses that belongs to the family, Poaceae/Graminae. There are two major millets (sorghum and bajra) and six minor millets (finger millet, foxtail millet, little millet, proso millet, kodo millet and barnyard millet). Recently few more minor millets have been added to this group viz., tef, fonio, quinoa and browntop millet (IIMR, 2020) (Table 1). Since centuries, millets have been a prized crop in India and are staple diet for nearly 1/3rd of the world's population. Millets have potentiality of contributing to increase food production, both in developing and developed countries. Millets are most commonly available in the form of pearled and dehulled rain. Millets are tasty grains that have a mildly sweet, nut-like flavour. Millets are amazing in their nutrient content and are commonly known as "nutri-cereals or nutri-millets".

MILLETS STATISTICS

Millets are most likely to be originated from and around India where they are largely cultivated with a production of 10.91 m t and stand first among the top ten countries having largest area under millet cultivation. In India, Rajasthan stands first in production of millets with a production of 6.57 m t from 5.91 m ha (Indiastat, 2018). Karnataka state is majorly known for cultivation of minor millets in India with finger millet (recently Karnataka was awarded with the GI tag for finger millet by central government) as staple food in southern parts (Table 2).

Table 1: Top 10 millet producers in the world

Country	Production (m t)
India	10.91
Nigeria	5.00
Niger	2.955
China	1.620
Mali	1.152
Burkina faso	1.109
Sudan	1.090
Ethiopia	0.807

Chad	0.582
Senegal	0.572
World	29.87

Source: Indiastat, 2018

Millets are the indispensable constituents of Indian traditional foods because of their taste and nutritional aspects. Hence, India is the major consumer of millets (Fig. 1) since ages and is the main reason for a healthy life of those Indians consuming the nutritionally rich food made from millets.

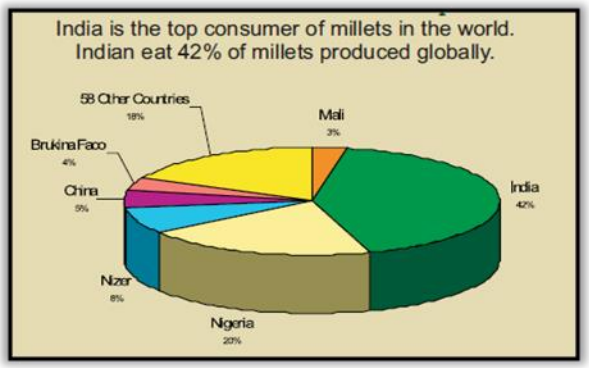


Fig. 1. Global millet consumption pattern (Source: Indiastat, 2021)

IMPORTANCE/BENEFITS OF MILLET CULTIVATION

Agronomic

Short duration (crop duration varies from 75-110 days) of the millets has the greater advantage in growing them as catch crops (efficient utilization of resources) and best suited ~~one's~~ under water scarce conditions (escapes seasonal drought by maturing early). Millets have high water productivity as compared to other crops (finger millet-13.4, sorghum-9.0, pearl millet-8.0 and rice-3.0 kg ha^{-1}) (Yellamanda Reddy and Sankara Reddy, 2016). These characters make them highly tolerant to aberrant weather. Grains can be stored for more than two years and hence, are known as 'famine reserves'. Sahu (1965) stated that the millets are the crops that have potentiality of contributing to increased food production, both in developing and developed countries. Millets are grown under harsh environmental conditions. Some of them are best suited to high soil moisture and drought situations. Thus, they do not burden the state with demands for irrigation or power(Kole et al., 2015).

Millets are adapted to a wide range of ecological conditions often growing on skeletal soils that are less than 15 cm deep(Tilahum, 2004). It does not demand rich soils or inputs for their survival and growth. Hence, for the vast dry land area, they are a boon. They have remarkable rejuvenation capacity due their tillering habit and recover very fast

once the moisture stress conditions are alleviated (Adekunle, 2012). These millets are grown under traditional methods and no millet attracts any pest. They can be termed pest-free crops. A majority of them are not affected by storage pests either. Therefore, their need for pesticides is close to nil. Thus, they are a great boon to the agricultural environment.

Table 3. Millets common and scientific names with their special characters

Sr. No.	Millets	Scientific name	Vernacular names	Special characteristics
1.	Sorghum	*Sorghum bicolor*	Jowar, jowari, durra, great millet	Known as camel of dryland
2.	Pearl millet	*Pennisetumglaucum*	Bajra, sajje, kambu, kambam, sajjalu	Highly tolerant to drought, heat and soil salinity
3.	Finger millet	*Eleusinecoracana*	Ragi, mandua,kapai, marua, nagli	Wider adoptability, rich source of calcium
4.	Proso millet	*Panicum milacium*	Cheena, baragu, panivaragu	Short duration tolerant to heat and drought
5.	Foxtail millet	*Setaria italica*	Navane,kauni, kangni,korra, rala	Short duration, tolerant to low soil fertility and drought
6.	Little millet	*Panicum sumatrense*	Same, samai, samulu, kutki	Short duration, withstand both drought and waterlogging
7.	Barnyard millet	*Echinochloacolona*	Sawan, oodalu, jhingora	Fastest growing and voluminous fodder
8.	Kodo millet	*Paspalumscorbiculatum*	Kodo, varagu, haraka, arikalu	Long duration, grown well in shallow and deep soil
9.	Teff grass	*Eragro stistef*	Williums Love grass, teffa	Ethopian staple food, high market price
10.	Quinoa	*Chinopodium*	Inca wheat	Nutritionally rich

		quinoa	goosefoot, pigweed	
11.	Fonio millet	*Digitaria exilis*	Findi/fundi, white fonio, acha rice, hungry rice	Long panicles, erect habit, long stem, strong and resistant to lodging
12.	Browntop millet	*Brachiariara mosa*	Baragu	Nutri rich

Source: IIMR, 2020

Nutritional

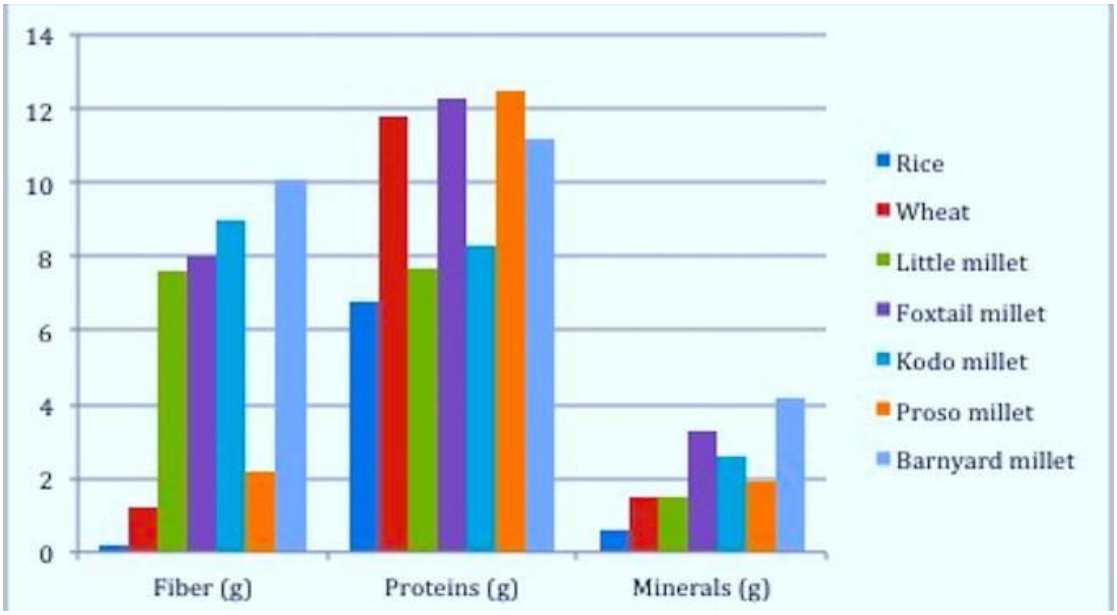
Each of the millets is three to five times nutritionally superior to the widely promoted rice and wheat in terms of proteins, minerals (calcium and iron) and vitamins and fibre hence, are known as "super foods" (Amadouet al., 2013). Millets are the ideal food group for all the people irrespective of age.Calcium and iron are essentially required for growing children, pregnant and lactating women who are more sensible for anaemic condition. Among all food crops, finger millet has a higher calcium (344 mg per 100 g) and that of in foxtail millet (12.9 mg per 100 g) followed by little millet (10.0 mg per 100 g)(Veena et al., 2005). Millets provide energy for a long time due to slow digestion,which makes them best diabetic food (). The millets are 'free of gluten'- wheat protein that is responsible for celiac disease (damage of the small intestine), is being seen predominately in western countries due to consumption of wheat (Nainwalet al., 2018).These millets have diversified high food value but the consumption of these millets is being declined due to lack of standardized processing techniques to compete with fine cereals. Recently these millet products are marketed as 'health foods'- to increase the utilization of small millets in popular foods. Small millet-based value-added products including traditional recipes, bakery products, pasta products, flaked and popped products instant food mixes were developed and standardized.

Table 4. Nutrient content of millets (per 100 g)

Crop/nutrient	Protein (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Sorghum	10	4	1.6	2.6	54
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Browntop millet	11.5	12.5	4.2	0.65	0.01
Quinoa	14.1	7	-	4.6	47
Teff	13	8	0.85	7.6	180
Fonio	11	11.3	5.31	84.8	18

Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

Source: IIMR, 2020



Socio-economic

Along with many agronomic and nutritional aspects, millets cultivation also helps in uplifting the socio-economic status of the small/marginal and medium farmers. Cultivation of millets is an integral part of integrated farming system. Millets cultivation helps in getting an average of Rs. 11,506 and 12,116 ha^{-1} net returns (little millet and foxtail millet) under dryland conditions (Amban Gouda et al., 2019). Nearly 2 to 3 times higher returns than the money invested in millet cultivation can be obtained under better management of agronomic practices viz., fertilizer, irrigation, spacing, date of sowing, etc. (Ambresha, 2017 and Shankar, 2017). Apart from this, millets cultivation is environment friendly because of lesser pollution involved in its cultivation which requires less amount of external chemical fertilizers, herbicides andpesticides which are essentially required by major cereals, hence, polluting the environment and ultimately adding to climate change.

Some of the factors hindering the popularization of millets

Production constraints:

- Grown on poor shallow and marginal soils under rainfed conditions.
- Often broadcast - major bottle neck in taking inter-cultivation operation and effective weed control.
- Non adoption of improved varieties.
- Non adoption of recommended practices.
- Lesser use of manures and fertilizers.
- Commercialization in today's agriculture.
- Research on crop improvement and agro-techniques was neglected till recently.

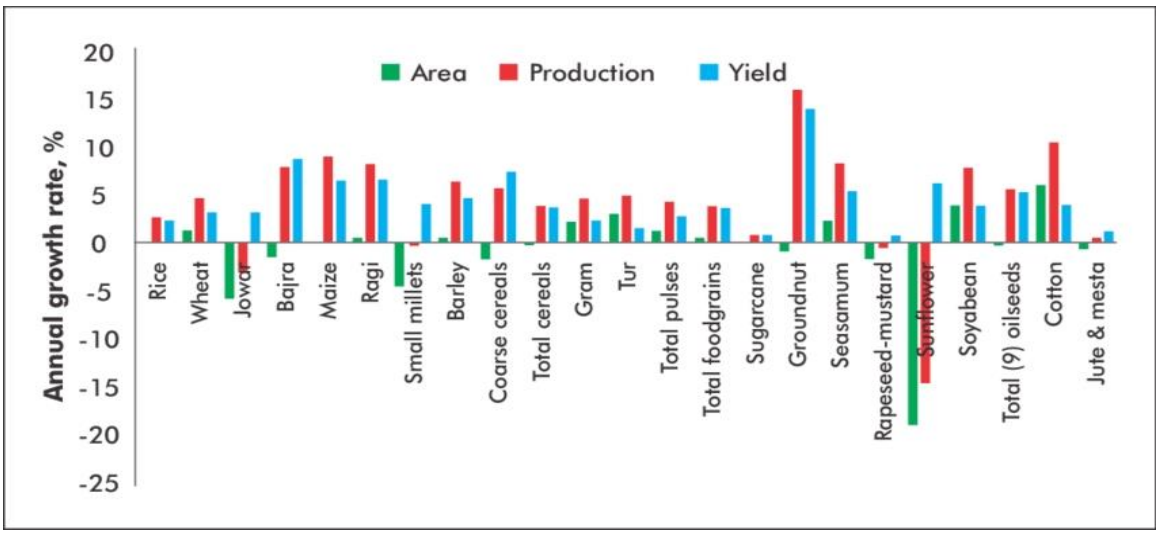


Fig. 2. Annual growth rate in area, production and productivity of different crops
(Source: Indiastat, 2021)

Nowadays farmers are much interested in commercial agriculture and are replacing the sustainable crops with cash crops, hence, area under millets is decreasing day by day (Michaelraj and Shanmugam, 2013; Durgadet al., 2019).

Factors responsible for lower consumption:

- Lack of regular supply due to less preference.
- Availability of cheap and preferred millets.
- Marketing channels were not well developed between producing areas and consumption.
- Food aid systems like public distribution system which supply cereals readily.
- Higher social prestige associated with the consumption of rice and wheat.

On the darker side, these crops have been included under "Orphan crop" list, due to lack of trade across the world. Government is trying hard to encourage cultivation of such nutri-millets through different schemes, and introducing new generation nutri-millets that are both nutritionally rich and can fetch higher price for the farmer viz., teff millet, chia, brown top millet, quinoa, etc., in order to dissect the social stigma attached to these crops as "food for the poor" and to overcome malnutrition among the community.

Conclusion

Millets are the amazing crops best suited for dryland soils. These can ~~sustain~~ even under aberrant weather conditions (climate of twenty first century) where most of other major crops fail. These are nutritionally rich and helps in overcoming malnutrition and food insecurity. Though, millets cultivation is advantageous, the research in improving the age-old cultivation practices is still at an infant stage and this needs to be addressed in order to popularize these healthy foods.

Recently introduced millets fetches higher market value (than even major cereals) and hence help in uplifting the socio-economic status of the marginal farmers under dryland conditions.

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Enhancing Idli Pre-Mix: Incorporation of Black Cumin Seeds (Nigella sativa) for Improved Nutritional and Functional Properties

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Fermented foods and beverages have been integral to human diets for centuries, produced either spontaneously or with the addition of starter cultures. This process Beverages local raw materials from plants or animals, transforming them through the activity of microorganisms. These microorganisms enhance the nutritional and biochemical properties of the raw materials, improving taste, texture, and aroma. The methods of producing and consuming fermented foods vary across different cultures and ethnic groups. Despite their numerous health benefits, the consumption of fermented foods globally is declining due to the effects of globalization and changing dietary habits.

In India, some of the most popular fermented foods include idli, dosa, appam, porridge (koozh), dhokla, gundruk, dahi, sinki, rumba, fermented rai, kanji ka, and handua. These foods were traditionally favored for their extended shelf life achieved through acetic acid and alkaline fermentations. Fermentation enriches foods biologically, increasing the content of proteins, essential amino acids, essential fatty acids, and vitamins, while reducing anti-nutrients. This process also enhances flavor and aroma, improves digestibility, and offers various health benefits.

Keywords: Traditional Fermented Food, Breakfast Food, Cereals and Pulses, Digestibility, Low Fat Content, Essential Amino Acids, Vitamins and Minerals.

Introduction

Idli, a well-loved fermented breakfast item, is especially popular in Southern India and Sri Lanka, appreciated for its texture and sensory qualities. This dish is prepared by steaming a batter composed of rice (Oryza sativa) and black gram (Phaseolus mungo) in a 4:1 ratio. The fermentation process of these ingredients is essential for producing a high-quality idli. The duration of fermentation significantly influences the sensory characteristics and nutritional value of the idli, affecting both its flavor and texture. Consuming a combination of cereals and legumes, such as in idli, provides nutritional benefits by ensuring a balanced intake of carbohydrates and proteins. Despite the wide array of traditional fermented foods in India, idli is notable for its higher protein efficiency ratio (PER) and enhanced levels of essential amino acids and vitamins.

1.1 Idli

Idli, a traditional and widely enjoyed fermented breakfast dish in India and other countries, is made from a fermented batter of black gram and rice. This dish is a significant source of protein, calories, and vitamins in the diet. When cooked, idlis are soft and spongy, making them easy to digest and nutritionally beneficial (Adsare et al., 2022)[I].

Idli is renowned for its nutritional advantages, combining black gram dal and rice to offer a balanced intake of proteins and carbohydrates. The traditional preparation process involves soaking the ingredients, grinding them, and allowing the batter to ferment overnight. During fermentation, microorganisms multiply rapidly, surpassing the initial contaminants (L. Roy et al., 2023)[XII].

Although the traditional method of preparing idli is intricate, the demand for convenience has led to the increasing popularity of ready-made wet idli batters and instant mixes in the Indian market. Various brands and local suppliers provide these batters. To address price disparities, some manufacturers decrease the proportion of black gram dal and increase the amount of parboiled rice or mix in other rice varieties such as raw rice and mixed rice. However, these practices might not be well-received by consumers. While variations in the batter ratio are not necessarily harmful, the increased starch from rice and reduced protein content from dal can affect the idli's taste and texture. Currently, there is no established method to quantify the exact proportions of parboiled rice and black gram dal in the batter (L. Roy et al., 2023)[XII].

1.2 Rice

Rice (Oryza sativa) is one of the oldest cultivated crops, with historical records tracing back to 2800 BC in China. It is a staple food for a large portion of the global population, particularly in Southern and Eastern Asia. Rice contributes to more than one-fifth of the calories consumed by humans worldwide. Its nutritional composition includes approximately 7.37% protein, 2.2% fat, 64.3% available carbohydrates, 0.8% fiber, and 1.4% ash content (Mahmoud et al., 2022)[XIII]. There are various rice varieties such as long grain, Basmati, and Arborio, but only a few are widely cultivated. In India, about 85% of the rough rice produced is processed into edible rice, with total production estimated at 1186.9 MT for the 2022-23 period. Around 10% of rough rice is used to produce rice products like puffed rice and flaked rice, while approximately 5% is kept as seed for the next crop. Milling methods vary from traditional hand pounding and dehusking pedals in remote Asian areas to modern equipment in developing countries (Mahmoud et al., 2022)[XIII]. Rice is a nutritious food source, low in fat and rich in starchy carbohydrates, and is packed with essential vitamins and minerals, including vitamin E, B vitamins (thiamin, niacin), and potassium[XIII].

1.3 Black Gram

Black gram (Phaseolus mungo), also known as urad, is a significant pulse crop in India. The country is the largest producer and consumer of black gram globally. Black gram contains about 26% protein, nearly three times that of cereals, making it a vital source of protein for the vegetarian population in India. It is cultivated over an area of 2.42 million hectares, with an annual production of 0.77 million tonnes and a productivity rate of 324 kg/hectare. In 2022-23, India's total black gram production was 123.6 MT. Black gram belongs to the Leguminosae family and is believed to have originated in India, with references found in ancient texts like Kautilya's 'Arthasasthra' and 'Charak Samhita' supporting this presumption (S. Saritha et al., 2018).

India is the world's leading producer and consumer of black gram, which holds a unique position in Indian agriculture, ranking fourth in production and acreage among pulses. Black gram is a

significant protein source for India's vegetarian population, consumed in both split and whole forms, supplementing a cereal-based diet. Common dietary combinations such as dal chawal (pulse-rice) and dal roti (pulse-wheat bread) are staples in the Indian diet. The nutritional value of wheat or rice increases significantly when paired with black gram due to the complementary essential amino acids, including arginine, leucine, lysine, isoleucine, valine, and phenylalanine (S. Saritha et al., 2018).

1.4 Black Cumin

Hazrat Aisha (R.A) narrated that she heard the Prophet Muhammad (PBUH) say, "This black cumin is healing for all diseases except As-Sam." Aisha asked, "What is As-Sam?" He replied, "Death" (Sahih Al-Bukhari, 5687).

Nigella sativa L., commonly known as black cumin seed or black seed, is an annual herb in the Ranunculaceae family. Native to Southwest Asia, North Africa, and Southern Europe, it is also cultivated in many Mediterranean and Middle Eastern countries, including Iran, Pakistan, India, Saudi Arabia, Syria, and Turkey. The plant and its seeds are widely used as both an edible herb and spice, with significant medicinal applications. Black seed oil is particularly popular in traditional medicine for treating conditions such as rheumatism, piles, jaundice, dyspepsia, parasitic infestations, and skin diseases. Animal research suggests that black seed oil has antihypertensive, antidiabetic, antimicrobial, anticancer, diuretic, analgesic, anti-inflammatory, and antioxidant properties (Y. Mazahari et al., 2018).

Studies indicate that the seeds and oil of Nigella sativa are extensively used in treating various diseases and ailments. Islamic literature frequently recommends its use due to its healing properties, as endorsed by Prophet Muhammad. The seeds are known by several names, including seeds of blessing, black cumin, black seed, Al-Habba Al-Sauda, Al-Habba Al-Barakah, Siyahdaneh, and Kalonji, and are found globally, especially in the Middle East. Nigella sativa contains key constituents such as thymoquinone (TQ), dithymoquinone (DTQ), thymol-hydroquinone (THQ), thymol (THY), p-cymene, 4-terpineol, and t-anethol. Thymoquinone, its most crucial component, has demonstrated hepatoprotective, anti-inflammatory, antioxidant, cytotoxic, and anticancer properties (Mahek and Md Ashfaq, 2022).

Nutritional Importance Of fermented Food:-

2.1 Overview of Idli and its Significance as a Breakfast Food

Idli is a white, fermented, acid-leavened, steamed product with a soft and spongy texture, widely popular across South India. Historical records indicate that idli batter fermentation has been practiced since 1100 AD (Angam and Rebika, 2021). Idli and dosa are staple breakfast foods in India and Sri Lanka. Idli is made from naturally fermented batter consisting of washed, soaked, and milled rice (Oryza sativa) and dehulled black gram dhal (Phaseolus mungo) (Anika Shaikh, 2021).

From a nutritional perspective, consuming mixtures of cereals and legumes is beneficial as it enhances the balance of carbohydrates and proteins, as well as essential dietary amino acids. Acidified and leavened foods like idli, dosa, and dhokla represent an interesting group of products made from cereal-legume mixtures. Being a cereal and legume-based fermented product, idli boasts improved nutritional composition due to a higher protein efficiency ratio and increased levels of essential amino acids and vitamins (S. Krisnamoorthy et al., 2013).

2.2 Importance of Fermentation in Idli

The fermentation of idli batter is carried out at an ambient temperature of 25–30°C, which is optimal for desirable fermentation (L. Roy, 2023). The microorganisms responsible for the characteristic changes in the batter have been isolated and identified. Although there is a progressive change in the bacterial flora, the predominant microorganism responsible for souring and gas production is Leuconostoc mesenteroides. In the later stages of fermentation, the growth of Streptococcus faecalis and subsequently Pediococcus cerevisiae becomes significant. The fermentation of idli is driven by the leavening action caused by the heterofermentative lactic acid bacterium, L. mesenteroides. It has been established that lactic acid plays a major role in the fermentation of idli batter (Viswanatha Angadi et al., 2021).

2.3 Process Optimization

Fermented foods have been essential components of diets worldwide for centuries due to their high nutritional value, improved sensory qualities, shorter cooking times, extended shelf life, and enhanced flavor and aroma. In India, most fermented foods are region-specific and traditionally prepared at the household level using unique methods (Neha S. and Laxmi A., 2014).
Research has shown that ready-to-reconstitute idlis made from optimized ground batter of black gram and parboiled rice grits (1:4) were dried using various technologies, including cabinet drying (CD), fluidized bed drying (FBD), and microwave drying (MD). These idlis were then packed in polypropylene (PP) and metallized polyester (MP) films and stored at ambient (15-34°C) and 37°C conditions. The drying methods significantly ($p \leq 0.05$) affected the chemical stability, texture, and color of the idlis during storage. FBD idlis exhibited the best chemical stability, followed by CD and MD idlis. MD idlis showed more browning and hardness initially and during storage compared to idlis dried by other methods. All idlis, regardless of drying method, demonstrated a shelf life of 12 months, except for MD idlis, which showed 9 months of stability at 37°C. Microstructural studies revealed that MD idlis had larger open pores and better rehydration characteristics (Muskan Shaikh et al., 2021).

2.4 Nutritional Importance of Black Cumin

Fermentation is crucial in idli preparation as it enhances the nutritional quality and organoleptic value. The preparation and fermentation process transforms the final quality of idli, improving flavor and texture while enhancing digestibility. Idli is nutritionally composed of carbohydrates, proteins, vitamins, and minerals. The nutritional composition and quality of idli vary due to different proportions and varieties of rice and black gram used (Anika Shaikh et al., 2021).
Rice is the primary source of carbohydrates in idli, while black gram contributes oligosaccharides (indigestible sugars) such as raffinose, stachyose, and verbascose. These oligosaccharides can cause flatulence, posing a challenge for elimination. The idli preparation process (soaking, fermentation, and steam cooking) reduces oligosaccharide content by up to 34%. Moreover, when steamed idli was fed to rats at 50% of their basal diet, a lower flatulence rate was observed. These indigestible sugars also possess prebiotic properties, supporting the proliferation of lactic acid bacteria (LAB) as a carbon source (El Sayed A. Mahmoud et al., 2022).

2.5 Value Addition in Idli

Co-fermentation of finger millet with horse gram was conducted to create a cost-effective, protein-rich food (dosa, an Indian breakfast item). Natural fermentation of finger millet-horse gram flour blend in various proportions (2:1, 3:1, 4:1, and 5:1) was performed for 24 hours. Biochemical

analysis showed a significant pH drop (6.6–4.2) and starch content reduction (25.52%), alongside notable increases in titratable acidity (0.168–1.046%), soluble proteins (1.1-fold), and free amino acids (2.6-fold) at 16 hours. Lactic acid bacteria outnumbered yeast counts throughout fermentation, leading to a decrease in total soluble and reducing sugars. Total essential amino acids increased 1.1-fold at 16-hour fermentation, with protein containing 48.68% essential amino acids. Lysine levels rose from 5.87 to 6.73 g of amino acid/100 g of total amino acids. Dosa prepared from 16-hour fermented batter showed superior sensory attributes at a 4:1 ratio. This newly formulated product could help address protein-energy malnutrition (Viswanatha Angadi, 2021).

Freshly blanched leaves of the drumstick tree (Moringa oleifera) were incorporated into three commonly consumed Indian recipes: mung (Phaseolus aureus), kabuli chana (Cicer arietinum), and desi chana (Cicer arietinum). About 20g of leaves were added to 30g of food products. These recipes were found to be acceptable, with overall composite scores ranging from 3.06 to 3.53 (on a scale of 1 to 5). Drumstick leaves are known for being rich in micronutrients and were found to meet 82.5% to 83.3% of the RDA for adult women. This study could facilitate the industrial production of ready-to-eat foods incorporating drumstick leaves (Akshaya et al., 2021).

3.0 Role of Ingredients Used in Idli Pre-Mix

Carbohydrate-rich foods, such as cereals, are a primary energy source in the Asian Indian diet. Idli, a popular fermented product made from rice and black gram, is known for its soft, spongy texture and is widely consumed across the Indian subcontinent. This combination of cereals and legumes offers a balanced intake of carbohydrates and proteins. Beyond basic nutrients, the fermentation process of this cereal-legume product enhances its nutritional value by delivering probiotics, prebiotics, fermentable sugars, and hydrolytic enzymes, all of which promote health.

Method of Preparation of Idli Pre-Mix

The dough is prepared, shaped, and cut into rounds with a thickness of 6 mm using a cutter. These are baked at 175°C for 15 minutes (Khetarpaul et al., 2018). For the idli premix, rice and black gram are washed, soaked for 2 hours, and ground separately. Black cumin is cleaned and roasted before grinding. The pastes are mixed, with 1-3% salt added, fermented for 14 hours at room temperature, poured into plates, and transferred to a hot air oven (50-60°C for 1-2 hours). After cooling to room temperature, the mixture is packed in polyethylene bags.

3.1 Materials

3.1.1 Ingredients

The raw materials white rice, brown rice, finger millet and dehulled black gram were procured from the local market of Aurangabad.

3.1.2 Instruments

The instruments like weighing scale, thermometer, hot air oven, kjeltron, fibrotron were used from MIT College Aurangabad to perform different tests.

3.2 Methodology

3.2.1 Determination of Moisture Content

Moisture content was estimated by method given by Ranganna (1995).
Formula

$$\%\text{Moisture} = \frac{\text{Initial weight - Final Weight}}{\text{Initial Weight}} \times 100$$

3.2.2 Determination of Protein

Protein content was determined by Kjeltron apparatus and operational procedure given by Ranganna (1995).
Formula

$$\%N = \frac{(\text{Sample-Blank}) \times \text{Normality of } H_2SO_4 \times \text{Vol. made for distillation} \times 0.014}{\text{Aliquot taken for distillation (ml)} \times \text{weight of sample (g)}} \times 100$$

Total Protien = %N × 6.25

3.2.3 Determination of Ash Content

Ash content was determined by method described by Ranganna (1995). Formula

$$\%\text{Ash} = \frac{\text{Final weight}}{\text{Initial weight}} \times 100$$

3.2.4 Determination of Fat content

Fat content was estimated by using soxtron apparatus and procedure given by Ranganna (1995).

The amount of fat present in the sample can be calculated as-

$$\%\text{Fat} = \frac{W2 - W1}{W} \times 100$$

3.2.5 Determination of Fibre

Fibre content was determined by fibrotron apparatus and method given by Ranganna (1995). Fiber content was determined by using following formula

$$\%\text{Crude fiber} = \frac{\text{Weight of residue-Weight of ash}}{\text{Weight of sample}} \times 100$$

3.2.6 Determination of Calcium

Calcium content was determined by method given by Ranganna (1995).
1 ml of 0.01N KMnO4 = 0.2004 mg calcium.

3.2.7 Total Phenol Content

The idli samples were dried at 30oC for 12 h first and the ground to make fine powder. The prepared powder was extracted with 80% aqueous methanol (1g/10mL) for 2 h at 37oC. The samples were then centrifuged at 10000 RPM for 15 minutes.

The supernatant collected was used for measuring total phenol content using Folin-Ciocalteu method (Lowry et al. 1951) The absorbance was measured at 750 nm. (Das et al. 2013)

3.3 Evaluation of Fermented batter

3.3.1 PH and Density of batter (g/cm3)

The pH of fermented batters was measured using PH meter. During the Idli Batter Preparation, the PH of the Batter Not More 5.9-4.8 is very important.If the ph of the batter is High its make a puffed Structure which is not acceptable. The batter density was measured using a pycnometer

3.3.2 Acidity

The acidity of fermented batters was measured using the titration method and using NaOH as the titrating chemical and phenolphthalein as the indicator.

3.3.3 Viscosity

Idli have viscosity in between 12000-14000 Poiseiulle (PI) for good appearance and Taste**.**

3.3.4 Sensory Analysis

Sensory analysis of prepared *idli* samples was done using a 9-point hedonic scale rating. (Das *et al.* 2013)

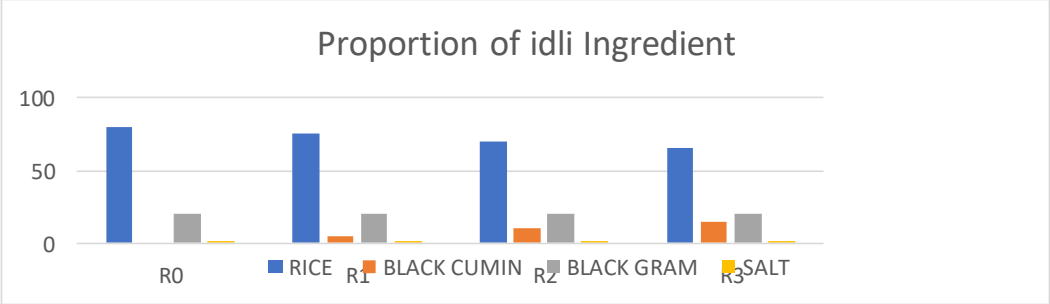
3.2.7 Preparation of Idli Pre-Mix

"The idli batter was prepared with a 4:1 ratio of rice to black gram dhal. Both the rice and black gram dhal were washed, soaked for 5 hours, and then ground separately. Additionally, black cumin was roasted and powdered to be added to the batter. The two batters were then mixed to the required consistency, and 1% of the overall weight of salt was added. The batter was then allowed to ferment at room temperature for 6 hours. After fermentation was complete, the batter was transferred to a tray, spread evenly, and left to dry. The drying process started at 400-500°C for 3-4 hours."

Table 1. The proportion of Idli ingredients in black Cumin fortified Idli Pre-mix

Samples	**Ingredient (%)**			
	Rice	**Black cumin**	**Black gram**	**Salt**
R_0	80	-	20	01%
R_1	75	05	20	01%
R_2	70	10	20	01%
R_3	65	15	20	01%

Fig.01 Graphical Representation Of Ingredient in Idli Premix



Method of preparation of Idli Pre mix

The dough was prepared and rolled in a proper shape and cut into round shape having thickness 6 mm with the help of cutter. These were baked at 175^{0}C for 15 min. **(**Khetarpaul *et al.,* 2018)

Rice And Black gram

↓

Wash and soak for 2Hrs

↓

Grinding

Black Cumin

↓

Cleaning and Roasting

↓

Grinding

↓

Paste was mixed together and well

↓

Add salt (1-3%)

↓

Fermentation for 14 Hrs in room temperature

↓

Pour Batter in Plates

↓

transfer to Hot air oven (50-60^{0}C For 1-2 Hrs)

↓

Cooled to room temperature

↓

Packed in polyethylene bags

Fig.01 Idli Pre Mix Preparation

4- Result And Discussion

4.0 Chemical Properties

Table 1. Chemical Parameters of Raw Material

Parameters (%)	Ingredients		
	Rice	**Black Cumin**	**Black gram**
Moisture	10.24	04.18	11.23
Protein	8.24	22.08	23.67
Crude Fat	2.84	41.31	01.68
Carbohydrates	76.61	17.00	57.23
Crude Fiber	0.64	08.24	01.08
Ash	1.13	04.30	03.16
Calcium (mg/100 g)	21.13	01.56	123.56

The highest value of moisture was found in black cumin (4.18 %) and the highest was in Rice (10.24 %). There is not much big difference in the moisture content of Brown Rice and black gram (11.23%). The protein content, a body-building unit of black gram (23.67%) was observed highest followed by brown rice (8.24%) and black Cumin (22.08%)*. The lowest crude fat was observed in black gram (1.68%) whereas black cumin has more fat (41.31%). This may be due to the Natural structure of black cumin contributing to crude fat content. The amount of carbohydrates present in black gram, Black cumin, and brown rice is 57.23, 17, 76.6, and 76.61 percent respectively. The crude fiber, a digestive tract cleanser is highest in Black cumin (8.24%) making the product more nutritious. The fiber content of brown rice (0.64%) is more than Black gram (1.08%) indicating its importance in fullness index and satiety value. Black gram contains 1.08 percent fiber. Rice has the lowest ash value (1.13%) whereas, black cumin has the highest ash (4.30%). The highest calcium 123.56 mg/100 g is present in Black Gram followed by black Cumin (1.56 mg/100 g) and brown rice (21.13 mg/100 g).

4.5.1 Organoleptic evaluation of black cumin seed Incorporation Idli Premix

Organoleptic characteristics of Idli Premix are pivotal in judging the suitability of product as consumer point of view. In order to study the effect of black cumin seed incorporation on sensorial quality characteristics, different random trials with wide range of Incorporation levels has been taken following the unorganized sensorial evaluation. It was observed that Idli Premix containing more than 5 % of black cumin seed powder Incorporation were not acceptable by panel members. Hence, for further optimization of black cumin seed Incorporation level in Idli Premix, organized trials were taken by incorporating different levels *viz*. 5, 10 and 15 % of black cumin seed Powder. The data pertaining to organoleptic quality evaluation of product is presented in Table-4.5.

Table 4.6: Organoleptic evaluation of Idli Premix Incorporated with black cumin seed

Sample Code	*Color*	*Taste*	*Texture*	*Flavor*	*Appearance*	*Overall acceptability*
Control	**8.5**	**8.4**	**8.8**	**7.9**	**8.3**	**8.38**
A	8.4	8.3	8.9	7.5	8.1	8.22
B	7.9	5.6	8.7	5.4	7.6	7.02
C	4.3	3.4	8.8	3.6	4.1	4.84
Mean	7.2750	6.4250	8.8000	6.1050	7.0275	7.1160
S.E. ±	0.1572	0.1299	0.1392	0.0392	0.0337	0.0271
C.D. at 5%	0.4351	0.3596	0.3853	0.1087	0.0932	0.0751

* Each value represents the average of 10 determinations

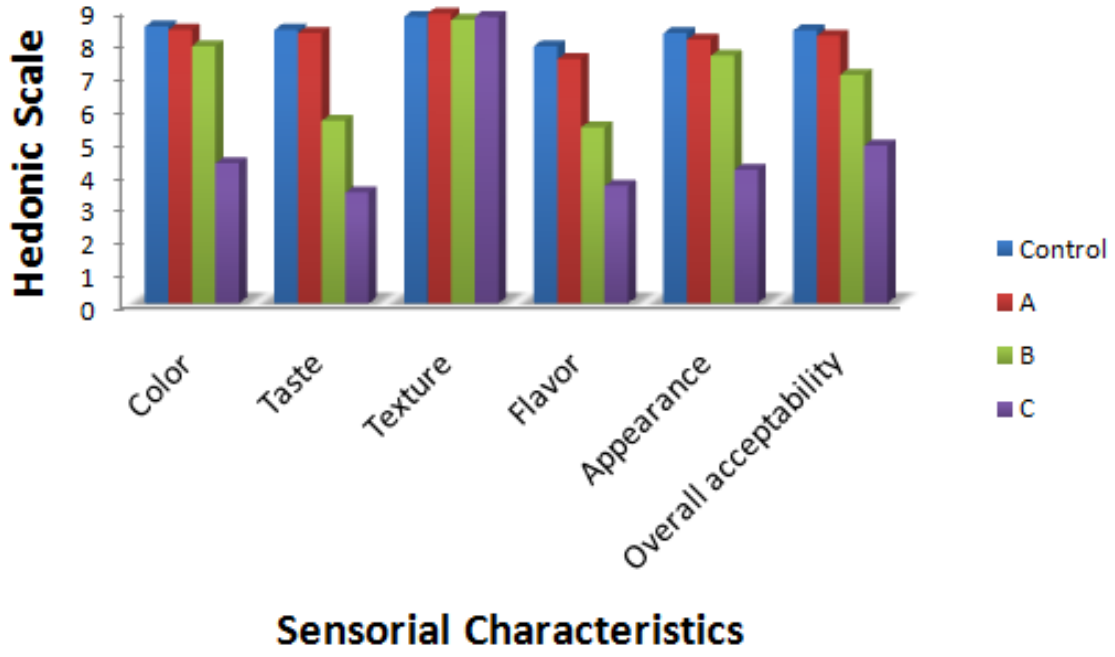


Fig. 4.1: Organoleptic evaluation of Idli Premix Incorporated with black cumin seed

4.5.2 Effect of black Cumin seed Incorporation on colour characteristics of Idli Premix

Color is considered as one of the important consumer quality judging parameters in the selection of food products. The attractive colour of product is a must-have in fast-moving consumer goods to appeal consumer for consumption.

It could be observed from Table-4.5 Idli Premix Incorporated with black cumin seed, the sensorial score for colour was found to decrease linearly with increase in level of Incorporation. Bright and light Idli Premix with increase in level of black cumin seed found to get contrast and dull has marked negative effect on colouring parameter of Idli Premix.

4.5.3 Effect of black cumin seed Incorporation on Taste of Idli Premix

With respect to taste characteristics of black cumin , 8.4 readings were observed for control sample while sample containing 5 % of black cumin seed scored 10 %. On consumer point of view, negligible change in taste was observed at the level of 5 % incorporation yet the taste was solely detectable as that of typical black cumin seed taste while more change was observed in sample

containing 10 % of black cumin seeds,. However, when the level of Incorporated was further increase to 15 % there was drastic reduction in quality and the sample were not liked by the panel members.
On the basis of observed results, it could be concluded that black cumin seed incorporation up to the level of 10 % is acceptable.

4.5.4 Effect of black cumin seed Incorporation on Textural characteristics of Idli-Premix

Textural characteristics of Idli play a pivotal role in judging its consumer acceptability. It could be stated that the textural characteristics of Idli are basically function of moisture content. It could be observed from Table-4.5 that in samples containing black cumin seed Powder, the textural properties are much more affected with increase in levels of black cumin seed.

4.5.5 Effect of black cumin seed Incorporation on Flavour profile of Idli

Flavour being a combination of taste, smell and mouth feel, has large number of factors it. Incorporation of black cumin seed powder resulted in negligible reduction of flavour characteristics up to the level of 5 %, while further increase in levels reduced the flavour scores to unacceptability. This may be due to typical flavour of black cumin, which could be prominently sensed in sample containing 10 and 15 % of black cumin seed. With the reference to incorporation levels of black cumin, it could be concluded that sample A and B is acceptable, amongst incorporated Idli.

4.5.6 Effect of black cumin fortification on Appearance characteristics of Idli Premix

The appearance properties of black cumin seed incorporated Idli were found to decrease with increase in concentration. The Idli were at the mark of unacceptability at higher concentrations. The incorporation of black cumin seed resulted in darkening of Idli which were principally responsible for reduction of appearance.

4.5.7 Effect of black cumin seed Incorporation on Overall acceptability of Idli Premix

Overall acceptability of product is depending on various factors including taste, colour, texture and appearance. The data pertaining to overall acceptability of product is described in Table-4.5. It could be observed from the table that overall acceptability of samples containing 5 % and 10 % of Black Cumin seed was acceptable.
It could be concluded on the basis of results that black cumin seed incorporation up to the level of 10 % acceptable on the basis of the overall acceptability score of Idli. While 15 % black cumin seed Incorporation Idli Premix was unacceptable.

4.5.8 Physical parameters of black cumin seed Incorporated Idli Premix

Physical properties of Idli Premix such as weight, diameter, thickness, spread factor and top grain development are indicative of the quality characteristics. The data pertaining physical parameters of black cumin seed Incorporated Idli prepared from Premix is presented in Table-4.6. It could be observed from the table that weight of Idli Premix remained more or less similar (though slightly lower) to that of control sample. Maintaining the constant weight of final product is essential to comply with the regulations and delivering uniform product to consumer. The weight of obtained product though lower to that of control, could be maintained to modifying initial weight of dough before baking.

4.5.9 Mineral Content (mg/100g)

Mineral	Idli Premix (mg/100g)	Idli Premix With Black Cumin (mg/100g)
Calcium (ca)	30	997
Iron (Fe)	2.1	68.3
Magnesium(Mg)	27	388
Phosphorus (P)	98	621
Zinc(Zn)	0.6	4.6
Potassium(K)	132	1788

4.5.10 Textural Analysis of Idli.

Idli, a traditional South Indian breakfast dish, is known for its distinctive texture, which significantly influences its popularity and acceptance. The textural qualities of idli are shaped by various factors, including the ingredients, fermentation process, and steaming conditions. Here's a detailed analysis:

Softness: Idlis are characteristically soft, which makes them easy to chew and digest. This softness is largely a result of the fermentation process involving a mixture of rice (Oryza sativa) and black gram dal (Phaseolus mungo). The lactic acid bacteria produced during fermentation help break down starches and proteins, resulting in a soft texture.

Sponginess: The spongy texture of idli comes from the carbon dioxide produced during fermentation. This gas is trapped in the batter, creating a porous structure. The ratio of rice to dal and the duration of fermentation are crucial in determining the sponginess. Idlis have a high moisture content, contributing to their softness and palatability. The steaming process helps retain moisture within the idlis, and achieving the right moisture level depends on proper fermentation and steaming time.

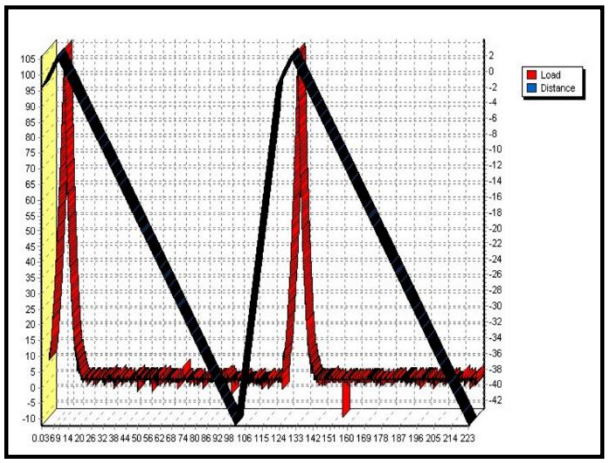
Elasticity:A well-prepared idli exhibits a certain degree of elasticity, allowing it to bounce back when lightly pressed. This elasticity is due to the gelatinization of starches during steaming and the protein network formed by the dal.

Mouthfeel: The mouthfeel of idli should be smooth and not grainy. Achieving this smooth texture requires grinding the rice and dal into a fine batter. The batter should have a consistency that allows for a smooth and homogeneous mixture.

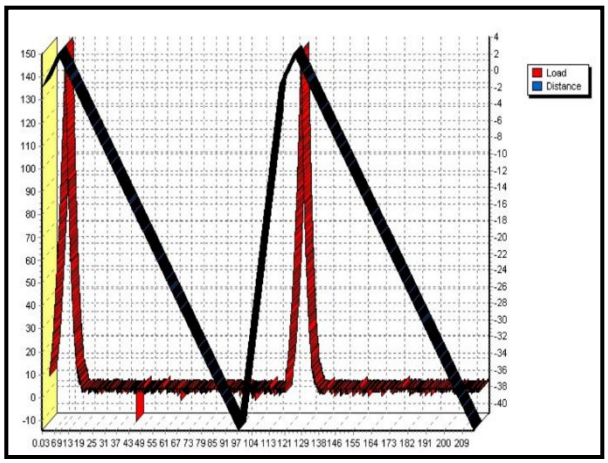
Cohesiveness: Idlis should hold together well without crumbling. Cohesiveness is influenced by the quality of the batter and the fermentation process. Both over-fermentation and under-fermentation can negatively affect cohesiveness.

Firmness: Although idlis are soft, they should have a slight firmness that helps maintain their shape and structure. This balance between softness and firmness is crucial for the perfect idli, and firmness is often assessed by the resistance offered by the idli when cut or bitten into.

Resilience: Resilience refers to the idli's ability to recover its shape after deformation. A resilient idli will bounce back after being pressed, indicating proper fermentation and steaming.



Graph 4.2 Graphical Representation of Texture of T1.



Graph 4.3 Graphical Representation Of Texture of T2.

4.7 Physical characteristics of the prepared Idli Premix

	Parameters	T1	T2
Physiological Parameters	Swelling ratio (%)	1.70±0.54	1.90±0.5
	Dispersion Test (minutes)	7.96±0.46	10.34±0.09
	Syneresis Test (%)	0	0
	Average weight (g)	3	2.5
Dimension	Length (cm)	1.50	1.50
	Width (cm)	1.50	1.50
	Thickness (cm)	1.0	1.0
Texture	Hardness (g)	106.00	150.00
	Adhesiveness (mJ)	0.00	0.00

Cohesiveness	0.90	0.88
Gumminess (g)	95.00	132.00
Springiness (mm)	3.90	3.98
Chewiness (mJ)	2.80	5.10

* Each value is an average of three determinations.

4.5.11 -Techno-economic feasibility of Idli Premix

Techno-economic feasibility of Idli Premix was evaluated based on the basis of

Operating Costs: Ongoing expenses such as utilities, maintenance, and other operational expenditures.

Raw Material Costs: The cost of acquiring and processing raw materials needed for production.

Production Costs: Expenses associated with the actual manufacturing process, encompassing labor, energy, and other inputs.

Processing Costs: Expenses linked to transforming raw materials into finished products, which may involve various processing steps.

Packaging Costs: Expenses related to packaging materials, labeling, and packaging operations.

4.5.12Theoretical energy of Idli Premix incorporated With Black Cumin Seed (Measurement)

The energy value is determined by using the values of crude protein, crude fat and total carbohydrate content in the sample, taking into account that 1 g of protein produces 4 Kcal energy, 1 g of fat produces 9 Kcal energy, and 1 g of carbohydrate produces 4 Kcal energy. The total energy value is obtained by adding the above three energy values, and these three energy values give the energy value per 100 g of sample.

5.Conclusion

In the study, Rice, black gram and black cumin is used to prepare idli premix by different ratios of black cumin seed at levels of 05%, 10%, and 15%. The sample with 05% black cumin was selected for further fortification based on sensory analysis. The study data indicates that incorporating black cumin into idli pre-mix increases its fiber and calcium content. Although texture showed that the fortified idli premix powder had a slightly harder texture after cooking, it was still deemed acceptable in sensory evaluation.

Different types of formulations were used to prepare the Idli Premix by incorporating different levels of black cumin seeds Powder. Experimental sample containing 10 % of black cumin seed were found to be the best which was resulted in organoleptic score. Higher percentage of black cumin seed drastically decreased taste and flavour of Idli.

Physical properties of Idli Premix were studied where data indicated that there was no significant change in values of weight, diameter and thickness of Idli where as slight deviation was observed in spread factor and top grain development of all treated samples.
The Idli Premix adjudged as a best were subjected to proximate composition of black cumin Incorporated Idli Premix. Result revealed that there was difference in Black Cumin Seed content of samples. The Minerals content was higher as compare to control.

Efforts were also made to study the effect of storage on physical and sensorial parameters of Idli Incorporation with fixed Black cumin at interval of 15, 30, 45, 60, 75 and 90 days. In the present investigation, storage of Idli Premix for 90 days produced non-significant changes in all sensory quality attributes.

In present investigation studied the antibacterial activity of petroleum ether, acetone extracts and steam distillation oil of *N. sativa* seeds were tested against pathogenic bacteria. Among the test bacteria *Staphylococcus aureus* was shown greater zone of inhibition against all extract of *N. sativa* oil. While *Pseudomonas aeruginosa* and *Escherichia coli* were show moderate zone of inhibition.

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Models Based on Machine Learning Techniques for Estimating Software Costs

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An essential aspect in software development is software cost assessment. It helps with software and project management and helps engineers to organize and oversee their assets. Still, creating a software with an appropriate cost estimating model project is a difficult procedure. This work develops a software cost estimate model with a machine learning methodology. Machine learning techniques are used on two open datasets to estimate the initial cost of software. Outcomes demonstrate how machine learning techniques can be applied to forecast software expense with a great degree of precision.

Keywords: Prediction, Cost Estimation, and Machine Learning.

I. INTRODUCTION

Estimating software costs is a crucial step that is being carried out at the early stages of the software development process. The purpose of this procedure is to improve one's vision for the future and the phases and progress of the project. Another primary goal is we should have precise project requirements and information in order to help participants in overseeing the project's human resources data, software, assets, resources, and even in the viability research. Precise approximation outcomes that unquestionably benefit the project manager to estimate project costs more accurately, the amount of time needed for different project stages and resources, or resources. Still, the project might be to blame for the error technique of cost assessment that will undoubtedly have an impact on the project delivery. A project with an inaccurate or imprecise assessment will confront problems with budget, resource requirements, and delivery schedule or even in the operational or quality aspects, and occasionally the project might be abandoned or fail. Therefore, the cost estimate is a major component of software projects, and as a result, it keeps on be a challenging problem in the world of software engineering [1].

In an effort to strengthen and improve the estimation process and produce more predictable and precise outcomes numerous investigations and studies have been carried out. However, more recently, machine learning (ML) methods become crucial in the study of software. In ML techniques are being employed in numerous scientific studies, including carried out probably in the different fields, however, depending on the goals and nature of the research, one or more of the approaches will be chosen. As the software development process Cost estimation is changing quickly, and this could involve technological advancements, team expertise, and tools make computer languages accessible, providing an advantage over ML approaches compared to various other strategies that might be adhered to mathematical and statistical work [2]. As a result, ML can

be a appropriate method to construct the suggested model because of the the capacity to draw lessons from past data and modify the vast variables included in the development of software projects.

This study assesses thirteen machine learning approaches and evaluated using the five primary statistical indices. Information utilized in this analysis was compiled using data from the general public and is accessible on online. It includes useful data for software engineering. One can obtain datasets from as well as (http://tunedit.org/repo/promise/effortprediction), made accessible to the general public in order to promote and enhance the cost work related to software engineering estimation. Finally, after all of this work, it is possible to determine which ML techniques are suitable to be applied in the process of estimating software costs. Additionally, the procedure for evaluating and contrasting the scored outcomes between the ML techniques that are employed will identify the greatest and most suitable machine learning that has a low mistake rate. The ML techniques utilized in the following section, comprehensive explanations of datasets and evaluation standards are provided. Prior to concluding with the section on future work and conclusion, the comparison and analysis of the experimental outcomes is being done.

II. LITERATURE REVIEW

There are two primary subsections in this section. Within the first section discusses the process of estimating software costs from many perspectives. The subsequent segment examines the application and use of machine learning techniques.

A. Review of Software Cost Estimation

Numerous researches offered various strategies for estimating software expenses. Numerous models have been developed and suggested to find alternatives, improve upon, or lend support to current models. COCOMO, or the Constructive Cost Model, is regarded as one of the most well-known models in the software costing domain estimation. With the intention of enhancing COCOMO II accuracy model [3], Langsar and colleagues suggested a technique to maximize the COCOMO II model's parameter values. The suggested model can identify incorrect and unclear inputs effectively, improving the software in the process dependability. A study by [4] sought to investigate the outcomes using fuzzy logic with FL-COCOMO and COCOMO II and how it affects the assessment of costs. The study's main focus was using fuzzy logic in conjunction with the SCE model to evaluate the inaccurateness of the software's features. The results of the study demonstrated using a variety of datasets that FL-COCOMO II model outperformed the COCOMO in estimating results.

[5] examined the factors that influence costs can directly impact the accuracy of the cost estimation model and a for the drivers closest to the values to demonstrate and demonstrate the decline in

software costs Agile COCOMO II was used in 2017. [6] suggested a further investigation using the COCOMO model. To strengthen and increase the software cost's accuracy procedure for estimate. The model COCOMO has been chosen because of its adaptability and suitability for a range of endeavors. An examination of the study's cost drivers has been carried out with various meta-heuristic techniques. The enhancement procedure was predicated on the successful selection of the coefficients and factors employed in the model. The consists of cost drivers and coefficients that were improved. The findings demonstrated that overt superiority once a comparison is made between the suggested model and COCOMO or other designs. [7] emphasis was on software cost assessment with several models, including COCOMO and the ways in which it might be enhanced by applying the WRAPPER function in DM. Essentially, it depends on Feature Subset Selection (FSS), which is the area of focus primarily the dataset's most promising fields and ignores the other to shorten the time needed for processing. Thus, by utilizing the WRAPPER function, they came to the conclusion that the COCOMO model can be enhanced, and the outcomes could be more effective.

[8] introduced a range of models for estimating software costs based on data mining techniques to select suitable Artificial methods of artificial intelligence (AI) that are required for new projects. All of their tests were primarily designed to compare and evaluate distinct methods for data mining combined with intermediate COCOMO models in terms of the accuracy of the prediction. The promised outcomes were evidently attained. In addition to several studies on the COCOMO model and how to improve it, additional research has been done attempting to suggest fresh theories and algorithms that could worth in the field. According to [9], a baseline paradigm that must be applied to every project that is being produced, and a research to estimate software work is needed. It is crucial to compare the outcomes with the reference point. When a method, whether new or old, is used to assess the forecasting procedure. The Automatic model they suggested the Analytical Transformations Linear Model (ATLM) can be utilized as a starting point for the software comparison procedure techniques for estimating work. [10] presented a fresh effort estimate algorithm that utilizes a mix of Interval analysis and Mean Absolute Error evaluation (MAE). The created algorithm has undergone testing and assessed according to three distinct criteria, although the Outcomes were highly anticipated. The studies were conducted on the collection of data gathered from over 700 software endeavors. Lately, [11] suggested a unique feature selection software model. It is able to be used in a variety of domains, such as drug design, biology, as well as picture processing. First, the model chooses a subset of characteristics or elements depending on algorithms for optimization to be sent thereafter to the learners or classifiers. The students are Decision trees, ANNs, and SVM, which can be used to datasets for categorization and regression analysis. Two categories of the three classifiers and optimization techniques can be can apply this model to any dataset in order to use it has the name FeatureSelect. Tests of the FeatureSelect were conducted on 8 distinct datasets of varying sizes and types produced excellent results. been noted.

B. Overview of Machine Learning Techniques

As an alternative, machine learning algorithms regarded as essential in today's academic endeavors. ML methods are often employed, provide consistent outcomes, and trustworthy in a variety of studies. In 2018, a thorough investigation [12] examined 25 releases with hundreds of classes each to assess the indications of effort. The analysis found that, among the eighteen machines learning algorithms employed, including additive regression, KStar, IBk, and The Multi-Layer Perceptron shown the ability to estimate test results. exact effort. Additionally, the research in [13] suggested a prediction model to gauge how long the software will take procedures that make use of ML algorithms. Two models for training that are Bayesian regularization and Levenberg-Marquardt (LM) back propagation (BR), which is utilized to assess and test FFNN and algorithms for RBNN. The two models' comparison demonstrated that BR results are marginally superior. Furthermore, BR is more appealing since it may be used at a lower cost. [14] suggested a structure to forecast the software utilizing two machine learning algorithms throughout the product life cycle. The study offered a more accurate and broadly applicable model for estimating the cost of the goods.

Research on breast cancer has been conducted in 2019 [15] in attempting to develop models for identifying and visualizing analytical ML algorithms for indicators of the survival rate of breast cancer. To Identify the critical elements of the survival rate for breast cancer prediction algorithms were created utilizing the most support for random forests, neural networks, decision trees, and boost vector machine, logistic regression, and others. Every algorithm scored really well, with tight results; the highest score was random forest, from which it can be inferred that those techniques might be applied as forecasting models in research on breast cancer. A few significant obstacles typically evolve in terms of software cost estimating procedure, including technological considerations and inventiveness. Furthermore, several ambiguous issues may arise during the implementation, such as a shortage of funds or an increase in the price of OS. As a result, [1] developed a hybrid approach to improve the SCE estimate founded on a fusion of KNN and COA-Cuckoo. The hybrid algorithm is tested using six distinct datasets based on eight criteria that were looked at. Overall, the findings indicate enhanced precision in the cost assessment.

[2] devised a method predicated on machine learning techniques to close the istance between current studies and practical applications. The outcomes attained for the suggested model was highly accurate, according to the authors that, in terms of software effort, it produces more realistic outcomes as well as time estimation for real-world tasks. Additionally, [16] conducted an analysis research covering the majority of the methods. Various techniques for estimating software costs. He made an attempt to enumerate the principal benefits and cons of each one. He came to the conclusion that every project component matters and vital to assess and calculate a project's cost, and they can vary in significance and impact from one project to the next. to a different person. The primary elements that ought to be included in qualitative metrics are used for estimating, such as team experience, development context, culture, and quantitative elements are the scope of the project and the resources at hand. Başkeleş and associates conducted numerous trials on software

effort [17] estimate based on various machine learning techniques on three primary, disparate datasets. 2019 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies is their completion.

According to (3ICT), parametric models are insufficient for software procedure for estimating effort. A few additional research were more concerned with cost estimation surroundings as well as additional relevant elements like software cycle of development connected to every project. For instance, [18] presented a study on in 2018 the function of organizational phenomena and the ways in which its A number of things can influence and enhance the software development process estimation of costs. The majority of studies concentrate on the advancement and enhancement of the SCE, comprising technological aspects and procedures without referencing or evaluating the effects of the surroundings or organizational elements. Through the use of quantitative research and a case study, the writers came to the conclusion that senior management accountability is necessary for arriving at a meaningful estimate, while the daily monitoring is not necessary. Moreover, they discovered that no important individual elements that could have a direct impact on the procedure of estimation. An additional work [19] carried out on Agile Life Cycle of evelopment. Because to its high rates of success and due to its flexibility and capacity to adapt quickly, Agile development Cycle gained enormous traction and was applied extensively. Ever since the late nineties. Vyas, Lamba, Bohra, and Vyas performed admirably work in 2017 by conducting a survey to identify the biggest trends pertaining to the Agile Software Development (ASD) methodology and how the cost estimate is affected by it. The writers were

capable of determining which elements should be included or omitted from the estimate procedure to obtain a more genuine and accurate project costs.

III. RESEARCH APPROACH

Within this part, the work process is examined. with a demonstration of the ML methods in use. Next, the used datasets, along with an explanation of its structure. Finally, the The evaluation standards are the main topic of discussion.

A. Automated Learning Systems

This section provides a fast and concise summary of the Machine learning techniques that have been applied to developing prediction models. An algorithm for machine learning is called Random Forest based on algorithms for decision trees. It functions as a collection of autonomously operating decision trees that have been built where a unique portion of the dataset is used by each tree. In there are two randomization levels in every tree. The initial one is referred to as bootstrapping or "bagging" of aggregation, and the other level is present at every decision tree node [20]. The REPTree is a reduction of the error pruning tree in abbreviation. The tree is being constructed quickly and easily based on the knowledge acquired details. Another type of decision tree is called a REPTree. Using regression trees, which can produce several trees in different cycles or repetitions. Next, among all the trees that were created, the best candidate is being chosen. To do the process of pruning for the tree, the tree is used to calculate the mean square error forecasts [21]. The M5P approach is an additional tree model that is built using Quinlan's M5 algorithm as a basis. Initially, the linear regression method was also added. The M5 model is likewise dependent

on the tree leave nodes traditional decision tree. Utilizing the trained data, the algorithm to create the decision tree's nodes and representations model [22]. One of the most basic algorithms is the ZeroR one classifiers. It takes into account all necessary potential values as well as the

qualities that are being sought after. Using the information supplied and based on the desired output, the target attribute will always be located. There is no rule in this classifier that is dependent on the unintended characteristic [23].

One classification model that is employed is the Decision Table Classifier in research on predictions. Its concept is comparable to that of decision trees or neural networks, in which a hierarchical table is used Every row represents a top level being disassembled to create a lower level fresh table. Its composition closely resembles dimensional stacks [24]. The Input Mapped Classifier functions similarly to a wrapper that identifies the discrepancies between training and test data by attempting to establish a relationship between the training data which the classifier's construction is predicated on the received instances or test cases [25]. Regression classifier using Additive enhances the effectiveness of classifiers built using regress. Every iteration makes use of the generated residuals from earlier incarnations. It can get around the overfitting issue onetheless, it requires more time [26]. Instance-Bases is what IBK stands for. Acquiring knowledge using parameter K. K-nearest is its well-known moniker.

Neighborhood (KNN), although it is employed in the Weka program as IBK. It establishes how many of the closest neighbors should be used during the process of classifying instances [27]. K-Star Hussain Aljazzar introduced the classifier for the first time. K denotes the quantity of shortest paths that exist between two a particular graph's chosen collection of data points [28]. The Gussian Processes classifier is regarded as an illustration of a non-parametric algorithm. It is employed to infer a collection of random variables distributed across functions. It seeks to identify comparable points in the distribution to estimate the amount [29]. ML's linear regression algorithm It falls under the category of guided learning. It forecasts values. According to the characteristics that were supplied separately. It is extensively utilized to determine connections between the features of datasets and studies that make predictions. Thus, this classifier looks for a linear connection between the input values and the desired values anticipated [30]. A neural network is called a multi-layer perception algorithm has three primary layers, including input layer, one or more hidden layers, and finally an output layer.

In light of the issue and the dataset, one or more nodes is able to build the output layer. The signals received propagated forward within the network as error signals proliferate in reverse. Some weight changes are made in order to lower the inaccuracy. being produced [31]. The term SMOreg stands for Sequential Minimal Optimization as a refined version of the SMO technique It uses support vector machines (SVM) as its foundation regress. SMOreg can be utilized in un-linear prediction a productive manner. Among the SMOreg algorithm's efficiency having only one threshold can lead to difficulties [31].

B. Databases and Assessment Standards

The datasets utilized in this study are ready for usage with software engineering trials that the general public can access. Two The ML approaches will be tested and contrasted using datasets. Usp05-ft is the first dataset, and Usp05 is the second. The dataset (Usp05-ft) is composed of the following and has 76 instances: 15 characteristics, as listed in Table 1. Apart from the fifteen characteristics, the second dataset (Usp05) comprises 203 occurrences and two additional properties. which, as Table 1 shows, are 16 and 17.

Item No.	Attribute	Description
1	ID	Object ID
2	Effort	The actual total hours expended on the implementing process
3	IntComplx	The level of the Internal Calculation's complexity
4	DataEn	Total Number of Data-Entry Items
5	DataFile	Total Number of Data-Files Accessed
6	DataOut	Total Number of Data-Output Items
7	UFP	Unadjusted Function Point Count
8	Lang	Language Used
9	Tools	Used Platforms and Development Tools
10	ToolExpr	Language and Tool Experience Level
11	AppExpr	Applications Experience Level
12	TeamSize	Size of the developing team
13	DBMS	Used DBMS
14	Method	The used Implementation

		Methodology
15	AppType	The used Architecture
16	ObjType	Type of the Object
17	Funct%	Percentage of Functionality of features or requirements

Table 1: Description of Datasets and Attributes

Examining Table 1, the primary and most significant the second feature in this study is called "Effort." It will be utilized by the ML algorithms during the prediction phase where the dataset's real value will be contrasted with the one that was anticipated. About half of the qualities that are used are integers, with the remainder consisting primarily of strings that describe the Platform, Tools, Database, and Language utilized. Collections of Data moreover include a few more noteworthy qualities that are thought to be crucial in development cycles, such as the size of the group, the process of implementation, and the expertise degree.

To assess the effectiveness of the ML algorithms after utilizing them on the datasets that were utilized, five fundamental statistical. The performance and assessment criteria were indices. The indices are Root, Mean Absolute Error (MAE), [32, 33]. The correlation coefficient, mean squared error (RMSE), relative absolute error (RAE), root relative squared error (RRSE), and Coefficient. In essence, they are calculating the error rate between the dataset's actual effort and the anticipated employing the machine learning algorithm. The used measures can be calculated as the following formulas:

$$MAE = \frac{1}{n}\sum_{j=1}^{n} |A_j - \tilde{A}_j| \quad (1)$$

$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{n}\left(A_j - \tilde{A}_j\right)^2} \quad (2)$$

$$RAE = \frac{\sum_{j=1}^{n} |A_j - \tilde{A}_j|}{\sum_{j=1}^{n} |A_j - \tilde{A}_j|} \quad (3)$$

$$RRSE = \sqrt{\frac{\sum_{j=1}^{n}\left(A_j - \tilde{A}_j\right)^2}{\sum_{j=1}^{n}\left(A_j - \tilde{A}_j\right)^2}} \quad (4)$$

$$R^2 = 1 - \frac{\sum_{j=1}^{n}\left(A_j - \tilde{A}_j\right)^2}{\sum_{j=1}^{n}\left(A_j - \tilde{A}_j\right)^2} \quad (5)$$

IV. EXPERIMENTAL FOUNDATIONS

Version 3.8 of the Weka tool has been utilized to assess the utilized algorithms. The cross-validation method of 10 folds is applied. to test the data on the remaining 10% after training it on 90% of the data Through ten tests, the entire set of data (100%), cycles. Weka has six different classifier types that are utilized for testing the thirteen algorithms. The classifiers or algorithms that are employed are Decision Table, Random Forest, REPTree, M5P, and ZeroR Additive Regression, Input Mapped Classifier, IBK, KStar, Gussian Processes, Multilayer, Linear Regression Both SMOreg and Perceptron. All 13 techniques have undergone testing on two datasets: the first has 15 attributes and is called Usp05-ft. and 76 occurrences. The second one (Usp05) has seventeen characteristics and 203 examples.

Table 2 displays the outcomes of using the thirteen algorithms on the Usp05-ft dataset. The assessment and contrast were conducted using five statistical error metrics. The final row in The average values for each measurement are shown in Table 2 standards. Table 2's results indicate that there is a very close the correlation between the expected and actual values utilizing the Random Forest technique. The range of R2 values is -1 up to 1. Because of this, the outcome is closer to 1 because the relation is more robust. For Random Forest, the correlation coefficient is the greatest value, 0.8441. Additionally, Random Forest also received the highest rating for the remaining measurement standards. The alternative techniques yielded closed outcomes to Random Forest types like IBK in MAE and RAE percentages, Multilayer-perceptual values in RRSE% and RMSE. The 2019 International Conference on Computing, Informatics, and Technology Innovation and Intelligence (3ICT)

Method	R^2	MAE	RMSE	RAE	RRSE
Random Forest	0.8441	2.5025	4.8546	41.7323	55.6778
REPTree	0.7607	3.2553	5.6754	54.2868	65.0918
M5P	0.705	3.2359	6.2428	53.9628	71.5994
ZeroR	-0.264	5.9965	8.7191	100	100
Decision Table	0.7137	3.4225	6.241	57.0738	71.579
Input-Mapped-Classifier	-0.264	5.9965	8.7191	100	100
Additive-Regression	0.7136	3.2441	6.5709	54.0993	75.363
IBK	0.7853	2.5132	5.8021	41.9101	66.5451
KStar	0.7797	2.7272	6.0219	45.4795	69.0658
Gussian-Processes	0.7604	2.8814	5.6809	48.0511	65.1554
Linear-Regression	-0.264	5.9965	8.7191	100	100
Multilayer-Perceptron	0.7979	2.8173	5.6413	46.9824	64.7004
SMOreg	0.7504	2.6597	6.2764	44.3547	71.9853
Average	**0.5244**	**3.6345**	**6.5511**	**60.6102**	**75.1356**

Table 2: USP05-FT DATASET PERFORMANCE RESULTS

Table 2 displays all available statistical measurements. Random Forest was employed to assess and test the error rate, scoring the best outcomes across all indices with the least amount of inaccuracy the highest among the four categories (MAE, RMAE, RAE, and RRSE) R2 is the correlation coefficient. Still, the worst outcomes have three algorithms that used the same score to calculate their scores number in every performance metric, which is ZeroR, Linear Regression with Input Mapped Classifier. Techniques that obtained the worst outcomes, with the RAE% and RRSE% reaching 100% were unable to produce reliable prediction results because With every input, the anticipated effort remained constant. The final row The average of the worst and finest is displayed in the table.

Method	R^2	MAE	RMSE	RAE	RRSE
Random Forest	0.4319	8.1464	31.8046	60.5244	92.3641
REPTree	0.6296	10.0367	29.757	74.569	86.4177
M5P	0.4628	9.9475	30.6858	73.9061	89.1151
ZeroR	-0.311	13.4596	34.4339	100	100
Decision Table	0.5118	8.7527	30.1391	65.0297	87.5273
Input-Mapped-Classifier	-0.311	13.4596	34.4339	100	100
Additive-Regression	0.558	8.445	28.2736	62.7431	82.1098
IBK	0.2504	8.7266	38.9912	64.8355	113.2349
KStar	0.3626	7.3318	32.1284	54.4729	93.3046
Gussian-Processes	0.4978	8.2471	29.659	61.2729	86.1333
Linear-Regression	-0.311	13.4596	34.4339	100	100
Multilayer-Perceptron	-0.022	15.7926	36.513	117.3334	106.038
SMOreg	0.4962	8.8851	29.5932	66.0134	85.9422
Average	**0.2496**	**10.3608**	**32.3728**	**76.9770**	**94.0144**

TABLE 3: USP05 DATASET PERFORMANCE RESULTS

As demonstrated in Table 3, it is evident that the best the three algorithms that provide the findings are REPTree, KStar, and Additive Regression; nonetheless, the most severe error outcomes have been evaluated using Multilayer Perception or IBk. The outcomes for the R2 are identical to those of the first experiment, since the worst results have been graded by ZeroR, input mapped classifier, and linear regression.

V. SUMMARY AND FUTURE WORK

13 ML algorithms have been assessed in this paper employing two sets of data. In this work, the evaluation criteria utilized are R^2, RRSE, RAE, RMAE, and MAE. The purpose of the suggested model is to forecast the work by utilizing the properties of the dataset and in order to gauge the actual effort, compare them with the

mistake based on distinct standards. The greater the R2 value, the improved outcome, with regard to the other measuring criteria, the a lower value indicates a superior outcome. Attained Random Forest the first experiment's best outcomes employing (Usp05-ft) dataset in addition to an additional three models, REPTree,

Kstar and Additive Regression yielded the highest scores utilizing (Usp05) data set. The ZeroR approach produced the lowest results when the initial dataset, yet a few more techniques, such as IBk, Linear Regression, and Multilayer Perceptron didn't work effectively with the second dataset. More datasets may be added to the study in the future to have a more varied range of inputs with a larger angle will be taken into account for a more precise and accurate estimation outcomes. Additionally, various additional ML methods can be evaluated.

and participating in future research to ensure that all accessible machine learning techniques.

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Effect of Climate change on Natural farming

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This research paper explores the impact of climate change on natural farming, a sustainable agricultural practice that relies on organic inputs and ecological balance. As global temperatures rise and weather patterns become increasingly unpredictable, natural farming systems face significant challenges. The study examines the effects of climate change on soil health, water management, crop yields, biodiversity, and pest dynamics within natural farming systems. While natural farming offers potential benefits such as enhanced soil fertility, water conservation, and carbon sequestration, its effectiveness is increasingly threatened by the adverse impacts of climate change. The paper further discusses adaptive strategies that can be implemented to improve the resilience of natural farming in the face of these challenges. Additionally, it evaluates the role of government policies in supporting farmers to adopt climate-resilient practices. The findings underscore the need for a holistic approach that integrates traditional knowledge with modern innovations to sustain natural farming in a changing climate. This research contributes to the broader discourse on sustainable agriculture and provides insights into how natural farming can be adapted to mitigate the impacts of climate change.

Keywords: Climate change, natural farming, soil health, water management, crop yields, biodiversity, sustainable agriculture.

Introduction

Natural farming is an agricultural practice that seeks to harmonize farming activities with the natural ecosystem, minimizing human intervention and eliminating the use of synthetic inputs such as chemical fertilizers and pesticides. This method of farming is rooted in traditional agricultural practices and has gained renewed interest in recent years due to its potential to promote sustainability, enhance biodiversity, and improve soil health. However, the impacts of climate change pose significant challenges to natural farming, affecting its viability and productivity. Natural farming relies on a few fundamental principles: maintaining soil fertility through organic matter, enhancing biodiversity, and employing natural pest and disease management techniques. These practices are designed to create a self-sustaining agricultural ecosystem that can thrive without the need for external inputs. For instance, composting, green maturing, and crop rotation are commonly used to enrich the soil with nutrients, while intercropping and agroforestry enhance biodiversity and protect against pests and diseases.[1]

Climate change, characterized by rising global temperatures, changing precipitation patterns, and increasing frequency of extreme weather events, directly impacts the delicate balance that natural farming systems depend on. One of the most significant effects of climate change on natural farming is the alteration of soil health. Higher temperatures accelerate the decomposition of organic matter in the soil, reducing its fertility. This reduction in soil fertility undermines one of the core principles of natural farming, making it more challenging to sustain crop yields without resorting to external inputs.[2]

Moreover, changes in precipitation patterns pose a significant threat to natural farming. Natural farming systems often rely on rain-fed irrigation, and unpredictable rainfall can lead to either water scarcity or waterlogging, both of which are detrimental to crop health. Prolonged droughts can dry out the soil, reducing its moisture content and making it more susceptible to erosion. On the other hand, excessive rainfall can lead to nutrient leaching and soil erosion, further degrading the soil and reducing its capacity to support crops.

The increased frequency of extreme weather events, such as floods, droughts, and heat waves, also presents a significant challenge for natural farming. These events can cause immediate damage to crops, disrupt planting and harvesting schedules, and lead to long-term degradation of the soil and agricultural infrastructure. For example, floods can wash away topsoil and organic matter, which are crucial for maintaining soil fertility in natural farming systems. In response to these challenges, natural farming must adapt to the changing climate by integrating innovative practices and technologies that enhance resilience. For instance, adopting climate-resilient crop varieties that can withstand extreme temperatures and water stress can help mitigate some of the impacts of climate change.[3]

Agroforestry, the practice of integrating trees into farming systems, can also play a vital role in adapting to climate change. Trees help stabilize the soil, reduce erosion, and create a microclimate that can protect crops from extreme weather. Furthermore, trees sequester carbon, contributing to climate change mitigation while enhancing the resilience of natural farming systems.The role of biodiversity in natural farming cannot be overstated, especially in the context of climate change. By promoting crop diversity and integrating livestock, natural farming can buffer against the impacts of climate change, ensuring that at least some components of the system continue to thrive even under adverse conditions.[4]

In conclusion, while climate change presents significant challenges to natural farming, it also underscores the importance of adopting sustainable agricultural practices that can adapt to and mitigate its impacts. Natural farming, with its emphasis on ecological balance and sustainability, is well-positioned to contribute to global efforts to combat climate change. However, the success of natural farming in a changing climate will depend on the ability of farmers to integrate adaptive strategies, enhance biodiversity, and employ innovative practices that build resilience into their farming systems.

Impact of Climate Change on Soil Health in Natural Farming

Climate change poses significant challenges to soil health, which is foundational to the success of natural farming. As global temperatures rise and weather patterns shift, the resilience of natural farming systems is increasingly tested. Soil health, a critical component of sustainable agriculture, is particularly vulnerable to the impacts of climate change, which can lead to soil degradation, fertility loss, and altered soil moisture levels.

Soil degradation is one of the most pressing challenges resulting from climate change. Increased temperatures and extreme weather events, such as heavy rainfall and prolonged droughts, can accelerate soil erosion and reduce the soil's structural integrity. In natural farming, where chemical inputs are minimized or avoided altogether, maintaining soil fertility is crucial for sustaining crop yields. However, climate-induced soil degradation can lead to the loss of topsoil, which contains essential nutrients and organic matter. This loss not only diminishes the soil's ability to support healthy plant growth but also undermines the long-term sustainability of natural

farming practices. Additionally, the increased intensity and frequency of rainfall can exacerbate the leaching of nutrients from the soil, further contributing to fertility loss.Natural farming systems rely heavily on the natural nutrient cycling processes to maintain soil fertility. Climate change disrupts these processes, leading to an imbalance in the availability of nutrients such as nitrogen, phosphorus, and potassium. As a result, farmers practicing natural farming may face challenges in sustaining soil fertility without resorting to external inputs, which goes against the core principles of this agricultural approach.[5]

Soil moisture levels are another critical factor in the success of natural farming, and climate change has a profound impact on this aspect. Changes in precipitation patterns, such as reduced rainfall or prolonged droughts, can lead to decreased soil moisture levels, making it difficult for crops to absorb the necessary water for growth. On the other hand, excessive rainfall can lead to waterlogging, which can suffocate plant roots and reduce microbial activity in the soil. Both scenarios negatively impact the effectiveness of natural farming practices, which rely on maintaining optimal soil moisture levels through techniques like mulching and cover cropping.Higher temperatures accelerate the decomposition of organic matter, reducing its availability in the soil. Organic matter is essential for maintaining soil structure, water retention, and nutrient availability. In natural farming, where organic matter is a primary source of nutrients, its reduction can have severe consequences for crop productivity and soil health. Furthermore, the loss of organic matter diminishes the soil's capacity to sequester carbon, thus exacerbating the effects of climate change.[6]

Water Management Challenges in Natural Farming under Climate Change

Water management is a critical aspect of natural farming, and climate change presents significant challenges to maintaining adequate water availability and efficient usage. As climate patterns shift, natural farming systems, which often rely on traditional water conservation methods, are increasingly threatened by unpredictable rainfall and altered water cycles. Climate changes have a direct impact on water availability, particularly in agricultural systems like natural farming that depend on rain-fed irrigation. In regions where rainfall has become erratic, the consistency of water supply is disrupted, leading to periods of both water scarcity and excess. This unpredictability poses a challenge for natural farming, where maintaining soil moisture is essential for crop growth and sustainability.

The increasing frequency of droughts, exacerbated by rising temperatures, can lead to severe water shortages, stressing crops and reducing yields. Conversely, when rainfall becomes too intense or concentrated over short periods, it can lead to waterlogging, soil erosion, and nutrient leaching, all of which are detrimental to the natural farming systems that rely on maintaining soil health and structure. These shifts in rainfall patterns require natural farmers to adopt more resilient water management practices to ensure their farms remain productive and sustainable under changing climatic conditions.[7]

To address the water management challenges posed by climate change, natural farming must incorporate effective water conservation strategies. One of the primary methods is rainwater harvesting, which involves capturing and storing rainwater for use during dry periods. This technique can help buffer the effects of erratic rainfall by ensuring a more consistent water supply. Additionally, mulching is widely used in natural farming to reduce water evaporation from the soil, thereby conserving moisture and enhancing soil health.In regions prone to heavy rainfall, contour plowing and the creation of water retention basins can help manage excess water, reducing runoff

and preventing soil erosion.Agroforestry is another water conservation practice that can be integrated into natural farming systems. By planting trees and shrubs alongside crops, farmers can enhance water retention, reduce wind erosion, and create a microclimate that supports soil moisture retention. These practices, combined with traditional knowledge and modern innovations, can help natural farming systems adapt to the challenges of climate change and maintain water efficiency and productivity.[8]

Biodiversity and Climate Change in Natural Farming

Biodiversity plays a pivotal role in the sustainability and productivity of natural farming systems. It contributes to ecosystem health, enhances soil fertility, and provides resilience against various environmental stresses. However, climate change poses significant threats to biodiversity, which in turn affects the efficacy of natural farming practices.

Climate changes can result in the loss of traditional crop varieties that are sensitive to new climatic conditions, thereby reducing crop diversity essential for natural farming systems. Decreased crop diversity undermines the stability and productivity of farms, making them more susceptible to pests, diseases, and extreme weather events.Moreover, altered climatic conditions can disrupt the balance of ecosystems by affecting beneficial insects, soil microorganisms, and pollinators critical for crop production. For instance, increased temperatures and irregular rainfall can lead to the decline of pollinator populations, directly impacting crop yields and quality. Soil microbial communities, responsible for nutrient cycling and soil structure maintenance, are also vulnerable to climate-induced stressors, leading to decreased soil health and fertility.[9]

The degradation of ecosystem health due to climate change not only affects current agricultural productivity but also reduces the capacity of natural farming systems to adapt to future environmental challenges. This necessitates the implementation of strategies that protect and enhance biodiversity within these systems.

Integrating and promoting biodiversity within natural farming practices can significantly enhance resilience to the adverse effects of climate change. Diverse cropping systems, including intercropping and crop rotation, can buffer against climate variability by ensuring that at least some crops can withstand adverse conditions, thus securing food production and farmers' livelihoods.Biodiversity also contributes to ecosystem services such as pest regulation, pollination, and nutrient cycling. A diverse community of plants and animals creates a more balanced and self-regulating ecosystem, reducing the reliance on external inputs and increasing adaptability to changing environmental conditions. For example, diverse plant species can improve soil structure and water retention, making farms more resilient to droughts and floods.Implementing agroforestry practices, where trees are integrated into agricultural landscapes, enhances carbon sequestration and provides shade and wind protection, mitigating some effects of climate change. Maintaining and restoring natural habitats within and around farms support wildlife corridors and preserve genetic diversity, which is crucial for breeding climate-resilient crop varieties.[10]

In conclusion, fostering biodiversity is a fundamental strategy for strengthening the resilience of natural farming systems against the impacts of climate change. Policies and practices that support diverse and healthy ecosystems will be essential for sustainable agriculture in the face of on-going environmental changes.

Impact on Crop Yields and Productivity in Natural Farming

Climate change presents significant challenges to crop yields and productivity in natural farming systems. Natural farming, which relies on ecological balance and minimal external inputs, is particularly sensitive to changes in temperature, precipitation, and other climatic factors. Temperature and precipitation are critical factors that directly influence crop growth and yields. In natural farming, where the use of synthetic inputs like fertilizers and pesticides is minimized, crops are more dependent on favourable weather conditions to thrive. However, climate change has led to increased variability in these conditions, resulting in fluctuations in crop yields. For instance, higher temperatures can accelerate crop maturation, leading to shorter growing seasons and reduced yields. Conversely, extreme heat can cause heat stress, affecting crop development and reducing productivity.

Changes in precipitation patterns, including irregular rainfall and extended dry periods, further exacerbate the challenges faced by natural farming. On the other hand, prolonged droughts can severely limit water availability, leading to water stress and reduced photosynthesis, ultimately lowering crop yields. These variations in temperature and precipitation create uncertainty for farmers practicing natural farming, making it difficult to predict and manage crop production effectively.[11]

To mitigate the impacts of climate change on crop yields, natural farming systems must adopt adaptive practices that enhance resilience and sustain productivity. These varieties are bred to maintain productivity under water stress and high temperatures, offering a more reliable yield even in adverse conditions.Diversification of crops is another adaptive practice that can help manage the risks associated with climate variability. By growing a variety of crops with different climate sensitivities, farmers can reduce the likelihood of total crop failure due to unfavorable weather. Intercropping and crop rotation are also effective methods for maintaining soil fertility and reducing pest pressures, which can be exacerbated by climate change.[12]

Additionally, improved water management techniques, such as rainwater harvesting, drip irrigation, and mulching, can help conserve water and maintain soil moisture levels during dry periods. These practices are particularly important in natural farming, where external water inputs are often limited.In conclusion, while climate change poses significant challenges to crop yields and productivity in natural farming, the adoption of adaptive practices can help farmers sustain their production. By leveraging resilient crop varieties, diversifying crops, and implementing effective water management strategies, natural farming systems can better cope with the uncertainties of a changing climate.

Pest and Disease Dynamics in Natural Farming with Climate Change

Climate change is altering the dynamics of pests and diseases in agriculture, posing significant challenges for natural farming systems. Natural farming, which relies on ecological balance and the use of natural pest control methods, is particularly vulnerable to these changes. As global temperatures rise and weather patterns become more erratic, the behavior, distribution, and intensity of pests and diseases are shifting, impacting crop health and yields. Warmer temperatures, one of the most direct consequences of climate change, are driving changes in the life cycles, distribution, and population dynamics of pests and diseases. Many pests, such as insects and fungi, thrive in warmer conditions, leading to accelerated reproduction rates and extended active periods.

This increase in pest populations can result in more frequent and severe infestations, challenging the resilience of natural farming systems.[13]

Additionally, warmer temperatures can expand the geographical range of certain pests and diseases, allowing them to invade areas where they were previously absent. For example, crops in cooler regions that were once protected from specific pests may now face new threats due to these temperature shifts. Similarly, diseases that require warmer conditions to spread, such as certain fungal infections, may become more prevalent, causing increased crop damage.These changes in pest and disease dynamics are particularly problematic for natural farming, which avoids synthetic chemical interventions. The traditional pest control methods used in natural farming may be less effective against these new or more aggressive pests, necessitating the adaptation of existing practices or the development of new strategies.[14]

Natural farming employs a variety of pest control methods that rely on ecological processes, such as biological control, crop rotation, intercropping, and the use of natural repellents. While these methods are generally effective in stable climatic conditions, their effectiveness can be compromised under climate stress.For instance, the predator-prey relationships that underpin biological control can be altered if the climate affects the survival or reproduction rates of either the pest or its natural enemy. Similarly, changes in temperature and humidity can influence the effectiveness of natural repellents and the timing of crop rotation or intercropping practices, potentially reducing their ability to control pests effectively.

Role of Natural Farming in Carbon Sequestration and Reducing Greenhouse Gas Emissions

Natural farming techniques, such as minimal tillage, composting, and the use of cover crops, significantly contribute to carbon sequestration. Minimal tillage practices help maintain soil structure and prevent the release of stored carbon into the atmosphere. By avoiding the disruption of soil, these practices promote the accumulation of organic matter, which acts as a carbon sink. Composting, another cornerstone of natural farming, involves the decomposition of organic materials, which not only enriches the soil with nutrients but also increases its carbon content.Cover cropping and agroforestry are additional methods employed in natural farming that contribute to carbon sequestration. Similarly, agroforestry systems, which integrate trees with crops, capture carbon dioxide through photosynthesis and store it in biomass and soil. These practices also reduce the need for chemical fertilizers, which are significant sources of nitrous oxide, a potent greenhouse gas.By reducing reliance on synthetic inputs and enhancing soil organic matter, natural farming minimizes greenhouse gas emissions. The reduction in chemical fertilizer use lowers the release of nitrous oxide, while improved soil health and biodiversity further contribute to a more resilient and low-emission agricultural system.[15]

The potential of natural farming as a climate mitigation strategy lies in its ability to sustainably increase carbon sequestration while simultaneously reducing greenhouse gas emissions. As climate change accelerates, the adoption of natural farming practices can play a vital role in achieving global climate goals by enhancing the carbon storage capacity of agricultural lands.In addition to sequestering carbon, natural farming practices such as crop rotation, integrated pest management, and organic mulching can mitigate climate change by promoting resilience to climate-induced stresses. These practices enhance soil health, reduce dependency on fossil fuel-based inputs, and increase biodiversity, all of which are crucial for adapting to and mitigating the effects of climate change.The widespread adoption of these practices could significantly contribute

to global efforts to combat climate change while supporting the sustainability and resilience of agricultural systems.

Conclusion

The impact of climate change on natural farming presents both significant challenges and unique opportunities for innovation and adaptation. As natural farming relies heavily on ecological balance and minimal external inputs, it is particularly vulnerable to the fluctuations in temperature, precipitation, and other climatic variables that are becoming increasingly common. However, by adopting innovative practices and technologies designed to enhance resilience, natural farming can continue to be a viable and sustainable agricultural practice in the face of climate change.

To adapt to the changing climate, natural farming must incorporate innovative practices and technologies that enhance its resilience. One such practice is the use of climate-resilient crop varieties that are bred to withstand extreme weather conditions, such as drought-resistant or heat-tolerant crops. These varieties can help ensure stable yields even under adverse climatic conditions.Agroforestry and silvopasture are other innovative approaches that integrate trees and shrubs into farming systems. These practices not only sequester carbon but also provide shade, reduce wind erosion, and enhance soil moisture, creating a more stable microclimate for crops. Water management technologies, such as rainwater harvesting systems and drip irrigation, are crucial for conserving water and ensuring that crops receive adequate moisture during periods of drought.

The long-term sustainability of natural farming in the context of climate change depends on its ability to adapt and maintain productivity while preserving environmental integrity. By enhancing biodiversity, improving soil health, and integrating innovative technologies, natural farming can build resilience to climate-induced stresses. Practices such as crop rotation, cover cropping, and organic mulching contribute to soil fertility and water retention, which are critical for sustaining agricultural productivity over time.Furthermore, the emphasis on reducing greenhouse gas emissions and sequestering carbon through natural farming practices aligns with global efforts to mitigate climate change. In conclusion, while climate change poses significant challenges to natural farming, the adoption of innovative practices and technologies can enhance its resilience and ensure its long-term sustainability. By integrating traditional knowledge with modern innovations, natural farming can continue to play a crucial role in sustainable agriculture and climate change mitigation.

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Climate Resilient Agriculture: Adaptation and Mitigation Strategies

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Climate change poses a severe threat to global agriculture, affecting food security, livelihoods, and ecosystems. Climate-resilient agriculture (CRA) has emerged as a vital approach to address these challenges by integrating adaptation and mitigation strategies into agricultural practices. This paper explores a range of adaptation and mitigation strategies within the CRA framework, highlighting their potential to enhance the resilience of agricultural systems to climate variability and extremes. Adaptation strategies discussed include diversified cropping systems, water management techniques, soil health improvement, genetic enhancement of crops, and the integration of crops and livestock. These practices help reduce vulnerability and increase the adaptive capacity of farming communities by improving resource use efficiency, enhancing biodiversity, and maintaining soil fertility. The paper also emphasizes the importance of conservation agriculture, community-based adaptation, and the use of climate-smart technologies as key components of effective CRA. On the mitigation front, the paper examines strategies such as agroforestry, improved livestock management, sustainable land use practices, and the development of bioenergy systems. These approaches not only reduce greenhouse gas emissions but also promote carbon sequestration, contributing to the long-term sustainability of agricultural systems. Despite the potential benefits, challenges such as limited access to resources, inadequate knowledge dissemination, and policy gaps remain significant barriers to the widespread adoption of CRA practices.The paper concludes by recommending a holistic approach to scaling up CRA, involving active participation from farmers, support from policymakers, and increased investment in research and development. By fostering resilient agricultural systems, CRA plays a crucial role in ensuring food security, sustaining livelihoods, and protecting the environment in the face of climate change.

Keywords: Climate Resilient Agriculture, adaptation strategies, mitigation strategies, sustainable agriculture, climate change, agroforestry, soil health, water management.

Introduction:

Agriculture is one of the sectors most vulnerable to the impacts of climate change, which manifests through increased temperatures, altered precipitation patterns, and more frequent extreme weather events. These changes threaten food security, reduce agricultural productivity, and exacerbate rural poverty, particularly in developing countries. In response to these challenges, climate-resilient agriculture (CRA) has been promoted as a comprehensive approach to adapt to climate variability and mitigate its effects on farming systems. Climate resilience is defined as the "capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance related to climate." Climate resilient agriculture (CRA) is an approach that includes

sustainably using existing natural resources through crop and livestock production systems to achieve long term higher productivity and farm incomes under climate variability.

CRA involves the adoption of practices and technologies that not only reduce the vulnerability of agricultural systems to climate impacts but also contribute to the reduction of greenhouse gas (GHG) emissions. This dual focus on adaptation and mitigation makes CRA an essential component of sustainable agricultural development. Adaptation refers to adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects. It refers to changes in processes, practices and structures to moderate potential damages or to benefit from opportunities associated with climate change. (IPCC). Mitigation is an intervention to reduce the emission sources or enhance the sinks of greenhouse gases(IPCC). Three pillars of CRA are reduce GHG's emission, building resilience and sutainability. This paper aims to explore various strategies for adaptation and mitigation within the framework of CRA, examining their effectiveness and potential for wider adoption.

Adaptation Strategies in Climate Resilient Agriculture

Adaptation strategies in CRA are designed to reduce the vulnerability of agricultural systems to climate change by enhancing their capacity to withstand and recover from climatic shocks.

Key adaptation strategies include:

- **Diversified Cropping Systems**

Diversification of cropping systems is a fundamental adaptation strategy in CRA. It involves growing a variety of crops that are resilient to different climate conditions, which reduces the risk of total crop failure. Practices such as crop rotation, intercropping, and the integration of legumes and cover crops into farming systems help maintain soil fertility, improve water use efficiency, and enhance biodiversity.

- **Water Management Techniques**

Effective water management is critical for climate resilience, particularly in regions prone to droughts or irregular rainfall. Techniques such as rainwater harvesting, drip irrigation, and the use of drought-resistant crop varieties are crucial for maintaining crop yields under water-scarce conditions. Additionally, the restoration of degraded watersheds and the adoption of agroforestry practices can improve water retention in soils and reduce the risk of erosion.

- **Soil Health Management**

Healthy soils are foundational to climate-resilient agriculture. Soil conservation practices such as no-till farming, cover cropping, and organic farming improve soil structure, enhance carbon sequestration, and increase the soil's ability to retain moisture. These practices not only reduce the impact of droughts and floods but also contribute to long-term agricultural productivity.

- **Climate-Smart Technologies**

The adoption of climate-smart technologies, such as precision agriculture, remote sensing, and early warning systems, allows farmers to make informed decisions based on real-time data. These technologies help optimize resource use, reduce waste, and enhance the efficiency of agricultural practices, thereby increasing resilience to climate variability.

- **Genetic Improvement of Crops**

Developing and deploying climate-resilient crop varieties is essential for adapting to changing environmental conditions. This includes breeding or genetically modifying crops to be more resistant to drought, heat, pests, and diseases. The use of improved seed varieties that have shorter growing cycles can also help farmers adjust to changing weather patterns and reduce the risk of crop failure.

- **Crop-Livestock Integration**

Integrating crops and livestock on the same farm can enhance resilience by diversifying income sources and improving nutrient cycling. Livestock provide manure, which can be used as organic fertilizer to enhance soil fertility. In turn, crop residues can be used as feed, reducing the need for external inputs and lowering costs.

- **Seasonal Climate Forecasting**

Utilizing seasonal climate forecasts allows farmers to make informed decisions about planting and harvesting times, crop selection, and resource management. By anticipating adverse weather conditions, farmers can adjust their practices to reduce risks and optimize yields.

- **Conservation Agriculture**

Conservation agriculture practices, such as minimal soil disturbance (no-till farming), permanent soil cover (using cover crops or crop residues), and crop rotation, help maintain soil structure and health. These practices reduce soil erosion, enhance water retention, and improve resilience to extreme weather events like droughts and floods.

- **Agrobiodiversity Management**

Maintaining and enhancing agrobiodiversity— the variety and variability of plants, animals, and microorganisms used in agriculture— strengthens the resilience of farming systems. Diverse crop and livestock varieties can better withstand pests, diseases, and climate shocks. Additionally, preserving traditional knowledge and practices related to agrobiodiversity can help farmers adapt to changing conditions.

- **Integrated Pest Management (IPM)**

IPM involves the use of biological, cultural, mechanical, and chemical methods to control pests in a sustainable way. By reducing reliance on chemical pesticides, IPM minimizes environmental damage and helps maintain ecological balance. It also improves crop resilience by reducing pest outbreaks, which are often exacerbated by climate change.

- **Community-Based Adaptation**

Community-based adaptation strategies involve collective action and local knowledge to address climate challenges. This can include forming farmer cooperatives, engaging in shared water management projects, and participating in community seed banks. By working together, communities can pool resources, share knowledge, and implement large-scale adaptation strategies more effectively.

- **Enhanced Agricultural Extension Services**

Strengthening agricultural extension services is critical for disseminating knowledge and best practices related to climate-resilient agriculture. Extension services can provide farmers with access to the latest research, training on adaptive practices, and support in adopting new technologies.

- **Climate-Sensitive Insurance Schemes**

Developing insurance schemes that account for climate risks can help farmers manage the financial impacts of crop failures due to extreme weather events. Weather-based crop insurance and index-based insurance are examples of mechanisms that can provide financial security to farmers, enabling them to recover and continue farming after climate-related losses.

- **Water-Smart Agriculture**

Water-smart agriculture involves the efficient use and management of water resources to cope with water scarcity and variability. Techniques such as mulching, contour farming, terracing, and the use of drought-tolerant crops contribute to conserving water in the soil and making the best use of available water for crop production.

- **Livelihood Diversification**

Encouraging farmers to diversify their income sources beyond agriculture can reduce their vulnerability to climate change. This could involve promoting agro-processing, eco-tourism, handicrafts, or other non-farm income-generating activities. Diversification provides a safety net in case of agricultural losses due to climate impacts.

Mitigation Strategies in Climate Resilient Agriculture

While adaptation is crucial, mitigation strategies in CRA aim to reduce agriculture's contribution to climate change by lowering GHG emissions and increasing carbon sequestration. Key mitigation strategies include:

- **Agroforestry**

Agroforestry, the integration of trees into agricultural landscapes, is a powerful mitigation strategy. Trees sequester carbon, improve soil fertility, and provide shade and windbreaks, which protect crops from extreme weather. Agroforestry systems also enhance biodiversity and provide additional income sources for farmers through the production of timber, fruits, and other non-timber forest products.

- **Improved Livestock Management**

Livestock production is a significant source of methane, a potent greenhouse gas. Improved livestock management practices, such as better feed quality, rotational grazing, and manure management, can reduce methane emissions while also enhancing productivity. Integrating livestock with crop production systems can further improve nutrient cycling and soil fertility.

- **Sustainable Land Use Practices**

Sustainable land use practices, including reforestation, afforestation, and the restoration of degraded lands, contribute to carbon sequestration and reduce emissions from land-use change. These practices also improve ecosystem services, such as water regulation and biodiversity conservation, which are essential for long-term agricultural sustainability.

- **Bioenergy and Waste Management**

The use of agricultural residues for bioenergy production is another important mitigation strategy. By converting waste into energy, farmers can reduce their reliance on fossil fuels and decrease GHG emissions. Additionally, the use of composting and anaerobic digestion processes for managing agricultural waste can further reduce emissions and improve soil health.

Challenges in Implementing Climate Resilient Agriculture

Despite the potential benefits of CRA, several challenges hinder its widespread adoption. These challenges include limited access to resources, inadequate knowledge and capacity among farmers, and insufficient policy support. Additionally, the upfront costs of implementing CRA practices can be prohibitive for smallholder farmers, who are often the most vulnerable to climate change.

Policy Recommendations

To overcome these challenges and promote the adoption of CRA, this paper offers several policy recommendations. These include providing financial incentives for farmers to adopt CRA practices, investing in research and development of climate-smart technologies, and enhancing extension services to disseminate knowledge and best practices. Additionally, integrating CRA into national and regional agricultural policies will be essential for scaling up these practices.

Conclusion

Climate-resilient agriculture represents a vital strategy for adapting to and mitigating the impacts of climate change on global agriculture. By integrating adaptation and mitigation measures, CRA can enhance the resilience of farming systems, protect livelihoods, and contribute to food security. However, the successful implementation of CRA requires concerted efforts from farmers, policy-makers, researchers, and the international community. This paper underscores the importance of a holistic approach to CRA, one that considers the diverse needs of different agro-ecological regions and supports the sustainable development of agriculture in the face of climate change.

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One Health Approaches for the Prevention and Control of Diseases in the Livestock and Poultry Sector

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In an increasingly interconnected world, the health of humans, animals, and the environment is more intertwined than ever before. The concept of "One Health" has emerged as a comprehensive approach that recognizes this interdependence and aims to address health challenges through integrated, cross-disciplinary efforts. The livestock and poultry sectors, critical for global food security and economic stability, are particularly vulnerable to infectious diseases that can have severe consequences not only for animal health but also for human health and environmental sustainability.

In recent years, the rise in zoonotic diseases—diseases that are transmitted from animals to humans—has highlighted the need for more effective and collaborative approaches to disease prevention and control. With over 60% of known infectious diseases in humans being zoonotic and 75% of new or emerging infectious diseases originating from animals, the One Health approach is increasingly recognized as essential. This framework encourages collaboration among veterinarians, physicians, ecologists, environmental scientists, and other professionals to create a holistic strategy that addresses the root causes of health issues across species and ecosystems.

The One Health Concept: An Integrated Approach

One Health is a multidisciplinary approach that brings together professionals from various fields to work collaboratively in addressing health challenges. This holistic perspective is essential in the livestock and poultry sector, where diseases can easily spread across species and have significant economic and public health implications.

Disease Transmission in the Livestock and Poultry Sector

The livestock and poultry sectors are particularly vulnerable to infectious diseases due to the high density of animals, close human-animal interactions, and the movement of animals across regions. Zoonotic diseases, which can be transmitted from animals to humans, pose a significant threat. Notable examples include avian influenza, swine flu, and brucellosis. These diseases can spread rapidly, causing widespread outbreaks that affect both animal and human populations.
According to the World Health Organization (WHO), over 60% of known infectious diseases in humans are zoonotic, and 75% of new or emerging infectious diseases in humans are of animal origin. This highlights the critical need for effective disease prevention and control strategies in the livestock and poultry sectors.

One Health Strategies for Disease Prevention and Control

- **Surveillance and Monitoring**

Effective disease surveillance and monitoring are cornerstones of the One Health approach. By closely monitoring animal populations for signs of disease, outbreaks can be detected early, allowing for timely interventions. For example, the Global Early Warning System (GLEWS), a collaboration between WHO, FAO, and OIE, integrates human, animal, and environmental health data to predict and respond to zoonotic disease threats.

- **Vaccination Programs**

Vaccination remains one of the most effective tools for controlling infectious diseases in livestock and poultry. Coordinated vaccination programs, informed by epidemiological data, can prevent the spread of diseases like avian influenza and foot-and-mouth disease. In the poultry sector, for instance, vaccination against Newcastle disease has been shown to significantly reduce mortality rates and economic losses.

- **Biosecurity Measures**

Implementing strict biosecurity measures is essential to prevent the introduction and spread of pathogens in animal populations. These measures include controlling the movement of animals, maintaining hygiene standards in animal housing, and ensuring proper disposal of animal waste. A study published by the Food and Agriculture Organization (FAO) found that farms with robust biosecurity protocols had a 50% lower incidence of disease outbreaks compared to those with lax biosecurity practices.

- **Antimicrobial Stewardship**

The overuse and misuse of antibiotics in livestock and poultry can lead to antimicrobial resistance (AMR), a growing global health threat. The One Health approach advocates for responsible antimicrobial use through stewardship programs that include guidelines for appropriate antibiotic use, monitoring resistance patterns, and promoting alternative treatments such as probiotics and vaccines.

- **Education and Training**

Educating farmers, veterinarians, and public health officials about the importance of the One Health approach is crucial for its successful implementation. Training programs that emphasize the interconnectedness of human, animal, and environmental health can lead to more informed decision-making and better disease management practices.

Case Study: Avian Influenza in Southeast Asia

Avian influenza (AI) serves as a prime example of how the One Health approach can be applied to control a zoonotic disease in the poultry sector. In Southeast Asia, AI outbreaks have caused significant economic losses and posed serious public health risks. By integrating surveillance, vaccination, biosecurity, and public awareness campaigns, countries like Vietnam and Thailand have successfully reduced AI outbreaks and minimized their impact on both animal and human populations.

Challenges and Future Directions

While the One Health approach offers a comprehensive framework for disease prevention and control in the livestock and poultry sectors, several challenges remain. These include the need for better coordination between sectors, limited resources for implementing One Health strategies in low- and middle-income countries, and the ongoing threat of emerging infectious diseases. The effectiveness of One Health initiatives is also often hindered by a lack of political will, insufficient funding, and the complexity of coordinating efforts across different disciplines and sectors.
To address these challenges, there is a need for increased investment in One Health initiatives, enhanced collaboration between international organizations, and the development of innovative technologies for disease surveillance and control. Strengthening the capacity of low- and middle-income countries to implement One Health strategies is particularly important, as these regions are often the most affected by zoonotic diseases. Additionally, fostering public-private partnerships and engaging local communities in disease prevention efforts can enhance the sustainability and impact of One Health initiatives.

Conclusion

The One Health approach is essential for preventing and controlling diseases in the livestock and poultry sectors. By integrating efforts across human, animal, and environmental health, this approach can help mitigate the risks posed by zoonotic diseases, safeguard food security, and protect public health. As the world continues to face new and emerging disease threats, the adoption of One Health strategies will be critical in ensuring a healthier future for all. The integration of human, animal, and environmental health is not just a theoretical framework; it is a practical necessity for addressing the complex challenges of the 21st century.

In moving forward, it is imperative that governments, international organizations, and other stakeholders commit to the principles of One Health. This commitment must be reflected in policies, funding priorities, and on-the-ground practices that recognize the interconnectedness of health across species and ecosystems. Only through such a concerted effort can we hope to effectively prevent and control the diseases that threaten our shared future.

Organic farming as a climate change adaptation and mitigation strategy

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Recent decades have transformed Indian agriculture from traditional methods to a mechanized system reliant on fossil fuels, chemical fertilizers and pesticides, increasing greenhouse gas emissions and impacting global climate. Higher greenhouse gas levels, including carbon dioxide, methane and ozone are likely, causing the observed rise in air temperatures and leading to significant climate shifts. In most subtropical regions, a 4°C rise in global temperatures is anticipated to reduce groundwater and surface water, heightening food demand and threatening global food security. Climate change denotes long-term, significant alterations in climate measurements. A production system that maintains the health of ecosystems, soils and human populations is known as organic farming (IFOAM, 2006). Organic farming is energy-efficient and reduces greenhouse gas emissions by minimizing chemical and fossil fuel use, while enhancing soil carbon, biodiversity and fertility. It reuses plant and animal waste to restore soil nutrients, relies on renewable resources and supports sustainable, low-pollution management. Organic farming not only helps to mitigate climate change but also provides lasting benefits as an adaptation strategy. Effective nutrient management and carbon sequestration in soils are crucial for adapting and mitigating climate change across diverse temperature zones and local conditions.

Keywords: Greenhouse gas, Adaptation, Climate change, Mitigation and Organic farming.

Introduction:

Codex Alimentarius Commission (FAO/WHO) defines "Organic farming is a system, which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc.,) and to the maximum extent feasible relies upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". According to Eyhorn (2007), organic farming addresses socio cultural, economic, and physical issues that affect vulnerability and sustainable development. A workable path to resilient food systems and climate change is provided by organic farming (Delate *et al*., 2013). Approximately half of the population depends on agriculture for their livelihoods, and it accounts for 14% of GDP and 11% of exports, making it vital to national economies (MOA, 2012). Additionally, it provides raw materials to a range of industries. Climate change has a considerable impact on crop productivity, water availability, and food security. Agriculture is particularly sensitive to these effects (Goyal, 2004). From 13.5% to 30% of the world's greenhouse gas emissions are caused by agriculture (Foereid *et al*., 2008). It accounts for about 17.6% of the country's emissions in India (INCCA, 2010). Emissions have increased due to conventional practices that rely heavily on fossil fuels and intensive inputs (West and Marland, 2002). Reducing inputs and increasing carbon sequestration are two ways that organic farming can reduce greenhouse gas

emissions and promote climate resilience (Gattinger *et al*., 2012). According to several emission scenarios, the IPCC predicts that global temperatures would rise by 1.1 to 6.4 °C by 2100 (IPCC, 2007a). It is predicted that temperatures in India would climb by 1.7°C to 2.0°C, and that rainfall will increase by 3% to 7%. Climate-induced extinctions and reductions in species distribution are already evident, with significant local population losses across diverse habitats (Patle *et al*., 2014) extreme weather events are intensifying, negatively affecting agriculture, forestry, fisheries, and aquaculture. Greenhouse gas emissions from agriculture contribute 10–12% of total anthropogenic CO_2-equivalent emissions (IPCC, 2007). Organic farming has potential for both reducing greenhouse gas emission and enhancing soil carbon sequestration. It offers resilience against climate variability and aligns with sustainable development goals, making it a crucial focus for adaptation and mitigation strategies in the face of climate change.

Greenhouse gas emission from global agriculture:

Monitoring for greenhouse gas (GHG) emissions across all relevant sectors is essential, as they occur across the food chain from agricultural production to consumption. Perhaps 25–30% of greenhouse gas emissions worldwide are related to agriculture. Each year, human activities release more carbon dioxide into the atmosphere than natural processes can remove, causing the amount of carbon dioxide in the atmosphere to increase. The amount of CO_2 in the atmosphere as of 2022 was 417 parts per million (ppm), (Fig:6). However, the Annual Greenhouse Gas Index (AGGI) indicates an equivalent concentration of 523 ppm CO_2 when taking into account the cumulative warming effect of all greenhouse gases (Fig:1, Fig:2 and Fig:5). Greenhouse gases have a considerable impact on global warming. A little over 36 billion metric tons of CO_2 are released into the atmosphere each year from a variety of sources, such as energy generation, cement production, deforestation, transportation, and agriculture. For more than a millennium, a considerable amount of CO_2 is retained in the atmosphere. Seventy-seven percent of the heat rise monitored by the AGGI since 1990 can be attributed to increases in atmospheric CO_2 levels of 63ppm. The global average carbon dioxide set a new record high in 2023, 419.3 parts per million. Atmospheric carbon dioxide is now 50 percent higher than it was before the industrial revolution. The annual rate of increase in atmospheric carbon dioxide over the past 60 years is about 100 times faster than previous natural increases, such as those occurred at the end of the last ice age 11,000-17,000 years ago,(Fig:11). Global average surface temperature has increased, (Fig:4). The ocean has absorbed enough carbon dioxide to lower its pH by 0.1 units, a 30% increase in acidity.

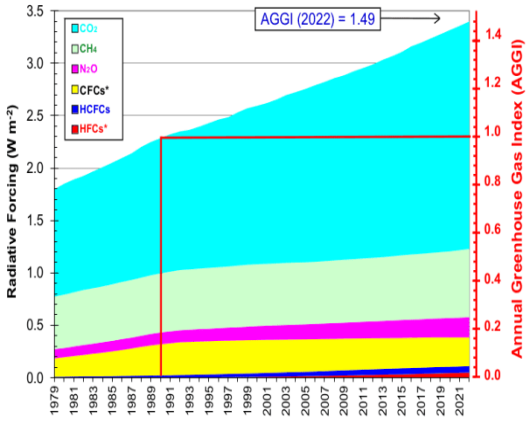

Fig:1 NOAA Annual Greenhouse Gas Index
Source: NOAA Global Monitoring Laboratory.

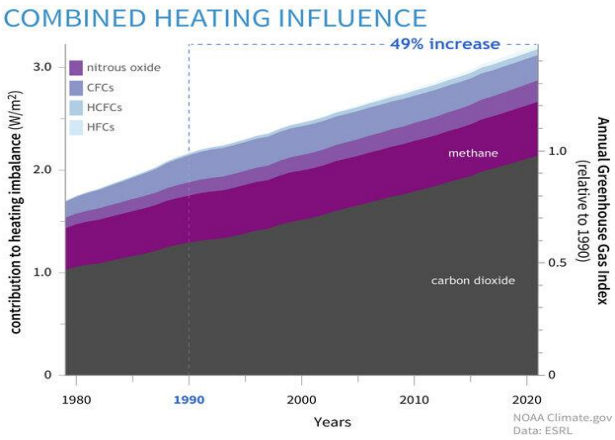

Fig:2 Greenhouse gas heating imbalance
Source: NOAA Global Monitoring Laboratory

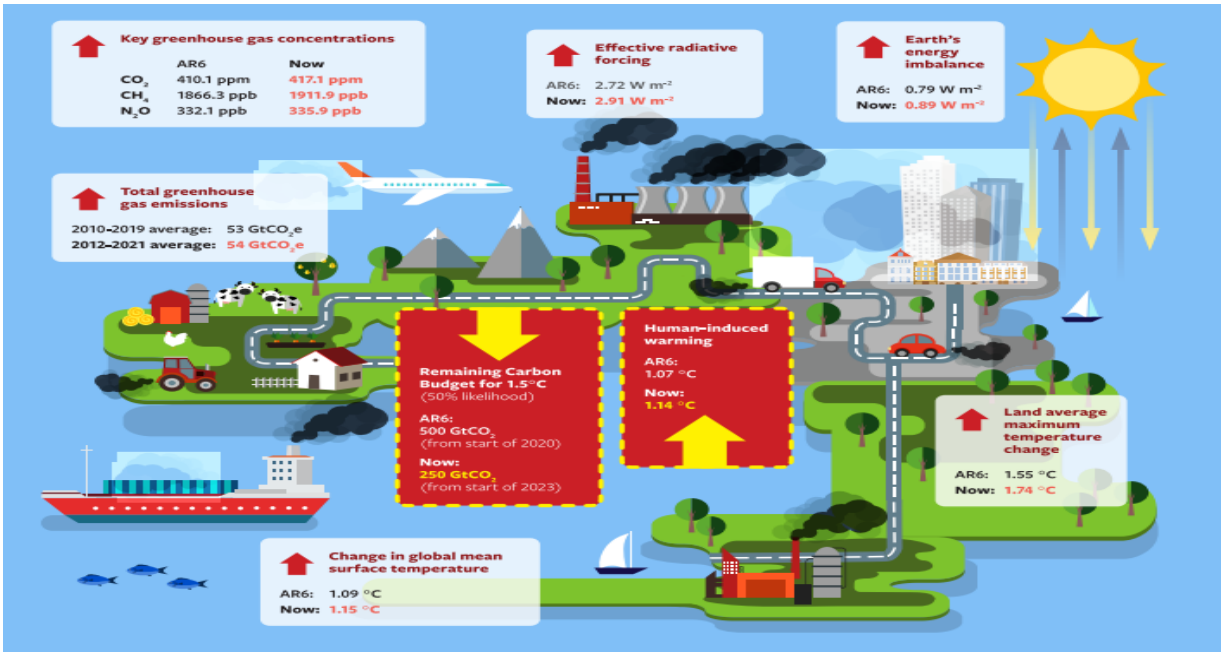

Fig:3 Indicators of Global Climate Change (IGCC) initiative. Source: essd.coprincus.org

Methane (CH_4) is the second most significant contributor after carbon dioxide. In 2022, the amount of heat trapped in the atmosphere by greenhouse gases caused by human activity was 49% higher than in 1990, as per the NOAA's Annual Greenhouse Gas Index, (Fig:3). A total of fifteen gases, including CO_2, methane, nitrous oxide, chlorofluorocarbons, and other heat-trapping gases, are tracked and their warming influence is measured by the AGGI. Methane in the atmosphere averaged 1,911.8 parts per billion (ppb) in 2022, which is almost 2.5 times more than pre-industrial levels (Fig:8). Furthermore, methane emissions from fossil fuels have increased. The concentration of nitrous oxide, the third most significant greenhouse gas produced by humans, increased by 24% from pre-industrial levels to 335.7 parts per billion in 2022(Fig:7). Due mostly to increased usage of nitrogen fertilizers and manure brought on by agricultural intensification and expansion, last year's 1.25 ppb growth was the third-largest since 2000. This emphasizes the continued influence of farming methods on greenhouse gas emissions and the requirement for focused mitigation plans.

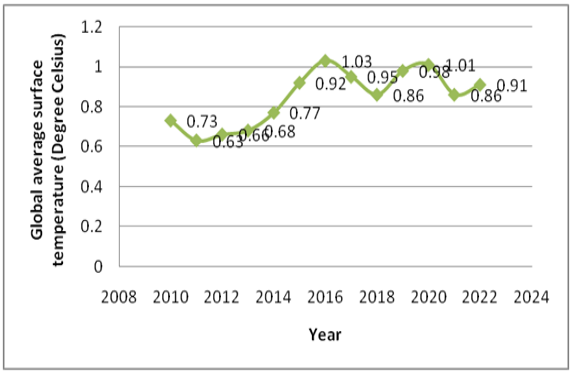

Fig 4: Global average surface temperature (°c)
Source: essd.coprincus.org

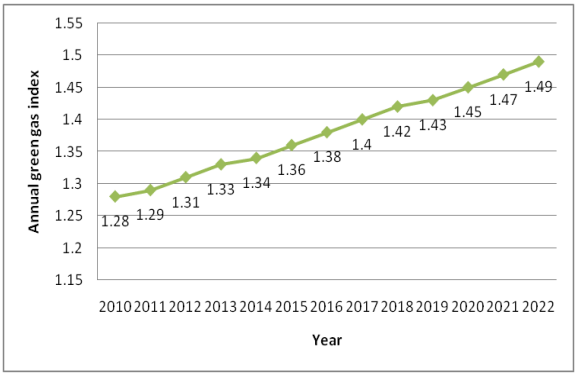

Fig 5: Annual greenhouse gas index
Source: essd.coprincus.org

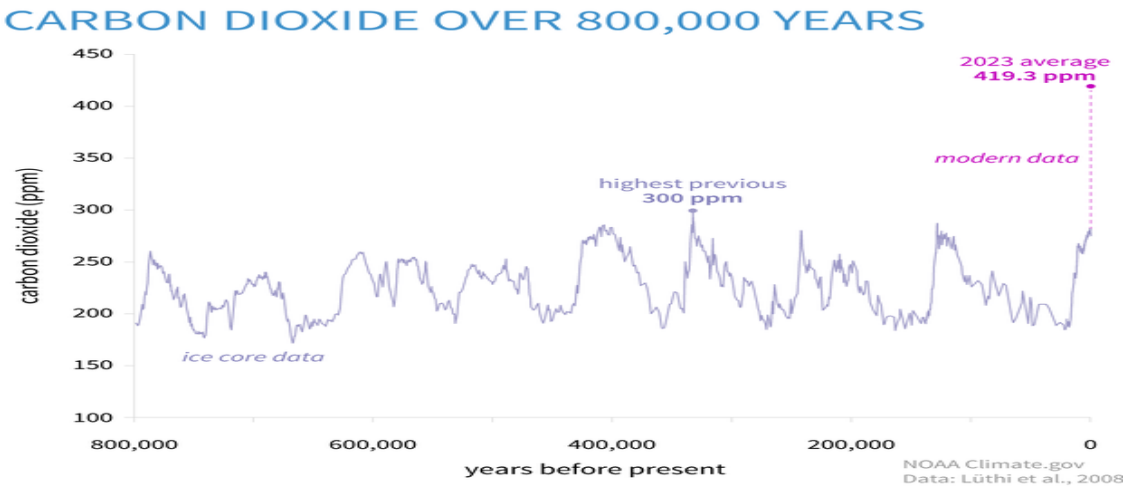

Fig6: Global carbon dioxide concentration (ppm)Source: NOAA Global Monitoring Laboratory.

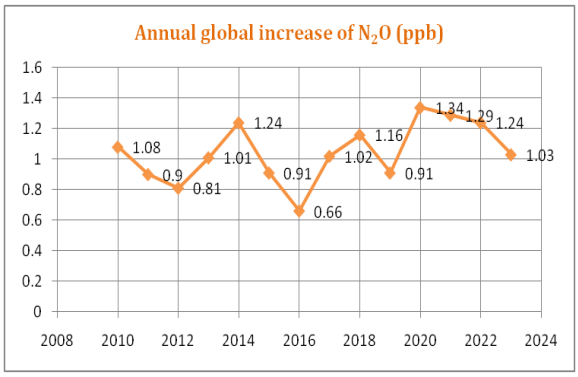

Fig:7 Annual global increase of N_2O(ppb)
Source: NOAA Global Monitoring Laboratory

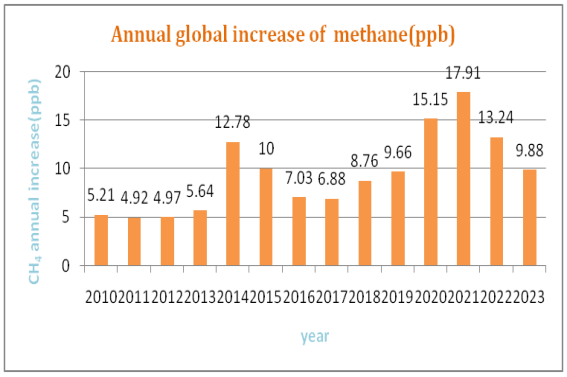

Fig:8 Annual global increase of CH_4(ppb)
Source: NOAA Global Monitoring Laboratory.

Emissions and removals of the greenhouse gases:

Gases that trap heat in the atmosphere are called greenhouse gases. Greenhouse gas consist of CO_2, methane, nitrous oxide, chlorofluorocarbons, and other heat-trapping gases (Fig:9).

- **Carbon dioxide (CO_2):** Carbon dioxide enters the atmosphere through burning fossil fuels (coal, natural gas, and oil), solid waste, trees and other biological materials, and also as a result of certain chemical reactions (e.g., cement production) (Fig:10). Carbon dioxide is removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- **Methane (CH_4):** Methane is emitted during the production and transport of coal, natural gas and oil. Methane emissions also result from livestock and other agricultural practices, land use, and by the decay of organic waste in municipal solid waste landfills.
- **Nitrous oxide (N_2O):** Nitrous oxide is emitted during agricultural, land use, and industrial activities; combustion of fossil fuels and solid waste; as well as during treatment of wastewater.

Fluorinated gases: Hydro fluorocarbons, per fluorocarbons, sulfur hexafluoride, and nitrogen tri fluoride are synthetic, powerful greenhouse gases that are emitted from a variety of household, commercial, and industrial applications and processes. Fluorinated gases (especially hydro fluorocarbons) are sometimes used as substitutes for stratospheric ozone-depleting substances (e.g., chlorofluorocarbons and hydro chlorofluorocarbons). Fluorinated gases are typically emitted in smaller quantities than other greenhouse gases, but they are potent greenhouse gases. They are sometimes referred as high global warming potentials gases because, for a given amount of mass, they trap substantially more heat than CO_2.

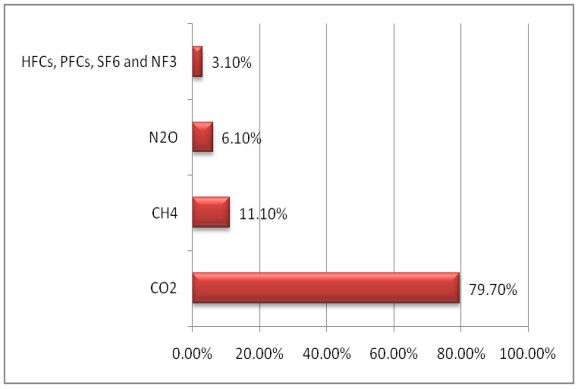

Fig:9 Greenhouse gas composition
Source: essd.coprincus.org

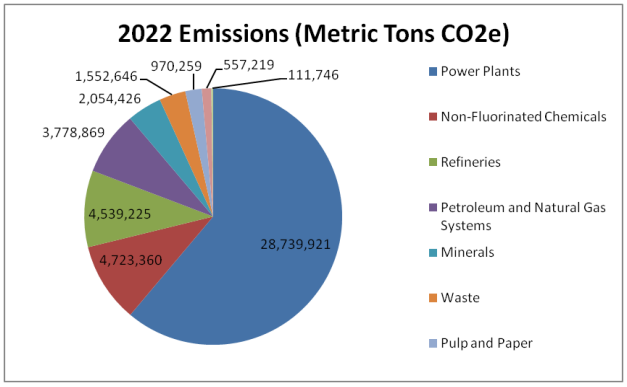

Fig:10 Global CO_2 emissions from various sources
Source: essd.coprincus.org

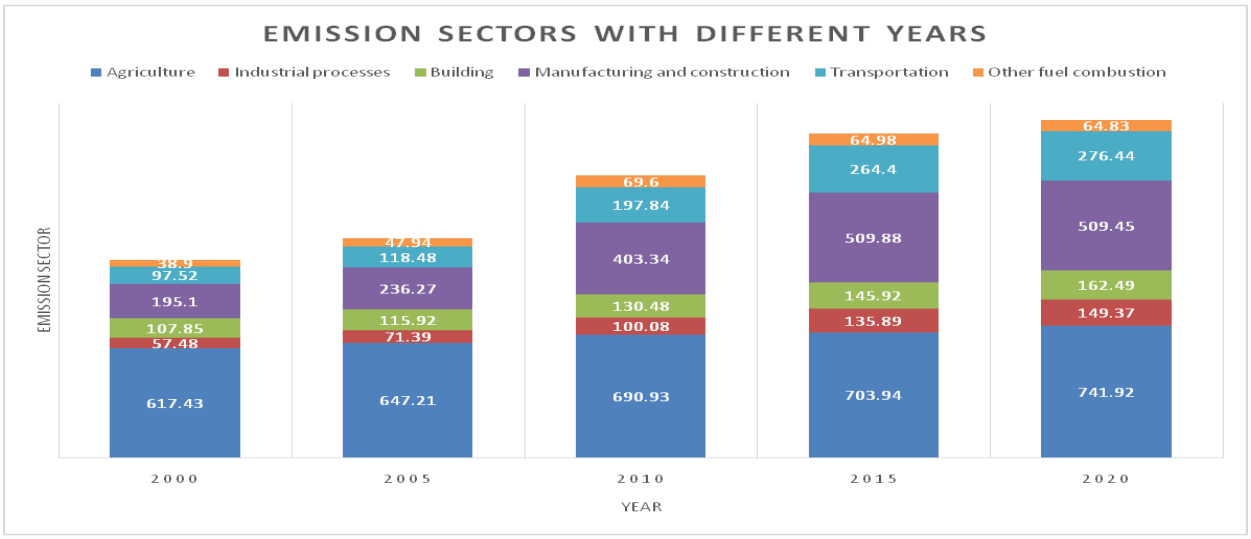

Fig: 11 Various sector annual greenhouse gas emissions worldwide(million metric tons of CO_2e).Source: Statista,2024

Impacts of climate change on the agricultural sector:

Climate change is one major obstacle to sustainable development. Global temperatures have risen by 1.0°C over pre-industrial levels due to anthropogenic greenhouse gas emissions. Between 2030 and 2052, it is predicted that global warming will increase by 1.5°C, which will increase the frequency of extreme weather events including heat waves, floods, and droughts, and impair

ecosystem function. Climate change impacts agriculture through primary and secondary effects. Agriculture is impacted by both primary and secondary effects of climate change. Primary effects include crop growth effects, changes to the energy and moisture balances in farming, and atmospheric changes brought on by an increase in greenhouse gases. Changes in the physical and chemical qualities of agricultural soil and adjustments to the best places for production are examples of secondary effects that arise from these primary changes. Producing agricultural products using suitable farming systems and choosing crops that are adaptable to local conditions. Climate change affects temperature, precipitation, and sunshine in agricultural ecosystems, changing biodiversity and increasing pest and disease incidence. Crop growth and maturity are directly impacted by temperature and rainfall variations, which expose crops to both biotic and abiotic stresses. According to a recent study, 30–50% of losses in agricultural productivity worldwide are attributed to these stresses. It alters pasture growth patterns and biological processes in cattle, such as fertilization and breeding. Due to changes in water sources, climate change has a substantial impact on agricultural infrastructure, farm household incomes, asset values, and agricultural production in rural areas. Climate change not just shifts in temperature, precipitation, and rising atmospheric CO_2, but also extreme scenarios like glacial melt, permafrost melting, and rising sea levels.

Status of organic farming in India:

As per the Agricultural and Processed Food Products Export Development Authority, (APEDA) India's rank second in terms of World's Organic Agricultural land and first in terms of total number of producers. India has lot of potential to produce all varieties of organic products due to its various agro climatic conditions. This holds promise for the organic producers to tap the market which is growing steadily in the domestic and export sector. In several parts of the country, the inherited tradition of organic farming is an added advantage. About 30% of global crop production and global food supply is provided by small land holdings, less than 2 hectares, using around 25% of agricultural land, and in a way that usually maintains rich agro-biodiversity. As on 31st March 2024 total area under organic certification process is 7.3 million ha. This includes 44.75 million ha cultivable area and another 28.50 million ha for wild harvest collection. Among all the states, Madhya Pradesh has covered largest area under organic certification followed by, Maharashtra, Rajasthan, Gujarat, Odisha, Sikkim, Uttar Pradesh, Uttarakhand, Kerala, Karnataka and Andhra Pradesh. India produced around 3.6 million metric tons of certified organic products. The total volume of export during 2023-24 was 2,61,029 MT. Organic production is governed by UK and EU legislation

Organic farming as adaptation to climate change:

The objective of adaptation strategies is to restore ecological resilience and production, which is essential for long-term, sustainable economic growth. Agriculture is extremely vulnerable to climate change, thus in order to guarantee food supplies, it needs to use workable adaptation strategies, (Tab:1). According to Ensor (2009), organic farming encourages resilient farming systems that withstand harsh weather conditions, droughts, and soil erosion—all of which contribute to agriculture being a more sustainable and ecologically friendly industry. Agro-ecosystems that practice organic farming are more resilient to the impacts of climate change. The adaptation costs associated with organic farming is minimal and mostly relate to information, education, and extension services.

Tab:1 Types of adaptation to climatic changes.

Aspect	Adaptation Measure	Description
Physical Adaptations		
Erosion Control	Contour farming, terracing. Wind breaks, cover crops.	Reduces soil erosion by slowing water runoff and increasing water infiltration. Protects soil from wind erosion and improves soil structure
Soil Moisture Management	Mulching, irrigation improvements. Rainwater harvesting.	Helps retain soil moisture and reduces evaporation. Collects and stores rainwater for agricultural use, reducing dependency on irregular rainfall
Temperature Regulation	Agro forestry. Conservation tillage.	Incorporates trees into agricultural systems to provide shade and reduce soil temperature. Minimizes soil disturbance, preserving soil moisture and structure.
Chemical Adaptations		
Nutrient Management	Organic amendments, crop rotation. Precision agriculture.	Enhances soil fertility and nutrient cycling. Utilizes technology to optimize fertilizer application and reduce chemical runoff.
pH Regulation	Liming acidic soils. Gypsum application on sodic soils.	Increases soil pH to improve nutrient availability. Helps reclaims sodic soils by improving soil structure and reducing salinity.
Biological Adaptations		
Enhancing Soil Biodiversity	Cover cropping, green manures. Reduced pesticide.	Improves soil health by increasing organic matter and supporting diverse microbial communities. Use Protects beneficial soil organisms and promotes a healthy soil ecosystem.
Promoting Soil Fauna	Habitat creation, reduced tillage.	Supports earthworms and other beneficial soil fauna that enhance soil structure and fertility.
Plant-Soil Interaction	Mycorrhizal inoculation.	Improves plant tolerance and enhances plant nutrient uptake through beneficial fungal relationships.

Organic farming as mitigation of climate change:

Organic farming mitigates climate change by emitting fewer greenhouse gases and sequestering more carbon in soil (IFOAM, 2009). Increasing soil organic carbon in farming systems has also an important mitigation option by IPCC (2007b). About 32 percentage of all current man-made greenhouse gases emissions can be sequester through adaption of organic farming globally (Jordan *et al*., 2009). According to FAO, organic systems emit fewer greenhouse gases due to lower energy inputs and sequester more carbon in biomass compared to conventional systems, (Ziesemer, 2007). Soil organic carbon sequestration potential in global grasslands is 2.3 to 7.3 billion tons of carbon dioxide equivalents per year (CO_2e $year^{-1}$) for biodiversity restoration, 148 to 699 megatons of CO_2e $year^{-1}$ for improved grazing management, and 147 megatons of CO_2e $year^{-1}$ for sown legumes in pasturelands. Organic farming minimizes N_2O emissions and reduces CO_2 emissions due to improved soil structure, increased plant cover, and lower fossil fuel use. Soils are the major sink for atmospheric CO_2, soil organic carbon increased through organic manures, crop cover and crop rotation and restores it for the longer duration in organic farming. Aher *et al*., (2012) found that organic yields are comparable to conventional yields while using 45% less energy, demonstrating greater efficiency in mitigation efforts. Organic farming systems use 20 to 50% less energy compared to the conventional farming system (Muller *et al*., 2012). It also enhances resilience through water efficiency, better handling of extreme weather, and reduced risk of crop failure.

Benefits of organic farming regarding climate change:

According to Wani *et al*., (2013) the numerous benefits of organic farming practices is its contribution to climate change. The following benefits are:

- Reduction in greenhouse gas emissions and decreased need for fossil fuels per acre and kilogram as a result of not using synthetic fertilizers. The successful sequestration of carbon dioxide into the soil reduces soil erosion, a significant source of CO_2 losses.

- Leguminous crops, agricultural residues, cover crops, and the stability of soil organic matter all contribute to better soil fertility and nitrogen availability. Increases the soil's ability to hold on water in the face of erratic weather that brings greater temperatures and erratic precipitation amounts. Retaining soil carbon aids in resilience to climate change.

- Largely in agro forestry production methods made feasible by farming. Highly adaptable systems due to applications of farmers traditional skills, soil fertility-building strategies, and a high level of diversity.

- Enrichment of soil, management of temperature, conservation of rain water, maximum harvesting of sun energy, self reliance in inputs, maintenance of natural cycles and life forms, integration of animals and maximum reliance on renewable energy sources, such as solar power and animal power.

- The foundation of organic farming lies in the health of the soil. A fertile soil provides essential nutrients to a growing crop plant, and helps support a diverse and active biotic community. Strategies to build soil fertility are crop rotations, animal and green manures, and cover cropping.

Conclusion:

An increasing population has put a lot of pressure on agriculture to ensure the food and nutritional security of the world, which is further worsening with climate change. The future climate scenario report that climate change will decrease agricultural productivity in the coming years. A number of mitigation and adaptation strategies have been developed to offset the deleterious impact of climate change on agricultural sustainability. Mitigation and adaptation strategies are expected to increase farmers income without compromising agricultural-production sustainability. Organic farming aims at cultivating the land and crops raising in such a way, as to keep the soil alive and in good health conditions by use of wastes that are organic such as (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial micro organisms(bio fertilizers and bio pesticides) to grow and protect the crops for increased sustainable production in an ecologically friendly and pollution free environment. Effective adaptation and mitigation strategies must be widely disseminated in order to improve the ecology and soil health of the environment and stop the impending negative consequences of climate change and variability. Suitable varieties need to be developed that could adapt to climatic variations, along with planned agronomic management and crop pest control. Farmers need to be educated regarding various climate-smart technologies, and be provided training to simplify their use at the field level.

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Green Energy: An eco-friendly push for sustainable farm income in Punjab

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India aims to meet half of its energy requirements from renewables and in this context, the efficient management of the abundantly available green energy source i.e. agricultural biomass in agriculture rich state of Punjab is imperative. With increased energy demand, depleting fossil fuel sources, sustainable agricultural waste management, and pollution from traditional fuel usage, attention has been attracted to sustainable energy generation from biomass. Additionally, the strategy to combat climate change and minimizing carbon footprint includes the sustainable use of bioenergy. Use of crop residues as feedstock for generating bioenergy (SDG 7) also provide livelihood and thus economic opportunities to farmers (SDG 1) which significantly improve the food and nutrition security for the household. Despite the government's earnest intent and efforts to address this issue, farm fires remain persistent policy conundrums. The total per capita power consumption being at 1975 KWH during 2022-23 is almost 1.57 times the national average. The main source of power in the state is thermal electricity. This could be increased further if Punjab were to leverage the power of biomass, abundant in the state due to its large agricultural sector . From 500 lakh MT crop residue generated in Punjab state during 2022-23, about 35 per cent remained surplus which has the capacity to generate 1637.2 MW. For existing 11 power plants in the state, utilized bioenergy potential is 97.50 MW, requiring approximately 8.76 lakh MT of straw per annum (only 6 % of available surplus). The present study highlighted the significant untapped potential for electricity generation from crop residue as 327 power plants of 5 MW may be set up in the state to harness the energy potential from the surplus paddy. Steps like dense network of straw banks, boosting demand for biomass to encourage more participation in biomass supply chain via proper market, enhanced financial incentives to support farmers and entrepreneurs investing in biomass machinery, streamlining the collection, public awareness campaigns and optimising the supply chain, investing in rural infrastructure can help to achieve the targets of sustainable management and promoting their use in socially and economically viable green energy generation.

Introduction

The primary requirement for economic growth is energy. Due to factors including increased energy demand, depleting fossil fuel sources, sustainable agricultural waste management, and pollution from traditional fuel usage, attention has been attracted to sustainable energy generation from biomass (Prasad et al 2020; Singh et al 2022). One potential green energy source that may either be converted directly or indirectly into energy is biomass (Baum et al2013). Use of crop residues as feedstock for generating biofuel and bioenergy (Sustainable Development Goals (SDG 7)) provide livelihood and thus economic opportunities to farmers (Poverty reduction SDG 1) which significantly improve the food and nutrition security for the household (SDG 2). Crop residue burning is greatly influenced by lack of casual labour (Lohan et al 2018), short turn-around time (Shyamsundar et al 2019), socio-economic constraints (Lopes et al 2020), farmers' ignorance

towards public health issues (Chawala and Sandhu2020) and low nutritive value of crop residues (Singh and Sidhu 2014). Additionally, the strategy to combat climate change, switch from fossil fuels to renewable energy, and minimizing carbon footprint includes the sustainable use of bioenergy (Prasad et al 2021).

Bioenergy is the main source of renewable energy on a worldwide scale, making up around two thirds of the mix of renewable energy sources and 13 to 14 per cent of overall energy consumption (Anonymous 2021a). In India, biomass accounts for around 32 per cent of all primary energy consumption, and over 70 per cent of the population relies on biomass for energy (Ramachandra and Shruthi 2007). Maintaining the environment and economic growth simultaneously is extremely difficult in emerging nations like India where economies are growing quickly (Mittal et al 2016). In the biomass power and bagasse cogeneration sector, 500 biomass power and cogeneration projects with a capacity of about 9187megawatts (MW) have been installed (Anonymous 2020). Longer gestation periods are required to build new non-renewable energy production plants (Venkatramanan et al 2021b) and in this regard, agricultural biomass demands careful attention in any energy development plan, especially in an agrarian state like Punjab, as it is more dependable, affordable, and easily exploitable than solar and wind energy choices.

Punjab being an agriculture rich state has huge potential of biomass resource availability in the form of crop residues. The state contributes about 19 per cent of wheat, 11 per cent of rice and 5 per cent of cotton of the country.The vast agricultural production further leads to huge agricultural waste generation which has a great use in the niche applications. In spite of huge potential, agricultural residues are mostly burnt out in practice. In Punjab, almost 12 million tons of paddy straw are burned annually, causing severe environmental problems like as air and soil pollution (Sood 2015). Because there is an abundance of biomass available, particularly in the form of agricultural waste, biogas power plants may produce power more efficiently and sustainably than traditional power generating methods. Presently, the state is home to 11 privately owned biomass-based power plants with an annual producing capacity of 97.5 MW and a rice straw consumption of 8.8 lakh tons. The state administration has been considering using 1.2 million tons of compressed biogas projects and one million tons of paddy straw at 11 biomass projects (TNS 2022).The use of agricultural biomass is continuous on the rise as it has emerged as a viable energy source for generating power. By February 2024, India's biomass power capacity had surged to 10,845 MW as per the Ministry of New and Renewable Energy (MNRE). This surge in biomass power is crucial for India as it aims to meet 50 per cent of its energy requirements from renewables. Proper management of crop residue not only helps in controlling environmental pollution but is also a source of valuable extra income to farmers. The System of Air Quality and Weather Forecasting And Research (SAFAR) under the Ministry of Earth Sciences estimated that paddy stubble burning in Punjab and Haryana contributed 40–45 per cent to Delhi’s air pollution during peak burning days in 2019 (Press Trust of India 2019).

Keeping this in mind, the present study was carried out to study the amount of surplus paddy residue generation, infrastructure available in terms of biogas power plants and CRM machinery along with perceptions, willingness and challenges faced by the stakeholders to participate in a supply chain.

Material and Methods

Data regarding district wise area and production of paddy, the most cultivated Kharif crop in the state was taken from Statistical Abstract of Punjab (2023). Also information regarding the

calculation of paddy residue generation and its surplus was gathered from different published research papers and studies.

Formulas used:

CR = (Ai* Yi*CRRi)

Where,

CR = Total crop residue generated
Ai= Area under 'paddy' crop
Yi= Average yield of 'paddy' crop
CRRi= Crop-to-residue ratio (CRR) of 'paddy' crop – extracted from (Hiloidhariet al (2014) and Chauhan (2012))

SCR =(CR*SF)

Where,

SCR = Surplus crop residue generated
SF = Surplus residue fraction (0.34 for paddy)

Total energy (MJ) = Total surplus residue × Calorific value of biomass (MJ tons)

Electricity (MWh) = (Energy (MJ) x 0.30)/(365*20)

•Combustion efficiency was assumed to be 30 per cent of the biomass, and it is assumed that plant will operate for 365 days 20 hours per day based on study by Chahal and Chhabra, 2014.

Primary data was also collected from farmers (adopters and non-adopters) & middlemen as well as biogas operated power generation plants working with different capacities from three different districts i.e. Sri Mukatsar Sahib, Moga and Hoshiarpur regarding challenges faced by them. Further, the data were analyzed using averages and percentages.

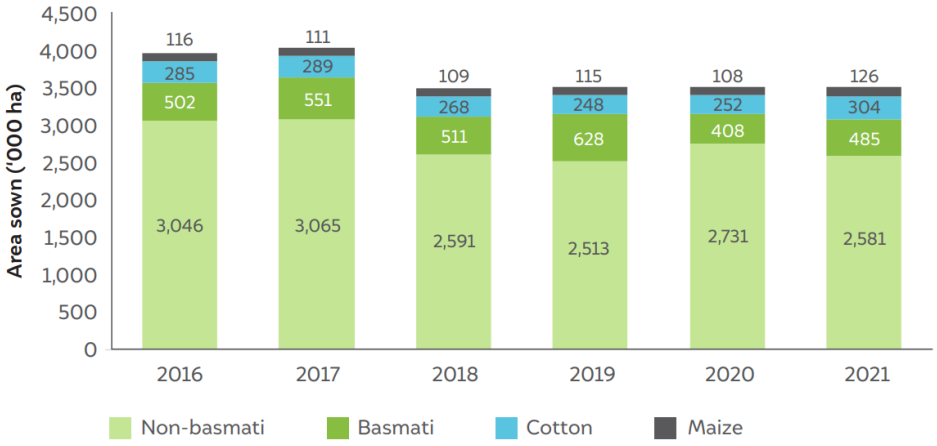
Results and Discussion

- Paddy cultivation in Punjab

The policy thrust on the self-sufficiency of food grains inadvertently led to the synchronisation of the Rabi and Kharif crop cycles, encouraging the practice of crop residue burning (Gupta 2019; Kurinji and Prakash 2021). Paddy remains most cultivated Kharif crop in the Punjab state and the paddy cultivated area in state during 2022-23 was 31.67 lakh hectares. Despite a gradual decline in area under paddy, variety Pusa 44 remains the dominant variety in Punjab state. It is one of the most dominant varieties in the districts of Barnala, Bathinda, Ludhiana, Patiala, and Sangrur, which are also among the high-burn districts in the state (ibid). Its long gestation period leaves farmers with little time to manage the vast quantities of residue generated. Despite the Indian Agricultural Research Institute having discontinued breeder seed production of PUSA 44 in 2017, state actors anticipate that the seeds stocked by farmers will likely be exhausted in the coming seasons, leading to the phase-out of the variety only by 2025 (Joshi 2022).

Among different crops, the cultivated area dedicated to the non-basmati paddy varieties (including Pusa 44) is the highest i.e. 25.81 lakh hectares (Kamal 2022) as shown in Figure 1.

Figure 1: Area under major crops in Punjab



Source: Authors' compilation from Agricultural Statistics of Punjab (2020); All India Crop Situation (2021); and Neel Kamal. 2021. 'Area under Water-Guzzling Paddy Falls by 4 Lakh Acres in Punjab'. The Times of India.

- Initiatives by the Government regarding crop residue management

As per the Punjab government's action plan submitted to the union government in 2022, the state aims to manage over 20.5 million metric tonnes (MT) of paddy straw through in situ and ex-situ CRM and crop diversification by the financial year 2023–24 (Anonymous, 2022a) as shown in Table 1.

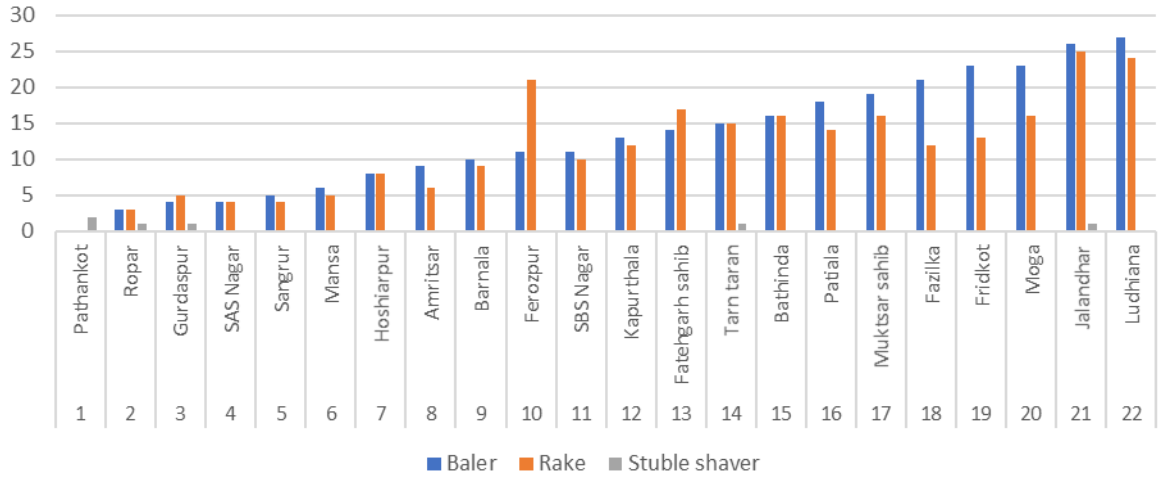
Table 1: Surplus paddy residue management plans by the Punjab Government

Strategy	Paddy residue utilisation target (Mt)			
	2020–21	2021–22	2022–23	2023-24
Crop diversification	2.57	3.57	4.57	5.22
In-situ CRM	6.45	8.13	9.44	10.7
Ex-situ CRM	0.92	1.22	1.52	4.67
Total	9.94	12.92	15.53	20.59

Source: Anonymous (2022a); Anonymous (2022b)

Among different steps taken to promote CRM, provision of assistance in form of subsisdies for ex situ residue management machineries i.e. Balers and rakes is also taken by the Agriculture Department in the Punjab (Figure 2). Analysis of the data indicated that Ludhiana ranks first in number of rakes while this is the case of Jalandhar for balers.

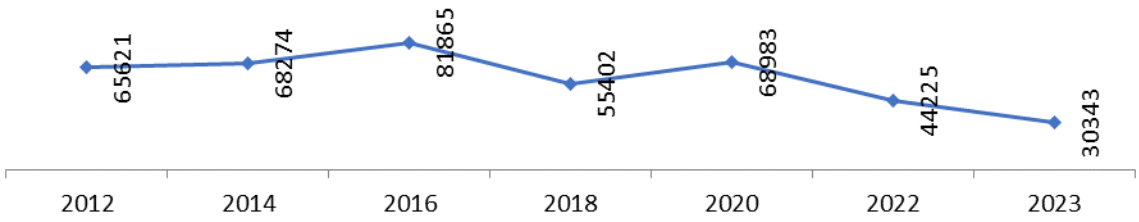
Figure 2: District wise machinery for CRM provided under subsidy in Punjab during 2018-19 to 2021-22



Source: Anonymous (2022a)

In recent times, the public, media, government, and judiciary have become increasingly concerned about the health and economic consequences of stubble burning. Both central and state governments have implemented various policy measures, including subsidizing CRM machines, offering cash incentives to small farmers refraining from burning, and imposing a complete ban on crop residue burning (MoAFW 2018; Rambani 2019; PTI 2019). In early 2023, the Punjab chief secretary assured the Commission for Air Quality Management (CAQM) that the state would reduce 50 per cent of farm fire cases in 2023 compared to the previous year (Express News Service 2023a).Despite the government's earnest intent and efforts to address this issue, farm fires remain persistent policy conundrums (Figure 3),

Figure 3: Stubble Burning Cases in Punjab (No. of open fires)



Source: CREAMS 2020 and Kurinji et al, 2024

It has been estimated that the annual monetary cost of crop residue burning to the state farmers, is around Rs 800-2000 crore in terms of nutritional loss and Rs 500-1500 crore in the form of government subsidies on nitrogen, phosphorus and potash fertilizers (Alexaki et al. 2019). Another study for North West India revealed that the private cost borne by the farmers which are associated with paddy straw burning are about Rs 8953 per hectare. Apart from this, the social cost of paddy straw burning was estimated at Rs 3199 crore being the highest for Punjab (Rs 1804

crores) as shown in Table 2.

Table 2 : Social cost of paddy straw burning (Rs Crore)

Particulars	Punjab	Haryana	Western UP	North West India
Loss of NPK	952	476	256	1684
Cost of additional irrigation	184	92	50	326
Cost of health	13	12	5	29
Loss due to reduction in yield	902	451	243	1596
Loss of carbon credit	279	139	75	494
Loss of soil biodiversity	13	7	4	23
Loss of employment	1040	520	280	1840
Losses avoided*	1579	789	425	2793
Net balance	1804	907	488	3199

*by ensuring timely sowing of wheat

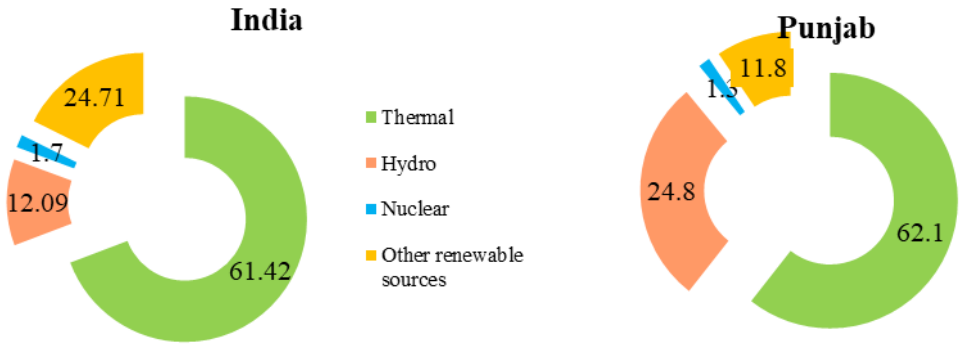
Source: Kumar et al. 2019

- **Energy scenario in Punjab**

The major sources of energy such as coalmines, natural gas, tidal power and oil are not available in Punjab. The scope for wind energy and tidal energy is also limited due to low velocity of winds and the distant location of the state from the sea. Despite wide scope of solar energy, the commercial exploitation of this source is negligible as yet. For many years there has been a demand for nuclear power station in the state but it has not yet materialized. Thus, the main source of power in the state is thermal electricity. The installed capacity for power generation in Punjab was 14687 MW and generated 38241 Million KWH of electricity during 2021-22 (Anonymous, 2023). The highest consumer of electricity is the industrial sector (33.58% of total electricity consumed in the state in 2022-23). The per capita electricity consumption was 623 KWH by domestic sector, 224 KWH by commercial sector, 663 KWH by the industry, 28 KWH by public lighting and 436 KWH by agriculture during 2022-23. The total per capita consumption being at 1975 KWH during 2022-23 is almost 1.57 times the national average of 1255 KWH (www.indiastat.com).

In terms of installed capacity for power generation, thermal power plants accounted for an overwhelming 61.42% of the total installed capacity in the country. Other renewable sources (excluding hydro) come next with about 25% of the total installed capacity whereas the share of hydro and nuclear energy was only 12 and 1.70 per cent, respectively (Anonymous, 2022c). As of 2022, majority of the installed capacity in the state comes from thermal sources. However, renewables and clean power sources, such as nuclear, hydro and other renewables (solar, wind etc.) constitute the remaining (Figure 4).

Figure:4: Share of different components in installed power generation capacity, 2022-23



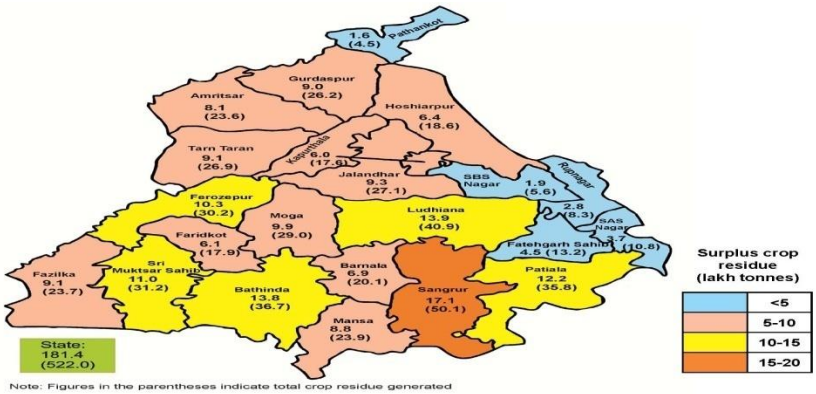
Source: Anonymous 2022c and Anonymous 2022d

This could be increased further if Punjab were to leverage the power of biomass, abundant in the state due to its large agricultural sector . Of the installed capacity, 21% is owned by the government of Punjab, 46% is privately owned and 33% is centrally owned (Anonymous 2022c). Of the total installed capacity in India, about 51 percent is privately owned while one-fourth is owned by the state government and rest 24 per cent is centrally owned (Anonymous, 2023b). The over dependence on private sector for power generation in Punjab may lead to tariff hike for monetary gains of private companies and resultantly may make the power costlier for the consumers. Biomass energy, from crop residues available in plenty in the state, can be used as substitute for these fossil fuels in the production of energy.

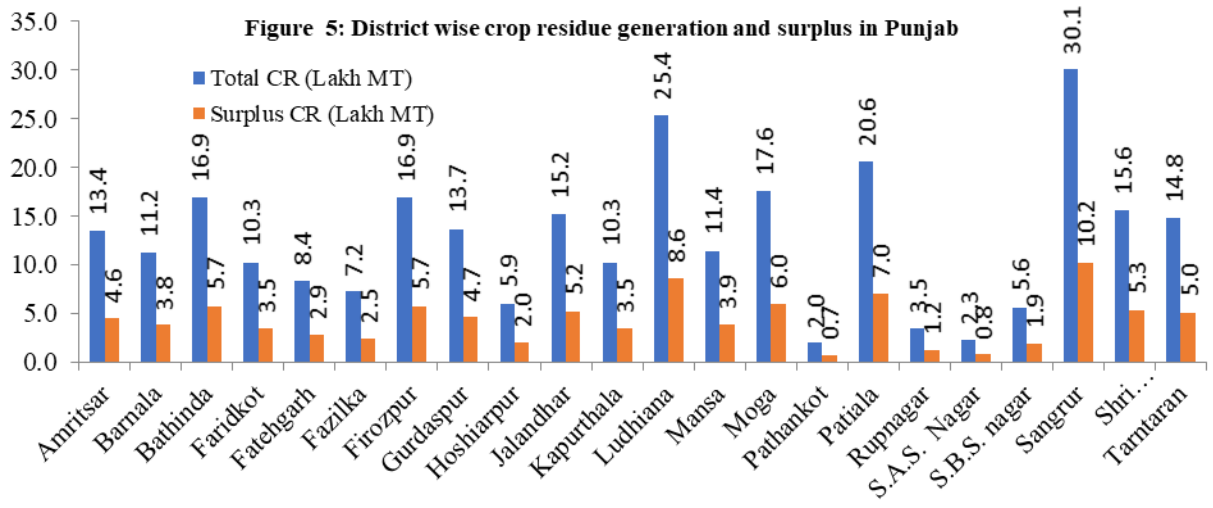
• Crop residue generation in Punjab

About 500 lakh MT crop residue was generated in Punjab state during 2022-23 (Figure 5). Of this total crop residue produced, about 35 per cent remained surplus i.e. 181.4 lakh MT.

Figure 5: Crop Residue Generated in Punjab



A detailed overview of the paddy residue generation and its surplus in different districts, offering insights into both the volume of residue has been shown in Figure 5. Total paddy residue generated in the state was 278.4 lakh MT while 94.7 lakh MT remained surplus.



Source: Author's calculations (Anonymous 2023a)

The paddy residue generation (straw and husk) varied from 30 lakh MT in Sangrur to 2 lakh MT in Pathankot. Accordingly the surplus paddy residue was the highest for Sangrur i.e. 10.2 lakh MT and 0.7 lakh MT in Pathankot.

- **Potential of energy generation from paddy residue**

The state has the capacity to generate 1637.2 MW by using surplus paddy residue for power generation (Table 3). Sangrur has capability of generating as high as 176.8 MW of power (10.8% of the state potential) while Pathankot with least surplus paddy residue has the potential to generate 11.6 MW power. For existing 11 power plants in the state, utilized bioenergy potential is 97.50 MW, requiring approximately 8.76 lac (876,500) metric tons of straw per annum utilizing only about 6 per cent of the surplus paddy residue available. It was also estimated that 327 power plants of 5 MW may be set up in the state to harness the energy potential from the surplus paddy residue. On the other hand, it was observed that there exist only 2 power plants each in Shri Mukatsar Sahib and Jalandhar while one each in Fatehgarh Sahib, Firozpur, Gurdaspur, Jalndhar, Kapurthala and Moga of varying capacities. Thus significant untapped potential for electricity generation from crop residue exists in the state for which utilization efforts can be further enhanced.

Table 3: District wise electricity potential from paddy residue and its utilization in Punjab

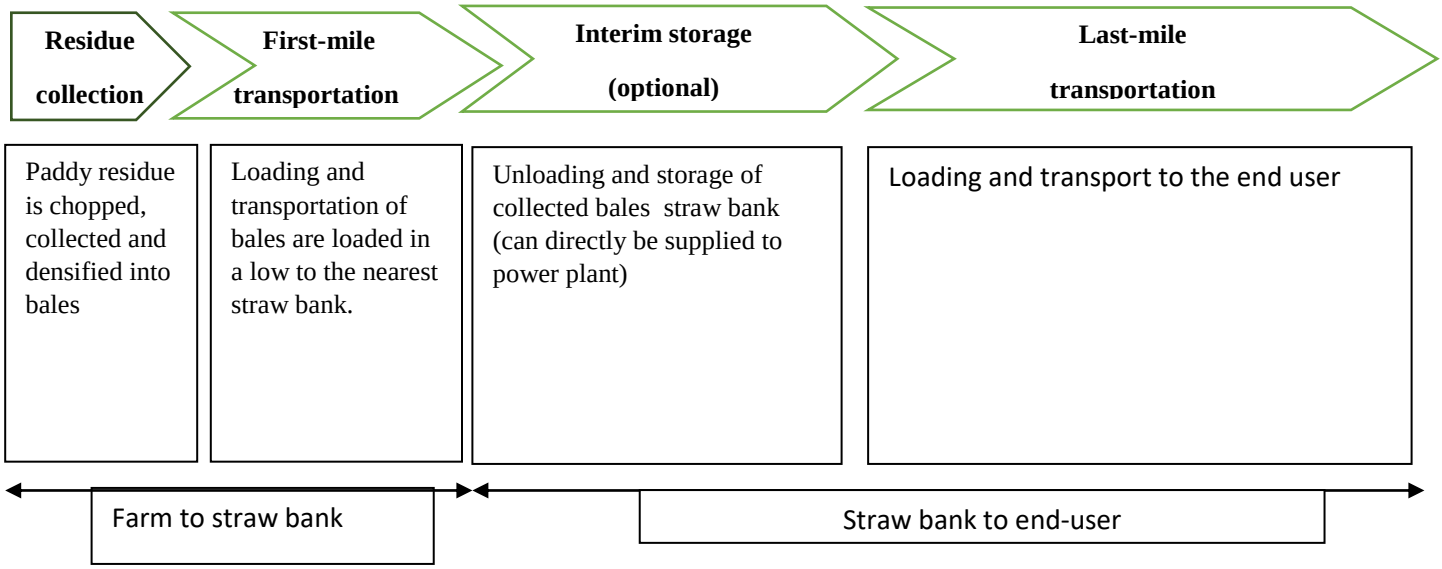
District	Electricity potential (MW)	No. of required power plants (5 MW)	Utilized electricity potential (MW)	Quantity of straw required for plant (MT per annum)	Actual No. of existing power plants
Amritsar	79.1	16	-	-	-
Barnala	66.1	13	-	-	-
Bathinda	99.4	20	-	-	-
Faridkot	60.3	12	-	-	-
Fatehgarh	49.4	10	18	162000	1
Fazilka	42.6	9	-	-	-
Firozpur	99.3	20	9	80000	2
Gurdaspur	80.5	16	18	162000	1
Hoshiarpur	34.9	7	-		
Jalandhar	89.6	18	10	90000	2
Kapurthala	60.3	12	6	54000	1
Ludhiana	149.5	30	-	-	-
Mansa	67.3	13	-	-	-
Moga	103.3	21	10	90000	1
Pathankot	11.6	2	6	54000	1
Patiala	120.9	24	-	-	-
Rupnagar	20.8	4	-	-	-
S.A.S.	13.6	3	-	-	-
S.B.S.	33.0	7	-	-	-
Sangrur	176.8	35	-	-	-
Shri	91.9	18	20.5	184500	2
Tarn	87.0	17	-	-	-
Punjab	1637.2	327	97.5	876500	11

Source: Author's calculations and Punjab Energy Development Agency (PEDA)

https://www.peda.gov.in/#:~:text=Punjab%20Energy%20Development%20Agency%20

The supply chain of paddy for use in biopower plants involves the collection of paddy residue from the field, transportation to an optional interim storage (straw bank), and, then transported to the end-user. The key stages are "Farm to Straw Bank" and "Straw Bank to End-User," with the latter incorporating biomass processing if needed as shown in Figure 6.

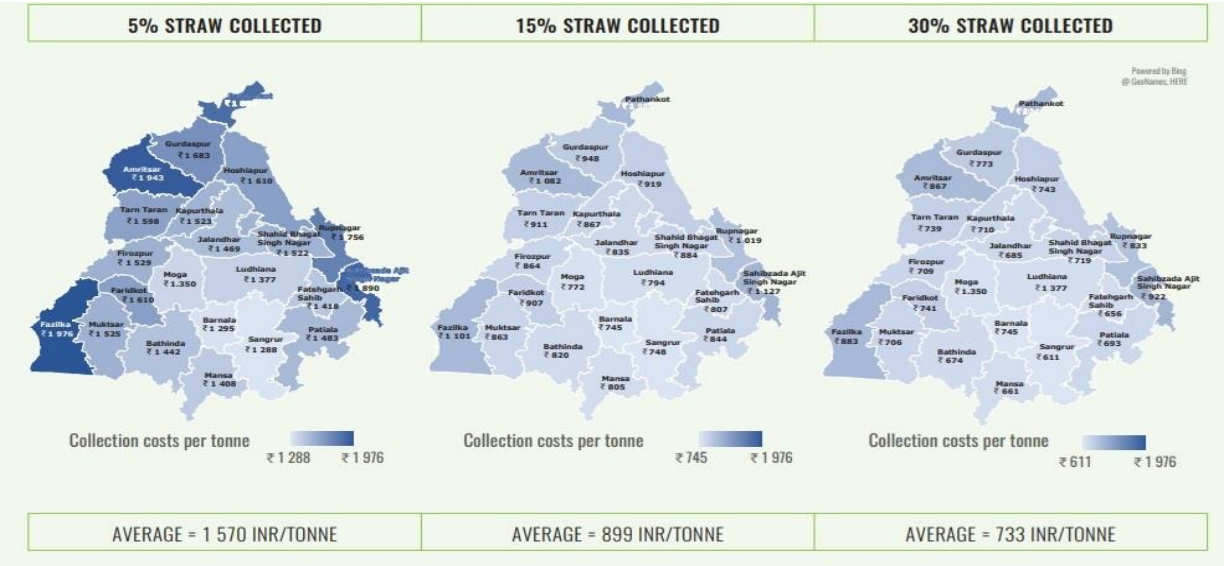
Figure 6: Supply chain of paddy residue for ex-*situ* management



For residue transportation from farm to the straw bank, firstly the paddy residue is chopped using the chopper/cutter-cum-spreader and then densified into bales using baler, and raker and then transported to the straw bank or directly to the end-user i.e. the bioenergy plant. This collection cost of crop residue varies depending on the distance between the farm or straw bank and the biogas plant.

A recent study by FAO, 2022 indicated that the collection costs per tonne of paddy straw varies across districts of Punjab, the breakeven price ranges from Rs 733 per tonne at a 30 percent paddy residue collection target to Rs 1571 per tonne for 5 percent collection target (Figure 7). The results also suggested that collecting more straw reduces the per unit cost of collection which is in line with the principle of economies of scale. The study also indicated that to mobilize 30 percent of the rice straw produced in Punjab an investment of around Rs 2,201 crore would be needed to collect, transport and store it within a 20 day period. Further depending on varying market prices, farmers can expect to earn between Rs 550 and 1500 per ton of rice straw sold.

Figure 7: Per unit collection cost at different collection targets for paddy straw in Punjab



Source : FAO, 2022

- **Benefits of ex-situ residue management of paddy residue**

Employment generation and Rural development- mainly in construction and operating at the power plants and in collection of the crop residue, improvement of urban and rural public health, and the development of local self-reliance. The manpower required for the production of bio-fuel resources is about five times higher than that needed for the production of fossil fuels (Remedio and Domac, 2003).

Environmental aspects- Operation of biomass power plants can significantly reduce field-burning of crop straw in rural areas, thereby reducing air pollution and improving the rural environment. Compared with the same-sized coal-fired power plant (1.38 gigawatts per year), a crop residue power plant can save more than 100,000 tons of coal and reduce 400 tons of SO_2 emissions. A 25 MW biomass power plant could reduce carbon dioxide emissions by 100,000 tons per year, compared with the same-sized coal power plant. The smoke and dust produced has no water-soluble component, so discharged wastewater needs no special treatment, except filtering of suspended particles. The ash residue from biomass combustion can be used as a high-quality potassium fertilizer.

Social Impact - Biomass energy presents the cleanest technology available to the mankind, to mitigate global warming and climate change, while creating rural employment in biomass

management and power generation. The biomass power can be collectively pumped into the state electricity grid. It will reduce the direct burning of the residues on the fields and simultaneously the generation of thermal energy from the polluting coal is reduced. Therefore, the biomass energy can provide the road map for any action plan on climate change and energy security, but the issues related to installation of the power plant and distribution of electricity to the consumer should be resolved, carefully

Economic benefits - Paddy straw management in the combine harvested fields by straw collection and baling in the field for further use in power generation is an appropriate and economically viable option for timely use of the field for subsequent sowing. In an earlier study for Punjab state, the cost economics was worked out (Table 4) based on expenditure costs and income from sale of bales per hectare (ha).

Table 4: Benefit cost ratio of paddy straw bailer in Punjab

Parameter	Per season (45 days)
Total cost (Fixed + variable) (Rs)	697211.5
Total area covered (ha)	144
Total yield of paddy straw (t/ha)	6.76
Total straw collection during season (t)	973
Gross income from sale of straw	1235583
Net income from sale of paddy straw	538371.5
Benefit cost ratio	1.77

Source: Singh et al 2017

The gross income from sale of collected straw during one season of 45 days was Rs. 8580.43 per hectare in addition to benefits to soil health and reduction in fire accidents by checking open field burning of straw. The benefit cost ratio from sale of baled paddy straw for power generation was Rs. 1.77 indicating it to be a viable option for removal of paddy straw from field.

Another study revealed that the net income increased from Rs. 1100 to Rs. 2800 per hectare if baler is operated after using hay rake and the B:C ratio increased from 1.20 to 1.74. The payback period of the straw baler reduced from 10 to 2 years if used after hay rake and operated for 300 hours per year (Kumar et al., 2020). Thus, the baler technology is economically viable in the state.

- **Perceptions and challenges regarding use of paddy residue for power generation**

Analysis of data regarding perceptions of farmers/middlemen regarding supply of surplus residue to biomass based power plant revealed that about 29 per cent farmers preferred this value chain as they want fast clearance of their fields (Table 5). About 13-15 per cent middlemen were liking it as a source of extra income for them and additional employment. On the other hand, about 13 per cent respondents didn't prefer it as it leads to increased pollution and ultimately affects health, another 9 per cent felt high transportation cost; about 7 percent felt the market prices to be lower.

Table 5: Perceptions of farmers/middlemen regarding supply of surplus residue to biomass based power plant

Sr. no.	Perceptions	Percentage
1	Fast clearance of fields	28.8
2	Extra income	13.3
3	Employment to local labour	15.6
4	Affordable and efficient	11.11
5	Increased air pollution and public health risk	13.3
6	High transportation cost	8.9
7	Delay in payment	2.2
8	Low market price of residue	6.7

Source: Field Survey

Also challenges faced by the bioenergy generation power plants were also analysed (Table 6). It was observed that there is no organized market for the supply of biomass feed stock. Different pricing and procurement strategies are adopted by different power producers for procurement of biomass. Further, weather has a great influence on the proper harvest of biomass because it can reduce the yield of the crop, affect the biomass quality, and pose difficulty in the harvesting process by giving bad condition. The rainy season may harm the biomass stored on fields, moisture may affect the quality of biomass to be fed as a feedstock in the power generators. Though the method of on-field storage has the advantage of low cost but on the other hand, biomass material loss is significant and biomass moisture cannot be controlled and reduced to a desired level, thus leading to potential problems in the power plant technological devices. Further-more, health and safety issues exist, such as the danger of spores and fungus formation and self-ignition due to increased moisture. The farmers also do not allow on-farm storage of the biomass for a longer time period, as they may want to prepare the land for the next crop. Also the biomass fuel has to be transported twice by road transport vehicles (first from farm to the intermediate storage facility and then from storage to the power station) which results in a higher delivered cost.

Table 5: Challenges faced by biomass based power plant in energy production

Sr. no.	Reason	Percentage
1	Huge capital investment	100.00
2	Lack of organized market for supply of biomass feedstock	33.33
3	Weather affecting the quality of feedstock	100.00
4	Intermediate storage adds to delivered cost	66.67
5	Additional handling costs	33.33
6	Low density fuel	33.33
7	High production cost	0.00
8	Loss in quality of biomass due to wind and decay	100.00

Source: Field Survey

Cost involved in bioenergy production includes raw materials, logistics service, equipment, maintenance of the grid-connecting device, and the overall operation of the plant. Due to a lack of professional logistics operators, the biomass power plant has to purchase raw materials either at a designated place or directly from scattered farmers. Furthermore, compared with conventional power plants, the generating capacity of biomass power plant is smaller, yet additional facilities are required, especially special storage fuel collecting and storage facilities. These aforementioned factors contribute to high investment and construction cost per KW and higher operation cost for the biomass project. Analysis of the data revealed that all of them felt that huge capital investment is involved and weather affects the feedstock quality.

Paddy straw is very voluminous i.e. it has relatively low energy density per unit of mass compared to fossil fuels. This makes handling, storage and transportation more costly per unit of energy carried. Being lighter weight, approximately 2 per cent by weight of biomass is blown away with wind when stored in open area. Biomass power generation is an emerging industry, of which the technology development and market cultivation demands a large amount of capital investment. Currently, while there lacks the investment and financing channel, the market operation mechanism is also incomplete. The maturing market mechanism gives rise to insufficient input of investment and R&D from the investors.

Conclusions and Suggestions

Crop residue has a potential to emerge as a one of important source of green energy in the Punjab state owing to availability in huge amount. If managed scientifically and used as a source of clean and green energy, it will go a long way to save the fossil fuels, protect the environment, precious foreign exchange expended on import of petroleum products, create huge opportunity for green jobs and income for the farmers. Baler technology is socially and economically viable in removal of paddy straw from the combine harvested paddy fields. The conversion of agricultural waste into fuel and useful value-added products is gaining traction as an agribusiness and demands utilization of appropriate technology. In this context, there is need to establish a dense network of straw banks and supply chain ecosystem. Boost demand for biomass to encourage more participation in biomass supply chain via proper market for bulk purchase of paddy straw; creation of a digital platform connecting farmers, straw banks, end-users, and other stakeholders involved in the biomass supply chain to trade crop residue. Government support through incentivising farmers to refrain from burning crop residues and promoting their use in bioenergy generation would also

help. To overcome the current lack of knowledge about the biomass sector's potential among financial institutions and facilitate access to capital for biofuel projects, capacity-building programmes need to be conducted. Increased emphasis on biomass and its supply chain dynamics should be advocated on a global scale. Policy interventions are pivotal for a sustainable agricultural biomass supply chain as well as to address challenges and foster a transition to cleaner energy. Further, enhanced financial incentives, infrastructure development, and capacity building for improving the agricultural biomass supply chain are crucial for India's greener and more sustainable future

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Effect of Presowing seed treatments on germination in Guaiacum

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CITAAS/LP/2024/009

The present investigation entitled 'Seed germination and growth studies in guaiacum' was carried out at Maharajbag Nursery Unit, Horticulture Section, College of Agriculture, Nagpur in 2022 to 2023. Completely Randomized Design was used consisting of twelve treatments and replicated thrice. The result revealed that significantly early germination was recorded in GA_3 500 ppm concentration treatment. Whereas the maximum germination percentage, plant height, shoot length, vigour index, fresh weight, dry weight and survival percentage were recorded in hot water at 60°C treatment. However, the maximum stem girth of plant was recorded in seed treated with GA_3 500 ppm concentration.

Keywords: Guaiacum, Seed, germination, Hot water, GA_3, H_2SO_4, KNO_3,

Introduction:

Ornamental plants play a vital role in the global horticultural industry. The ornamental industry is primarily focused on the planting of foliage and flowering trees for different purposes in garden and landscape. The commercial cultivation of ornamental plants is growing all over the world. As a result, ornamentals add artistic value to our surroundings (Noor-un-Nisa et al., 2013). and there has been a growth in the market for ornamental plants for personal and ritual purposes. In the last century, landscape was reasoned as an crucial tool in raise life quality of individual in parallel with the Recent epoch developments in urbanization in the world, particularly in developed countries.

Guaiacum is an evergreen and flowering tree known as “Lignum-vitae”, “Tree of life” or “Wood of life”. Its scientific name is *Guaiacum officinale* which belongs to the family Zygophyllaceae. Genus “Guaiacum” have five species of slow- growing shrubs and trees. All species are native to subtropical and tropical regions of the America*. Guaiacum officinale* is the National flower of Jamaica. Guaiacum plant is classified as 'Endangered' in the IUCN Red List of Threatened Species (IUCN Red list 2012). It is used of medicinal or other plants procurable at shops’ or ‘used or recognized in pharmacy or medicine’ Fresh seeds of Guaiacum are soft; seed reduces its viability and germination percentage during storage period due to its hard seed coat. Due to nature of seed coat which is impermeable to water, do not imbibe sufficient moisture for germination. In case of mechanically dormant seeds integuments are very hard and do not allow embryo to grow or expand. So, seeds are scarified with hot water (Zarchini *et al.* 2011) and (Gashi *et al.* 2012).

MATERIAL AND METHODS:

The investigation is carried out at Maharajbag Nursery Unit, Horticulture Section, College of Agriculture, Nagpur 2022-2023. The experiment was laid out in Completely Randomized Design

consisting of twelve treatments and replicated thrice. The seeds were procured from endangered Guaiacum tree at Collage of Agriculture, Nagpur during the month of March and April - 2022. The fully matured and healthy red colour seeds were collected. After that separation of healthy and damaged seed by dipping in water floated seed were discarded. The crates were filled with potting media garden soil, sand and well decomposed farm yard manure with 1 part each respectively. Hundred seeds were sown for each treatment and each crate and it replicated thrice. Tags specifying each treatment and replication were fixed up. Every day watered the crates and maintain proper moisture level. Used water can for irrigation up to the germination takes place. Guaiacum seedlings were irrigated and maintain the proper moisture level. The crates were watered every day and then required till germination takes place with the help of watering can. At the right time and suitable plant protection measures were applied. The plants protected from rotting by drenching of Carbendazim 1 g/lit water.

Treatments comprised of T_1 - conc. H_2SO_4 for 1 min, T_2 - Conc. H_2SO_4 for 2 min, T_3 - Conc. H_2SO_4 for 3 min, T_4 - GA_3 500 ppm, T_5 - GA_3 1000 ppm, T_6 - GA_3 1500 ppm, T_7 - KNO_3 0.2%, T_8 - KNO_3 0.3%, T_9 - Brine solution 2%, T_{10} - Hot water (60^0 C), T_{11} Scarification (Removal of seed coat) and T_{12} - Control. Randomly five plants were selected from each plot for recording the observations. The data on various observations recorded during the course of investigation was statistically analyzed.

Result and Discussion:

The data recorded in table 1 revealed that, all treatments are significantly influenced by seed germination and growth.

Regarding germination parameter, early germination (17.67 days) was recorded in the treatment seed soaking with GA_3 500 ppm (T4) which was followed by the treatments GA_3 1000 ppm conc (18.67 days). Whereas, late germination (24.00 days) was recorded in the control treatment.

This might be due to fact that treatment gibberellin help accelerate amylase hydrolysis to sugars maltose and glucose. The existence of high energy reserves that can stimulate cell division and elongation so that the growth of sprout increases, consequently the quality of the resulting sprouts become better in veitchia merilli crop. This result is conformity with Suradinata *et al.* 2015 in Christmas palm and Vidyasagaran *et al.* 2016 in calamus.

Significantly maximum germination percentage (53.00%) was recorded in the treatment seed soaking with hot water 60^0 C which was followed by the treatment GA_3 500 ppm (47.00%). Increased germination percentage after hot water treatment at 50-52°C for 30 min. than control and higher as well as lower temperature. This temperature range of hot water might have resulted in increased imbibition and stimulated germination related activities such as gibberellic acid synthesis, RNA synthesis, protein synthesis and DNA replication and finally weakening of the endosperm and there increasing germination by Groot and Karssen (2019) in bell pepper, Bewley and Black (2000).

At the stage 210 DAS significantly, maximum height of seedling (32.91 cm) was recorded in the treatment seed soaking with hot water 60^{0}C which was followed by the treatment GA_3 500 ppm (28.97 cm). Significantly maximum shoot length (27.93 cm) was recorded in the treatment seed soaking with hot water 60^{0}C which was followed by the treatment scarification (22.53 cm). At the stage of 210 DAS significantly maximum stem girth of seedling (0.74 cm) was recorded in the treatment seed soaking with GA_3 500 ppm conc. treatment which was followed by the treatment KNO_3 0.3% (0.55 cm). This might be due to the gibberellic acid is a plant hormone that plays a role in promoting stem elongation and cell division, among other physiological processes like optimal conc. of GA_3 used in seed treatment is crucial similar result found by Opoku 2018 in Silver butterfly tree.

Significantly maximum fresh weight of seedling (9.99 g) was recorded in the treatment seed soaking with hot water 60^{0}C which was followed by the treatment GA_3 500 ppm conc. (8.23 g) at 180 days. Maximum dry weight of seedling (2.62 g) was recorded in the treatment seed soaking with hot water 60^{0}C which was followed by the treatment GA_3 500 ppm conc. (2.02 g) at 180 days. At the stage of 180 DAS significantly maximum survival percentage (85.46%) was recorded in the treatment seed soaking with hot water 60^0 C which was followed by the treatment GA_3 500 ppm conc. (77.21%). Similar results were observed by Chaiyarat and Ingole *et al.* in the 2020.

At the stage of 180 DAS significantly maximum vigour index (2228.70 cm) was recorded in the treatment seed soaking with hot water 60^0 C which was followed by the treatment GA_3 500 ppm conc. (1448.40 cm).

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Abstracts

Comparative Study of Substrate Types for Improving Growth and Welfare in Zebra Loach (*Botia striata*)

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Botia striata (Zebra loach) is a highly demanded ornamental fish endemic to the Western Ghats of India. They are known for their attractive patterns and stripes present on the body. According to a recent IUCN report (2019), this fish species is classified as endangered due to habitat loss and heavy reliance on wild capture. In response, a 90-day experiment was conducted to evaluate the effects of artificial habitats on its growth and to promote its conservation as a domestic aquarium fish species. The experiment was conducted with three experimental groups in triplicates viz., control (without substrate), T1(sand substrate) and T2(stone substrate). At the end of the trial, growth parameters like Weight gain, Percentage weight gain, Specific growth rate, Feed Conversion ratio and Feed Efficiency ratio were recorded to be higher in sandy substrate as compared to stone and without substrate. Additionally, various stress and nutrient utilization parameters also showed better results in sandy substrates compared to the other treatments. Based on the results of this study, it can, therefore, be concluded that utilisation of sand as substrate enhances growth in zebra loach. This study will further aid in optimizing the conditions for captive maturation and subsequent breeding of this highly demanded indigenous ornamental fish, which is yet to be developed commercially.

Keywords: *Botia striata*, Habitat, Indigenous ornamental fish, IUCN, Growth

Assessment of Productivity, Palatability and Utilization of Tree Fodder under fodder tree based Agroforestry systems

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Fodder shrubs and trees (browse) are crucial in farming systems, particularly in arid regions where they are vital for livestock during dry seasons when other feed resources are scarce. Trees, especially leguminous species, are rich in protein and nutrients, making them essential supplements for low-quality grasses. Integrating fodder trees into agroforestry is crucial to enhance livestock production and support rural livelihoods. In India, the demand for fodder far exceeds supply, with a gap of 218.22 Mt in green fodder and 227.73 Mt in dry fodder. Strengthening existing resources through policy and research is needed to address this shortfall. Against this background, the present study was carried out to palatability of different fodder species viz., Leucaena leucocephala, Albizia lebbeck, Inga dulce Albizia lebbeck and Gliricidia sepium under fodder based agroforestry system. The results from the study showed that Leucaena leucocephala was mostly preferred by sheep and goats and consumption of tree leaves was 25.21±0.46 and 36.18±4.16g DM/kg. In both sheep and goat, palatability of Leuceana leucocephala and Inga dulce were ranked first and second respectively. This could be due to the presence of secondary plant metabolites such as Beta-carotene and Xanthophyll in Leucaena. The study revealed that Albizia lebbeck was least preferred tree fodder in goats and Gliricidia sepium in sheep thus indicating that these fodders could be fed first followed by the most palatable tree fodder to improve/increase the dry matter intake. The Study concluded that leaves of L. leucocephala could serve as a better tree fodder for small ruminants.

Assessment of combination of leguminous and non leguminous silage feeding in dairy cattle during summer to mitigate the green fodder scarcity

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There is common practice of growing and feeding the Hybrid Napier and African tall maize as green There is common practice of growing and feeding the Hybrid Napier and African tall maize as green fodder by the dairy farmers. Fodder scarcity is most common problem noticed in summer mostly feed maize silage alone, to intervene this problem combination of different silage trial was conducted by ICAR-KVK Dharwad in the adopted villages during the year 2021 to 2022. Total five on farm testing (OFTs) were conducted in farmer's field, each trial containing 5 dietary treatments, T0 [Concentrate+ dry fodder], T1 [Concentrate + Maize silage (100)], T2 [Concentrate+ DHN6 silage (100)], T3 [Concentrate + Maize silage+ DHN6 silage (50:50)], T4 [Concentrate + Maize + DHN6 + Cowpea silage (40:40:20)]. Each treatment consists of 4 cross breed cows with same age group and same stage of lactation. Silage quality was assessed before the experiment, feeding trial was conducted for 90 days and daily milk yield was recorded. The physico-chemical characteristics of different types of silages were compared, which revealed no statistical significant difference between T1, T3 and T4 with respect to pH, colour, aroma, and texture which were within the normal range of good quality silage. However some visible changes were observed. Also T2 (DHN6 silage) was having relatively poor quality characteristics compared to T1, T3 and T4 silage. The average milk yield (L/d) of the 90 days feeding trial for T0, T1, T2, T3 & T4 group were observed as 3.5, 6.5, 5.4, 6.8 & 7.2 L respectively. Here all the silage fed groups (T1, T2, T3, T4) showed significantly ($p < 0.05$) higher milk yield than that of the animals on control ration (T0). However, within treatment groups, T4 showed significantly ($P<0.05$) higher milk yield as compared to other groups T1, T2 & T3. Farmer's practice of feeding maize silage alone will be costly and less economical as compare to maize+DHN6 silage (T3) and combined maize+ DHN 6+ cowpea silage (T4). Hence, feeding of combined leguminous and non leguminous silage can be an effective alternative feeding practices in dairy cows for sustainable the milk production in summer where there will be green fodder scarcity.

Keywords: Silage, Maize, DHN6, Cowpea, Milk

Role of extension in promoting organic farming

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Organic farming system in India is not new and is being followed from ancient time. It is a method of farming system which primarily aimed at cultivating the land and raising crops in such a way as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco friendly pollution free environment. Maintenance of soil health for future generations is the need of the hour. Plants require a number of soil nutrients like nitrogen, phosphorus, potassium, sulphur etc for their growth. Hence, these essential nutrients need to be compensated either through chemical fertilizers or through natural process of decomposition like farm yard manure, Green manures and Green leaf manures. The best and the alternative method for protecting the soil is organic farming. For expansion of organic farming availability of organic fertilizers, pesticides, biomass is the limitation. This will be overcome by creating awareness, knowledge, changing attitudes, motivation, training and capacity building, transfer of technology, adoption and diffusion etc on the importance of organic farming through mass media i.e. Radio, TV, Newspapers, Bulletins etc. Other strategies like practising integrating farming system approach, women groups in preparation of organic inputs, KVK, enlightening farmers on organic farming markets will improve the area and production of organic products.

Keywords – Biofertilizers, Eco friendly, green manure, nutrients, organic farming

DEVELOPMENT AND PERFORMANCE EVALUATION OF ENGINE POWERED MAIZE HARVESTER

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Agriculture in India faces significant challenges due to a persistent shortage of labor, particularly during peak seasons. Fodder harvesting, a critical yet labor-intensive task, is especially affected by this scarcity. Therefore, a manually drawn engine powered fodder crop harvester to reduce working stress and increase working capacity of a man, was developed and it's performance was evaluated in the department of farm machinery and power engineering at collage of agricultural engineering and technology, JAU, Junagadh. The harvester was tested at three different forward speeds: 0.3-0.6 km/h, 0.6-0.9 km/h, and 0.9-1.2 km/h. The optimal performance was observed at a speed of 0.6-0.9 km/h, where it achieved a cutting efficiency of 96.06%, a field efficiency of 81.47%, and minimal plant damage of 7.08%. Additionally, the harvester reduced costs by 58.07% compared to manual harvesting.This innovative solution not only enhances the efficiency and effectiveness of fodder harvesting but also significantly alleviates the labor shortage challenges faced by Indian farmers.

Self sustainability of young generation through sheep/goat farming; Impact of vocational training

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Vocational training allows the participants to prepare for a particular enterprise and is one of the important objectives of the Krishi Vigyan Kendra which emphasis on "learning by doing" for reducing the input cost, generating self-employment, enhancing output and to acquire knowledge about the new technologies in agriculture and allied subjects. In view of this, ICAR-Krishi Vigyan Kendra, Dharwad conducted three days vocational training programmes on “Scientific sheep and goat farming as economical security” during the years 2017 to 2021. This study was designed with an objective to study the impact of these trainings on knowledge gain and cost benefit ratio of sheep and goat farming by the trainees. Totally 280 youth participated in the training programme, among which 11.79 % participants already had sheep and goat farming units but were uneconomical and remaining 88.21 % participants were new to this enterprise and wanted to explore sheep and goat farming. Before the training programme, participants profile and knowledge on scientific sheep and goat management was assessed by setting up questioner and score was given. Topics on scientific sheep and goat farming including animal husbandry department and bank facilities, records, marketing and project report were taught in the training, along with exposure visits. Post evaluation was done on the last day for the knowledge gain and cost benefit ratio of trainees who established sheep and goat farming were also analyzed. Among the participants 64.64% were young and 45.71% were degree holders which indicate that sheep and goat farming mainly attracting the young generation for their self sustainability. Pre and post evaluation study revealed that 96.61 % participants had poor knowledge and 98.52 % trainees upgraded their knowledge on scientific sheep and goat farming respectively. The impact analysis shows that 76.78% trainees started their own sheep and goat farming or upgraded the existing unit with a good cost benefit ratio range from 3.36 to 4.57 based on the unit size of sheep and goat. Study showed that vocational trainings along with field exposure play a vital role in exploring the knowledge enhance the economic status and to attract the rural youths/ farmers towards profitable enterprise through sheep and goat farming by adopting good animal husbandry practices.

Keywords: Vocational training, Evaluation, Knowledge, Enterprise, Cost benefit ratio

Solar drying techniques for preservation of fish and fishery product: An overview

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Solar drying is the ancient, cheapest and most basic way of drying known to mankind. Most agricultural goods, including grains, spices, fruits, and vegetables, fishery products are still sun-dried today. However, drying these items in the open sun has various drawbacks, including dirt, rain, wind, insect infestation, human and animal intervention, contamination and weather dependent. Solving such issues is easy with solar dryers. This paper describes the current condition of several types of solar dryers that are extensively used today, as well as the drying processes that have been performed during the drying of various fish items. The potential of indirect, direct, mixed mode, and hybrid dryers for drying agricultural /fish products in tropical and subtropical regions is explored. Solar dryers are specialized equipment that use sunlight to dry fruits, vegetables, meat, and fish. The development of solar technology has made it feasible to create affordable, environmentally friendly solar dryers for agricultural products. It is crucial to support the construction of these facilities, even at the village level, in order to reduce post-harvest losses and extend the shelf life of food items without compromising quality. This paper addresses the various solar dryers and drying procedures used mainly on agricultural and fishery items.

Keywords: Solar dryer, direct solar dryer, indirect solar dryer, mixed mode, hybrid mode

NUTRITIONAL STUDIES OF COLLETOTRICHUMCAPSICI [(SYD.) BUTLER AND BISBY] A CAUSAL AGENT OF ANTHRACNOSE (LEAF SPOT) OF BETELVINE.

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Betelvine (*Piper betle* L.) commonly known as paan, is a vine belonging to the family piperaceae. It is an important cash crop of India mainly cultivated for its leaves which is used for mastication along with arecanut due to its stimulatory aromatic taste. The productivity of betelvine is affected by different fungal and bacterial diseases, among them anthracnose is one of the important fungal disease caused by Colletotrichum capsica. The present research work was conducted at Department of Plant Pathology, JNKVV, Jabalpur, M. P. during 2022-2023.The nutritional studies were taken up to know the best source of carbon and nitrogen required for the growth and sporulation of the fungus. The study indicated that out of seven different carbon sources tested, glucose(81.00mm) was found to be the best source of carbon for the growth followed by maltose(79.00mm) and dextrose(71.33mm). Excellent sporulation was observed where glucose was used as carbon source followed by good sporulation in dextrose and sucrose. Among the different nitrogen sources tested, potassium nitrate (67.16 mm) and ammonium nitrate (63.50 mm) supported excellent growth and sporulation.Histidine (63.16 mm) also showed good growth but with good sporulation.

Keywords: Betelvine, Anthracnose, Nutritional study, Sporulation, Growth, Colletotrichum capsici.

Propagation of new exotic clonal rootstocks of apple (Malus x domestica Borkh.) through hardwood stem cuttings

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The investigation entitled ‘‘Propagation of new exotic clonal rootstocks of apple (Malus x domestica Borkh.) through hardwood stem cuttings” was carried out under shade net house condition in Fruit Nursery Block of Department of the Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, (HP) during 2021-22. The experiment was laid out in a Randomized Block Design (Factorial) having 12 treatments which were replicated thrice. The different length of cuttings exerted a significant influence on the rooting of cuttings of various clonal rootstocks of apple. The results of present investigation revealed maximum percentage of rooted cuttings (47.55 %), total root length (3.38 m), average diameter of main roots (2.93 mm), fresh and dry weight of roots (5.96 g and 2.90 g, respectively), average length and average diameter of main shoots (112.33 cm and 24.32 mm, respectively), fresh and dry weight of shoots (48.93 g and 30.36 g, respectively), total number of leaves (67.33), leaf area (67.49 cm2), fresh and dry weight of leaves (0.79 g and 0.59 g, respectively), total biomass (55.51 g), total phenol (14.54 mg/g) and C:N ratio (46.78) in 15 inch cuttings length of M9 T337 rootstock. However, maximum average number of main roots (11.66) was observed in treatment with 15 inch length of Bud 10 rootstock, average length of main roots and root: shoot ratio (26.43 cm and 0.130, respectively) were noticed in treatment with 15 inch length of cuttings of Bud 9 rootstock. On the basis of present investigation, it is inferred that 15 inch length of cuttings can be further used for propagation of clonal rootstocks of apple through hardwood stem cuttings.

Adopting non-chemical weed management practices enhances the growth and yield of basmati rice sustainably.

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An experiment entitled " Adopting non-chemical weed management practices enhances the growth and yield of basmati rice sustainably." was conducted at the Organic Farming Research Centre, Chatha of SKUAST- J during kharif season of 2019-2020. The soil of the experimental site was sandy clay loam in texture. The experiment consisted of 13 treatments viz.,T1-Stale bed fb one hand weeding at 30 DAT, T2-Wheel hoeing at 20 & 40 DAT, T3-Rice straw mulch @ 2.5 t/ha, T4-Rice straw mulch @ 5.0 t/ha, T5-Azolla 1.0 t/ha,T6-Mustard seed meal (MSM) @ 2.5 t/ha at 10 DBT,T7-MSM @ 1.25 t/ha at puddling, T8-MSM extract with MSM @ 0.4 t/ha at 5 DBT T9-MSM extract with MSM @ 0.6 t/ha at 5 DBT T10-MSM extract with MSM @ 0.8 t/ha at 5 DBT T11-MSM extract with MSM @ 1.0 t/ha at 5 DBT T12-Weed free,T13-Weedy check. Stale bed fb one hand weeding at 30 DAT and Wheel hoeing at 20 & 40 DAT exhibited significant increase in growth parameters viz. plant height, dry matter accumulation and leaf area index at 60, 90 & at harvest and found lowest weed dry matter. Among the different non chemical weed management practices, stale bed fb one hand weeding at 30 DAT gave higher grain yield (3047 kg//ha) followed by Wheel hoeing at 20 & 40 DAT (2958 kg/ha).

Keywords: Mustard seed meal (MSM), DAT- Days after transplanting, Stale bed

Economic Analysis of Backyard Poultry interventions of ICAR Farmer FIRST Programme on Farmers

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The ICAR Farmer FIRST programme is being implemented since 2016-17 in the two project villages Chinchvihire and Kangar in Rahuri tahsil of Ahmednagar district. The Farmer FIRST programme aims at enriching farmers-scientist interface for technology development and application. The backyard poultry farming is an age old practice in rural India. Most of the backyard poultry comprises rearing of indigenous birds with poor production performance. Potential of indigenous birds in terms of egg production is only 70 to 80 eggs/ Birds / Year and also less meat production. However, Backyard poultry production can be boosted up with improved breed of poultry bird. Backyard poultry component was successfully demonstrated through the ICAR Farmer FIRST programme in project villages.

The present study was conducted mainly with the objective of to study the economic analysis of backyard poultry on the respondents. From these two villages 130 farmers were selected for study. It was observed that the majority of respondent had middle age, higher secondary education and medium experience in backyard poultry.

The cost on feed accounted for 78.37 percent of the total cost of production in kavri followed by poultry shed 11.15 percent, cost of day old chicks 6.70 percent and cost of vaccination is 1.00 percent. In case of income generation, it was found that maximum amount of income was contributed by sale of eggs 82.23 percent followed by sale of male birds 17.77 percent in kaveri breed. The benefit cost ratio in kaveri breed is recorded as 2.63 while in local breed it was 1.72.

EVALUATION OF PRPH2 GENE IN NORTH INDIAN RP PATIENTS

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To investigate the PRPH2 gene in a cohort of retinitis pigmentosa (RP) patients. Methodology: PCR-DNA sequencing was used to identify potential pathogenic mutations within the coding sequence and intron-exon boundaries of the PRPH2 gene in a cohort of 70 RP patients and 100 controls. Six distinct online algorithms were employed to predict the pathogenicity of the identified variants. Further investigation into the structural alterations induced by these pathogenic mutations was conducted using GOR IV for secondary structure prediction, along with PyMol and ChimeraX for tertiary structure analysis. Molecular dynamics (MD) simulations were performed using Gromacs to elucidate differences in root-mean-square deviation and root-mean-square fluctuation values between the wild-type and mutant variants. Results and Discussion: The Sanger DNA sequencing analysis revealed 15 variations within the PRPH2 gene, encompassing 3 pathogenic missense mutations (p.(G31D), p.(D84N), and p.(R220Q)). All the three pathogenic mutations were heterozygous and found in sporadic cases of RP with severe disease phenotypes. These mutations induce disruptions and structural alterations in the mutated protein, thereby compromising their functionality, resulting in the photoreceptor degeneration and the eventual manifestation of RP. Conclusion: In the current study, we have identified three pathogenic missense mutations in the PRPH2 gene. These mutations affect the protein structure and impair its proper functioning, leading to disease phenotype. This study may contribute further insight into the patterns and prevalence of RP gene mutations within the North Indian RP patient cohort. More and more genetic investigations like this study offer significant opportunities for enhancing our understanding of the genetic causes of the disease and may help in advancing treatment efficacy in the near future.

Microsatellite based diversity assessment among Triticum aestivum L. genotypes for biofortification

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Micronutrient deficiency is one of the major global health problems afflicting more than 2 billion people globally. Wheat attracts the highest global research priority for micronutrient (Fe, Zn, Se, and Ca), being staple food crop of about two billion people (36 % of the world population). Its genepool possesses significant natural genetic variability for these micronutrients, which can be utilized for breeding micronutrient dense varieties. Globally, wheat has been under cultivation in 224.05 million hectare with an annual production of 793.37 million tones. In India, 112.74 million tonnes wheat has been produced on 31.82 million hectare with average productivity of 35.43 q/ha (IIWBR, 2023). The study was undertaken with the objective to identify potential genotypes based on genetic diversity using micronutrient specific SSR. Forty-eight bread wheat genotypes were sown in RBD with three replications at Research area of Wheat and Barley Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar. Data was recorded for morph-quality and biochemical traits. Fe and Zn content ranged from 26.33 to 44.30 ppm and 29.05 to 44.97 ppm respectively. For genetic diversity analysis, 49 SSR markers were used out of which 43 were amplified (26 primers gave polymorphic while 17 gave monomorphic band). Total numbers of alleles amplified were 64 with an average of 2.461. Subsequent UPGMA based clustering analysis unveiled two distinct clusters: Cluster I encompassing 47 genotypes and Cluster II comprising one genotype. Cluster I further divided into 2 sub-clusters at similarity coefficient of 0.545. This encapsulates the richness of genetic diversity among the studied wheat genotypes. PCR product ranged from 100 to 500 base pairs. The significance of this study revealed that PIC value ranged from 0.17 (Cfa 2149) to 0.74 (Barc 124) and 4 primers (Cfd 2114, Barc 124, Barc 216, Barc 199) out of 26 SSR loci had above 0.65 PIC values and thus can be considered highly useful for differentiation of genotypes for Fe and Zn contents. Molecular analysis revealed the presence of high degree of polymorphism for the selected genotypes. The findings can be utilized further in wheat breeding proramme aimed to develop high yielding biofortified wheat.

Keywords: Biofortification, Clustering, diversity, Polymorphism information content (PIC), microsatellite, Triticum aestivu

Effect of Different Levels of Farmyard Manure (FYM) Integrated with Organic Modules on Yield, Quality and Pest Incidence of Okra (*Abelmoschus esculentus* L. Moench)

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The study was conducted during late Kharif season during 2021-22 and 2022-23 at administrative office (PGIHS), Sri Konda Laxman Telangana State Horticultural University, Mulugu, Telangana, India. The experiment was laid out in contrast factorial randomized block design (CFRBD) with two factors i.e., factor-1 consists of three levels of FYM (FYM equivalent to 100% RDN, 75% RDN and 50% RDN)and factor-2 consists of three organic modules [Organic Module-1: application of Trichoderma viride @ 5kg/ha enriched in farmyard manure and neemcake @ 250 kg/ha and incorporated into the soil at the time of last ploughing., seed treatment with Trichoderma viride @ 4g/kg seed, spraying of 3 % panchagavya solution and 5 % neem oil at every 10 days interval up to the last harvest, spraying of Beauveria bassiana @ 5g/liter and Bacillus thuringiensis @ 1kg/ha at every 10 days interval starting from flower initiation. Organic Module-2: Application of Pseudomonas fluorescens @ 5.0 kg/ha enriched in farmyard manure and neemcake @ 250 kg/ha and incorporated into the soil at the time of last ploughing, seed treatment with Bacillus macerans @ 3% w/w, spraying of 10 % vermiwash solution and Neem Seed Kernel Extract (NSKE) @ 5 % at every 10 days interval up to the last harvest, spraying of Metarhizium anisopliae @ 5g/liter and NPV @ 250 LE/ha at every 10 days interval starting from flower initiation and organic module-3: application of Vesicular Arbuscular Mycorrhizae @ 10kg/ha enriched in farmyard manure and neem cake @ 250 kg/ha incorporated into the soil at the time of last ploughing, seed treatment with beejamrit @ 10 %, spraying of 10 % jeevamruth solution and neemastra 5 % at every 10 days up to the last harvest, spraying of Lecanicillium lecani @ 5g/liter and Trichoderma + Pseudomonas spp. @ 5g/liter at every 10 days interval starting from flower initiation] and separate control (100% RDF) plot was grown and replicated thrice. The pooled results indicated that, control treatment (100 % RDF-100:50:50 kg NPK/ha + chemical pesticides) reported highest number of fruits per plant (19.05), highest fruit weight (14.72 g), maximum fruit yield per plant (0.28 kg), maximum fruit yield per hectare (9.52 t/ha) over the other treatments. L1M1 (FYM equivalent to 100 % RDN + organic module-1) registered minimum crude fibre content (7.10%), and maximum chlorophyll content in fresh fruit (1.19 mg/100g). While, minimum mean percent of fruit infestation (6.28%) was reported with control (100% RDF-100:50:50kg NPK/ha + emamectin benzoate 5%SG @ 70 g/200 lit) and lowest mean population of jassid per leaf (1.08/leaf), was recorded with control (100 % RDF-100:50:50 kg NPK/ha + imidacloprid 17.8 SL @ 100 ml/acre).

Geographical Evaluation of Basin Hydrology Using Google Earth Engine: A Case Study of the Dikrong River Basin

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Basin hydrological behaviour is the movement of water in different sub system of the environment such as atmospheric, surface and sub-surface system in various forms. The manual interpretation of hydrological processes can be unimaginable task. Researchers used to have different software to assess hydrological processes which have their own limitations and benefits. The present study is focused on utilizing google earth engine to assess the hydrological phenomena of the basin. The study includes physiographical, hydroclimatic, and land use and land cover (LULC) patterns in the Dikrong River Basin, located in the Eastern Himalaya comprising 10 sub-watersheds (SWs). The proposed approach is easily replicable to others basin as well. The morphometric analysis of all the SWs shows diverse topographical features notably circular SW6 with area 154.60 sq.km and largest SW9 with area 192.70 sq.km. All these basins are characterized by high relief and steep slopes, indicating significant topographical variations. Hypsometric analysis suggests that most of the SWs are in the equilibrium and monadnock stages. The combination of these parameters, along with LULC patterns, influences the hydroclimatic characteristics, demonstrating temperature variations with elevation. Specifically, maximum and minimum temperatures increase as elevation decreases. The LULC analysis shows forest predominance in most areas, except in SW5, SW6, SW8, and SW9, where agricultural and urban areas are more prevalent. This comprehensive study provides essential insights for watershed management planning, considering the potential impacts of future climatic changes.

Evaluation of cost effectiveness of Azolla cultivation in West Tripura district for livestock, poultry, dairy and aquaculture feed supplementation

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Now a days, farmers are facing a big problem in procurement of animal and fish concentrate feed from the market due to its high price cost. Scarcity of concentrate feed in the market and green fodder in the farm is being observed in the West Tripura district. Azolla (*Azolla pinnata*) is a versatile and nutrient-rich aquatic fern that can be used as a low-cost feed supplement for livestock, poultry, dairy and fish. Azolla is persistent plant that grows faster in freshwater bodies. It can adapt biodiversity and aquatic environment significantly. Azolla cultivation provides a sustainable and economical solution for animal feed supplementation in West Tripura District. This paper investigates cost-effective cultivation techniques, evaluates the nutritional benefits of Azolla and explores its impact as a feed supplement. The findings provide practical guidelines for optimizing Azolla production and its application in various feed systems. This study also examined the extent of Azolla adoption, the factors influencing it, and its impact on household economics and agricultural practices. Azolla can feed to livestock, cattle etc. because it is easily digestible. Azolla can reduce 10 to 30% animal and fish feeding cost, if it incorporates in animal and fish diet. This study also found that cattle milk production increased by15-20%, after incorporating of Azolla in their feed diet in a proper ratio.

Keywords: Azolla cultivation, cost effectiveness, feed supplement

Biopesticide role in management of various pest and diseases in organic farming

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Biopesticides are considered a natural, safe and environmentally friendly alternative of synthetic pesticide. Biopesticides are compounds made from microorganisms and various natural materials of plant and animal origin. The most important types of biopesticides are based on bacteria, fungi and viruses. The bacterium Bacillus subtilis is the most studied bacterial species used in biological protection, whereas the species Bacillus thuringiensis is predominantly used for the control of harmful insects. There are various bacteria as well as fungi which are being used in the production of various biopesticides, (viz, Trichoderma sp., Verticillium sp., Metarhizium anisopliae, Beauveria bassiana, Bacillus thuringiensis, Pseudomonas fluorescens.) Trichoderma harzianum is mainly used for Several Soil-borne diseases, wood decays, mushroom bubble, silver leaf of fruit trees. Pseudomonas fluorescens is used for Rhizoctonia and Pythium damping off, Bacillus subtilis is used for Seedling diseases, Agrobacterium radiobacter K84 is used for Crown gall disease, *Metarhizium anisopliae* is used for *Musa domestica*, Verticillium spp. is used for *Trialeurodes vaporariorum and Bemisia tabaci, Bacillus thuringiensis* is used for *Ralstonia solanacearum*. Biocontrol agents/Biopesticides being integral part of natural biodiversity are safer to the environment. They not only control the disease and pests but also enhance the root and plant growth by way of encouraging the beneficial soil micro flora. They are harmless to human beings, animals and other natural fauna and flora. So nowadays they are very useful to protect the agriculture and production of chemical residue free organic agriculture product.

Keywords: organic production, biopesticide, bacteria, fungi, viruses

Phenotypic evaluation of a core set in maize for low-temperature tolerance related traits

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Cold stress is a major abiotic stress that drastically reduces maize yield by limiting the emergence and seedling vigor during early growth stages. Thus, increasing the low temperature stress tolerance in maize seedlings will be helpful in mitigating the effects of climate change on yield. The present study was aimed to identify cold tolerant maize lines by screening an association mapping panel of 305 lines under natural conditions for different cold tolerance related traits in three different trials during 2018 in the month of January, October and December. Observation recorded were days to emergence, % germination, chlorophyll content, purpling of leaves at 50 DAS, purpling of leaves at 65 DAS, seedling vigor, yellowing of leaves at 50 DAS, yellowing of leaves at 65 DAS, drying of leaves , days to 50% anthesis, days to 50% silking , plant height and grain weight. Significant variability was observed for almost all the traits studied. The pooled ANOVA showed significant differences for most traits for genotype and genotype × environment interaction. Association analysis revealed that germination percentage, chlorophyll content, seedling vigor and plant height were significantly and positively correlated with grain weight while negatively correlated with purpling of leaves at 50 DAS and at 65 DAS, days to 50% anthesis and days to 50% silking. Based on the observations recorded under all three trials and various analyses, a total of 21 lines performed better under cold stress and consider them as tolerant. These promising identified lines will be subjected to generate cold tolerant hybrids suitable for winter season specially in Northern part of India.

Impact of Organic Fertilization on soil health - under southern Andhra Pradesh

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Organic fertilization plays a crucial role in soil health, especially in Southern Andhra Pradesh, a region with diverse soil types and a tropical climate. Organic fertilizers like compost, green manure, and animal manures improve soil structure by promoting aggregate formation, increasing porosity, aeration, root growth, and water infiltration. They provide essential nutrients in a balanced, slow-release form, promoting sustained crop productivity and nutrient availability. Organic matter stimulates beneficial microbial activity, improving soil fertility and suppressing soil-borne diseases. It also enhances soil's water-holding capacity, enhancing crop resilience in variable rainfall conditions. Organic fertilization reduces soil erosion by improving soil cohesion and stability, especially in hilly terrain. It buffers soil pH, maintaining optimal nutrient availability and microbial activity. The long-term benefits of organic fertilization include reduced dependence on synthetic fertilizers and pesticides, environmental sustainability, and improved human health. Adopting organic fertilization requires considering local soil and climatic conditions, but it offers significant advantages for enhancing soil health and promoting sustainable agricultural practices in Southern Andhra Pradesh.

Keywords: Organic manures, green manure, microbial activity, soil erosion, environment sustainability.

FARMERS' PERCEPTION OF AND ADAPTATION STRATEGIES TO CLIMATE CHANGE IN THE THAR DESERT REGION OF INDIA

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The threat of climate change is a global environmental concern, impacting all economic sectors, particularly agriculture. Agriculture is the backbone of the Indian economy, which is subjected to climate change impacts. Especially, the arid region is very sensitive to climate change impacts. The Thar Desert region is experiencing changes in temperature and rainfall patterns, leading to increased water scarcity and unpredictable growing seasons. Understanding farmers' perceptions of climate change and their regional adaptation strategies is essential for developing effective policies and interventions to enhance sustainable agriculture. The Bikaner and Jaisalmer districts, which are situated in the Thar Desert were selected for the study. Primary data were collected from the farmers of the Bikaner and Jaisalmer districts on socio-economic details and their perception of climatic variables viz., rainfall, temperature, drought, etc. Secondary data on rainfall and temperature were collected from the Indian Meteorological Department (IMD). Rainfall Anomaly Index (RAI), Cumulative Departure Index (CDI), linear trend, and Mann-Kendall test were used to analyze the secondary data on rainfall and temperature. A binary logistic model was used to analyze the factors influencing farmers' adaptation strategies. The results of the RAI and CDI show the variability in the annual rainfall and seasonal rainfall respectively. There was a positive trend exhibited in temperature as well as in rainfall. The results of the study show that the perceptions of increasing mean temperature match well with farmers' perceptions. However, a discrepancy is found in some cases between the rainfall changes and farmers' perceptions. Increased fertilizer application and water conservation techniques, adjustments in sowing/planting dates, and crop rotation were the adaptation strategies employed by most of the farmers in both districts to adjust to climate change. Shortage of irrigation water, limited knowledge about climate change impacts, and lack of funding for adaptation strategies were major barriers to climate change adaptation in both regions. Land-holding, education level, and farming experience were positive and household size was negatively related to the probability of employing the climate change adaptation strategies. Policy implications were suggested for climate education, farmers' training, the establishment of automatic weather stations, and the adaptation of drought-tolerant varieties.

Keywords: Climate change, Adaptation, Agriculture, Thar Desert, etc.

Screening of elite genotypes through genetic diversity analysis for their utilization in improvement of mungbean (*Vigna radiata* L.Wilczek)

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The present study consisting of 200 lines along with five checks, namely, HUM 16, Virat, IPM 2-3, SML 668 and IPM 99-125 were evaluated in augmented block design with eight blocks during kharif, 2019. Each entry was grown in paired rows of 4m length with 45 x 10 cm spacing. The experimental site was at Agriculture Farm (25.50 N, 80.30 E and 113 MSL) of Banda University of Agriculture and Technology in Banda district of Uttar Pradesh. The mean data of five randomly selected competitive plants in each entry of every block on thirteen quantitative traits including yield were subjected to analysis variance for augmented block design and genetic divergence (D2) statistics. The 38 genotypes out of 200, displayed significantly higher seed yield per plant than best check IPM 2-3 (10.19g). Based on D2 values, all 205 genotypes were grouped into five clusters following Ward's linkage method. The cluster II had maximum genotypes (62) followed by cluster I (42), cluster III (39), cluster IV (36) and Cluster V with genotypes (26). The minimum intra cluster D2 value was in cluster II (218.44) while it was the maximum in cluster III (467.02). On the basis of inter cluster distance and per se performance of genotypes across the traits with desirable direction, the hybridization programme of genotypes IPM 2-3, Selection 18-5, Asha mung and BMS 18-11 from cluster III with genotypes IPM 2-19, AKM/NP/8/9, Taram 18, ML 1299, Selection 18-3, IC 296672 and MH 805 from cluster IV and with genotypes PAU 911, SML 1455, CO-5 and Brazil mung from cluster V may be taken for generating materials for improvement of yield and most of its important traits. However, similar genotypes of cluster IV (IPM 2-19, AKM/NP/8/9, Taram 18, ML 1299, Selection 18-3, IC 296672 and MH 805) and genotypes SML 1815, F8 (MXU) Extra Early, MH 2-15, MS 03-18 and GM 4 from cluster I may be utilized in hybridization for obtaining recombinants for optimum vegetative and reproductive period along with substantial yield in mungbean.

Keywords: Genetic diversity (D2), quantitative traits, mungbean

Design and Development of Prototype Seed and Fertilizer Sowing Agri Bot Machine for Spices Crop

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In this day-to-day life Agriculture sector is very crucial. In India more than 65% people work in farm. The equipment use in agriculture is not fully automize requires more labors, time required more for operation, requires fuel for some equipment. Considering all these factors the agribot is design for seed and fertilizer sowing because it is considering important aspect in India for crop cultivation. Generally sowing of seed and fertilizer by machine is depend upon type of soil, location, and weather condition. Growth of crop is totally depended upon type of seed and fertilizer. The machine is control by the Bluetooth through android application. Arduino board relates to all component. it has unique type of prototype design. This machine has high end application in agriculture yielding and other level designs for optimization of time, work, and efficiency to increase the production of crops, reduce human efforts. The prototype agribot seed cum fertilizer for spices crops is basically used in clay soil, clay loam soil, silty clay soil etc. The percentage of wheel slippage should not be more than 10%. The field efficiency varies from 67.16%,70%,75%,80%,85% for five trials with increased operating speed. For this machine we can plant different types and different sizes of seeds also we can vary the space between two seeds and planting. This also increased the planting efficiency and accuracy. we made it from raw materials thus it was so cheap and very usable for small scale farmers. for effective handling of the machine by any farmer or by any untrained worker we simplified its design. also, its adjusting and maintenance and method also simplified

Keyword: Agribot, Aurdino, Field efficiency, Seed, Fertilizer.

Zero Budget Natural Farming : A New Strategy for Sustainability in Agriculture (millets) Farming and Enhancing Farmer's Income

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In the present day, chemical-based modern agriculture practices pose a serious threat to the well-being of humans, the health of soil, and the farmers' livelihoods. Agricultural industrialization has led to alarming indebtedness among indigenous farmers due to the exorbitant costs of raw materials. Zero Budget Natural Farming, proposed by Padma Shri awarded "Shri Subhash Palekar", is the new strategy of chemical free sustainable agriculture farming without any use of external inputs like fertilizers, pesticides, etc. The phrase "Zero Budget" refers to no use of credits on purchase of external inputs and "Natural farming" represents farming in-tune with natural environments. Zero Budget Natural Farming is based on the four most prominent pillars i.e., Beejamrita (Seed treatment), Jeevamrita (Organic manures), Acchadana (Organic soil mulching), and Whapasa (minimal watering for optimum moisture and good aeration). It eliminates farmers' dependence on Agriculture loans by encouraging them to use natural resources and disheartens the use of chemicals and expensive inputs. A key aspect of Zero Budget Natural Farming farming is soil preservation, mulching, organic pesticides, organic fertilizers, crop rotation, and biological pest control and mechanical cultivation. Additionally, indigenous livestock is emphasized for its unique quality and importance, is crucial for scaling up agro ecology. The Zero Budget Natural Farming method allows farmers to assure low cost of crop production without the use of chemical while maintaining soil fertility, and increasing farmer's income. Furthermore, it has the potential to prevent straw burning repercussions by practicing organic mulching. Thus, Zero Budget Natural Farming is a sustainable alternative approach to the rural world in which people, animals, plants, mycorrhizae, and microorganisms collaborate to boost agricultural productivity, economic development, and social wellbeing.

Keywords: Integrated nutrient management gram crop, Economics, Bio fertilizer

Estimates of genetic impacts on calf survival in Hardhenu (Bos taurus × Bos indicus) cattle

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Present study utilizes data records of 2593 calves born to 102 sires and 790 dams over a 25 years period to perform a risk analysis and Bayesian estimations of genetic impacts on calf survival in Hardhenu cattle. In order to quantify the direct and maternal impacts on calf survival of the studied population, threshold animal models were subjected to Bayesian analysis utilizing Gibbs sampling. According to the findings, the death rates for calves born within three months (S1), six months (S2), and twelve months (S3) were 10.22, 12.88, and 14.65%, respectively. The outcomes of the logistic regression analysis showed that, in comparison to female animals, male animals were more likely to die during the first three stages of life (1.41–1.61 times higher). On the other hand, compared to calves born during the winter, those born during the rainy season had a 1.36 to 1.44 times higher risk of mortality. When respiratory and digestive disorders were co-occurring, they accounted for the majority of animal deaths (26.84%–30.19%), whereas each condition alone only accounted for 18%–20% of deaths. After evaluating six threshold animal models, model 1 was determined to be the most appropriate model. Under model 1, the direct additive heritability for S1, S2, and S3 were estimated to be 0.15 ± 0.07 (0.04–0.23), 0.23 ± 0.12 (0.02–0.44), and 0.26 ± 0.06 (0.08–0.41), respectively, based on Bayesian estimates (95% highest posterior density confidence intervals). The study's conclusion was that adding survival qualities to the current selection criteria might boost the dairy herd's calf survival rate and, eventually, financial gain.

KEYWORDS: Heritability, Hardhenu (Bos taurus × Bos indicus) Cattle, Calf survival, Threshold Animal model.

Effect of weed management practices on weed dynamics of wheat (*Triticum aestivum* L.) under irrigated conditions Nagender

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In wheat, weeds can reduce yields by 10-82% based on species, severity, infestation duration, and agro-ecological conditions, emphasizing the need for effective weed management. An experiment was conducted during winter rabi season 2020 at Reasearch cum Instructional Farm, S.G. College of Agriculture and Research Station, Jagdalpur, Chhattisgarh in Randomized Complete Block Design comprising 5 treatments (T1: Hand hoeing at 30 DAS, T2: Metribuzin 175 g a.i. ha-1 at 20 DAS, T3: One hand weeding (20 DAS), T4: Two hand weeding (HW) 20 and 40 DAS, T5: Control (Absolute control) which replicated four times. Results revealed that Two HW 20 and 40 DAS had lower dry matter accumulation in case of Chenopodium album L. (2.78 and 1.30 g m-2), Leucas aspera (Willd.) Link (1.24 and 0.99 g m-2), Digitaria sanguinalis (L.) Scop. (1.55 and 1.50 g m-2), Spilanthes acmella Murr (0.78 and 1.77 g m-2), Vicia hirsute (L.) Gray (0.92 and 1.00 g m-2), Medicago denticulata Willd. (0.78 and 0.71 g m-2) than remaining weeds at 45 and 65 DAS, respectively, and found significant over rest of treatments. Two HW 20 and 40 DAS observed lower weed density compared to rest of the treatments. Chenopodium album, Leucas aspera, Spilanthus acmella, Vicia hirsute, Digitaria sanguinalis and Medicago denticulata had higher weed control efficiency (WCE) ranging from 50.6 to 96.4% under two HW 20 and 40 DAS and lower (9.5%) weed control efficiency was noticed with Digitaria sanguinalis under one HW 20 DAS. It was concluded that two HW at 20 and 40 DAS performed better than the rest of the treatments.

Keywords: Weed Density, Hand weeding, Dry matter accumulation, Weed control efficiency

A detailed study on leaf spot causing pathogen Curvularia tuberculata on Capsicum (*Capsicum annum var. grossum* (L.) Sendt.)

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Capsicum plants are affected by both biotic and abiotic stresses that has indeed led to significant economic losses over the past few decades. Among all the stresses, "Curvularia leaf spot" of Capsicum (Capsicum annum var. grossum (L.) Sendt.) caused by Curvularia tuberculata posed a significant biotic stress. The present study was focused on the isolation, and identification of Curvularia tuberculata based on morphological- microscopic and colony characteristics, physiological (different temperatures), biochemical (qualitative and quantitative), and molecular characteristics (ITS- Accession no. OR555998; TEF- Accession no. PQ140565). The pathogenicity of Curvularia tuberculata was confirmed through Koch's postulates. Growth and sporulation were tested on 12 different media and found that Acidified PDA (APDA- pH 4.8-5) was the best medium. Growth was also evaluated in different range of temperatures (-25°C, -18°C, 3°C, 27°C, 30°C, 40°C and 50°C) and maximum at 27 ± 1°C. By considering all the characteristics and phylogenetic analysis, this is the first report of Curvularia tuberculata causing leaf spot in Capsicum in Varanasi, India. In vitro efficacy of six bio-agents and two botanicals were tested against Curvularia tuberculata and found that Bacillus sp. showed the highest inhibition percentage (92.22%). Among botanicals, neem ethyl acetate extract (poison food technique- 85.55% and cavity slide method- 92.1%), tulsi methanolic extract (agar well diffusion- 86.94%) showed maximum inhibition %. In vitro efficacy of fungicide (Tebuconazole) was tested and maximum inhibition % was observed at 2 ppm (100%). Through HPLC analysis, 11 secondary metabolites (Valinilic acid (Rt 5.333min), Salicylic acid (Rt-4.435min), Nicotinic acid (Rt-3.224min), Ascorbic acid (Rt 3.167min), Rutin (Rt-4.326min), Coumaric acid (Rt-4.420min), Shikimic acid (Rt-5.557min), Quercetin (Rt-5.393min), IAA (Rt-4.414 min), Synergic acid (Rt-3.149min) and Cinnamic acid (Rt-4.196min)) were identified and more than 3000 secondary metabolites were profiled with the help of HRMS technique.

Keywords: India, Curvularia leaf spot, Curvularia tuberculata, molecular characterization, HPLC, HRMS, Management

Dissection of Physiological Traits for Terminal Heat Stress Tolerance in Indian Mustard (*Brassica juncea* L.) Using Microsatellite Markers

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Heat stress, especially during the reproductive stage, has been exacerbated by changing climatic conditions, resulting in reduced seed yield in crops like Indian mustard. In the present study, 154 genotypes of Indian mustard were used to find novel SSR marker-based associations for seed yield and physiological traits by linkage disequilibrium. Extensive phenotyping of 154 genotypes for seed yield and various physiological traits was done for two consecutive years (2020–2021 and 2021–2022) in timely and late-sown environments. Out of 237 SSR markers, a total of 111 polymorphic markers containing 312 alleles were used for analysis. Two different models, i.e., general linear model (GLM) and mixed linear model (MLM), were used to detect the significant marker–trait associations for timely and late-sown environment separately. A total of 12 and 10 MTAs were found to be associated under timely and late-sown conditions with seed yield and physiological traits using MLM model. Out of these promising MTAs identified in the present study, five SSRs were specifically detected only in late-sown environments which meant that these specific genomic regions and QTLs were associated under terminal heat conditions. This is the first report on the identification of marker-trait associations for physiological traits under terminal heat stress conditions. It may be possible to develop the molecular markers for significant SSRs after due validation. The findings contribute to our understanding of the genetic basis of heat tolerance and provide valuable information for breeding programs aiming to improve crop productivity under heat stress conditions.

Keywords: GLM, MLM, MTAs, SSRs, Indian Mustard

Exotic Vegetables: A Promising Innovation

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Exotic Vegetables recognized by many people as Chinese or English vegetables. Most of the crop types and its cultivation practices ideas has come to India from western world the crops are now very much grown in India. Indian farmers successfully grow such crops like Lettuce, Broccoli, Yellow and Red Capsicums, Brussels Sprouts, Celery, Parsley, Red Cabbage, Asparagus, Cherry tomatoes from a decade in Indian soils and weather conditions. There are very few areas in India which grow these vegetables commercially such as Bengaluru, Nasik, Mahabaleshwar, Uttarakhand, Ooty, Himachal Pradesh and Jammu Kashmir. As the demand is high supply is low requirement for the exotic vegetables is increasing day by day, It is generally due to the fact that these Vegetables among the super healthy food class. Exotic Vegetables have high Market value, fastest growing industry with promising economic returns in comparison to traditional vegetables. Exotic Vegetables hold some really important medicinal and pharmacological properties such as anti-inflammatory, anticarcinogenic, antiulcerogenic etc. immunomodulatory, hepatoprotective

KEYWORDS: Exotic Vegetables, Broccoli, hepatoprotective, anticarcinogenic.

Organic Cultivation of Watermelon using a mix of Modern and Traditional cropping methods.

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CITAAS/AB/2024/029

This paper aims to illustrate the feasibility and advantages of sustainable agricultural practices by providing a thorough analysis of an organic watermelon cultivation project. The project was carried out on a 28m x 36.6m (0.25 acre) plot. In the research work modern methods like Tunnel farming, Drip irrigation, better seed selection and traditional methods such as organic soil amendments, and land preparation practices were merged with an aim of obtaining improving crop yield and quality. The use of humic acid, biofertilizers, and organic fertilizers like Jeevamrut was stressed as a means of preserving soil health. Natural remedies like Dashparni Ark and Neem Ark were employed to control pests and diseases. The findings emphasize the sustainability of organic farming from an economic and produce quality standpoint.

Keywords: Organic Farming, Sustainable Agriculture, Economic Viability, Environmental Sustainability

Women Empowerment and Gender-inclusive Approaches Decision making profile of hill women in farming and allied activities

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CITAAS/AB/2024/030

Women, especially of hill region are the backbone of agriculture and play a significant role in management of natural resources. They work harder and for longer hours than men and have a vital role in conservation and management of sustainable eco-system. It is unfortunate that the actual and potential role of women in bringing about sustainable development has been ignored, preventing rural women from making their rightful contribution to progress. Present study examines time allocation and decision making profile of farm women in farming and allied activities. Research was conducted on 300 farm families of various villages of Nainital district of Uttarakhand. Findings reveal that household work was predominantly women-dominated(51.00%), with significant portions being women-exclusive(35.67%). In farming and caring of animals activities, equal participation was found in more than half of the families of households (55.26% and 56.36%, respectively) followed by women dominated participation in more than 20.00% families. The average daily time spent by farm women includes 5.29 hours on farming, 4.26 hours on household chores, 3.12 hours in caring of animals and 2.56 hours in child care activities. Majority of the production, post harvest management, horticultural and dairy farming activities were jointly performed and joint decisions were made by women and men in more than half of the farm families but the activities that involve finances i.e. sale, purchase, obtaining and repayment of bank loan etc. were independently performed and independent decisions were taken by men in more than half of the farm families. Overall, the study highlights the critical role of women in farm households, with little involvement over financial matters. Thus, there is need for improved support from extension services to enhance women's participation and decision making in activities that involve finances for their socio-economic empowerment and achieve sustainable development.

Keywords: hill women, decision making, socio-economic empowerment, sustainable development

Spatial distribution of silicon in the Saccharum spontaneum and Erianthus arundinaceus energy canes and their relationship with sugarcane borer pests

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Rind hardness and fibre content are important traits in the development of resistant cultivars to combat borer pests in important agricultural crops. Improved silica deposition in plant tissues strengthens the constitutive defence by employing improved stiffness and reducing palatability to herbivores, as well as the wearing of larval mandibles. In the study, total of eight energy canes comprising Type I (>15% juice brix & >20% cane fibre) and Type II (<15% juice brix and >25% cane fibre) categories were used for this study. Among the eight energy canes, four energy canes from Saccharum spontaneum (SBIEC 11003, SBIEC 13010, SBIEC 11002, and SBIEC 14003) and the another four energy canes from Erianthus arundinaceus (SBIEC 14006, SBIEC 11004, SBIEC 11001 and SBIEC 14001) were chosen based on the fibre content and biomass yield attributes. Profiling of silicon was done at the preferential feeding sites of sugarcane tissue borer on the type 1 S. spontaneum and type 2 E. arundinaceus energy canes. Silicon content was higher among the plant parts in the order of leaf > leaf sheath > rind > midrib invariably in all the S. spontaneum energy canes. The same pattern was observed in E. arundinaceus energy canes, with the exception that the rind sections had a lower silicon content. In the two groups, silicon content was significantly highest in E. arundinaceus energy canes than in S. spontaneum energy canes. Furthermore, silica content in all the parts was highest in the energy canes SBI EC 13010 followed by SBI EC 11002 under S. spontaneum category and SBI EC 14006 and SBI EC 14001 under E. arundinaceus category. Subsequently, extracted silicon from S. spontaneum and E. arundinaceus were correlated to early shoot borer (ESB) and internode borer (INB) infestations. In the correlation studies, E. arundinaceus silicon content were negatively correlated with both borer pests as compared to the silicon content of S. spontaneum.

Keywords: Saccharum spontaneum, Erianthus arundinaceus, early shoot borer, internode borer, silicon, energy canes.

Boosting Socio-Economic Development in Hill Areas: Insights from the Farmer FIRST Project

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The global market is experiencing a growing trend towards mushrooms as a commodity, driven by consumers shifting from animal protein to mushrooms. As a cash crop, mushrooms offer significant harvest potential from limited organic and financial resources. Mushroom cultivation presents a viable path for socio-economic development in rural communities by generating employment opportunities, alleviating poverty, and combating malnutrition. This practice helps reduce vulnerability to poverty and strengthens livelihoods by providing a quick-yielding, nutritious food source and a reliable income.

Governments have initiated various projects to raise awareness of mushroom cultivation in rural areas, including the ICAR-Farmer FIRST Project, which aims to empower rural communities. A training program on "Mushroom Cultivation and its Value-Added Products" was organized under Farmer First Project in village of Dogra, Nainital district, Uttarakhand. During the training, 70 ready-to-use mushroom bags (each with 10 kg of compost) were distributed to seventy farmers, with each beneficiary receiving 10 bags.

The results showed a significant increase in awareness and perception towards mushroom cultivation among the beneficiaries. The awareness improvements included harvesting and processing methods (82.86%), preservation techniques and compost making (91.43%), sorting/packaging (87.15%), handling techniques for sprayers and other equipment (81.43%), types of mushrooms (88.58%), marketing channels (77.15%), government schemes for mushroom growers (62.86%), and loans and subsidies for mushroom growers (64.29%). Additionally, perceptions shifted, with participants recognizing mushroom cultivation as a profitable venture, the viability of selling mushrooms in local markets (91.43%), the high nutritional value of mushrooms, and the availability of value-added mushroom products.

Keywords: Economic Empowerment, Mushroom, Women

One Health Approaches for the Prevention and Control of Diseases in the Livestock and Poultry Sector

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The One Health concept underscores the interconnectedness of human, animal, and environmental health, advocating for a multidisciplinary approach to address health challenges, particularly in the livestock and poultry sectors. These sectors are integral to global food security and are highly susceptible to infectious diseases, which can have severe implications for both animal and human populations. Zoonotic diseases, which are transmitted from animals to humans, pose significant risks; over 60% of known infectious diseases in humans are zoonotic, and 75% of new or emerging diseases are of animal origin.

The One Health approach integrates efforts across multiple disciplines, including veterinary medicine, human health, ecology, and environmental science, to create a comprehensive strategy for disease prevention and control. Key strategies within this framework include disease surveillance and monitoring, vaccination programs, biosecurity measures, antimicrobial stewardship, and education and training. Surveillance systems like the Global Early Warning System (GLEWS) exemplify how integrating human, animal, and environmental health data can facilitate early detection and response to potential outbreaks. Vaccination and biosecurity practices, particularly in the poultry sector, have demonstrated significant reductions in disease incidence and economic losses.

However, implementing One Health strategies presents several challenges, including the need for better coordination between sectors, limited resources, and the complexity of addressing health issues across different regions, particularly in low- and middle-income countries. Moreover, the threat of antimicrobial resistance (AMR) due to the overuse of antibiotics in animal husbandry underscores the urgency of adopting responsible antimicrobial practices.

The One Health approach is not only essential for mitigating the risks of zoonotic diseases but also for safeguarding global public health and ensuring food security. As the world continues to face emerging health threats, the adoption and implementation of One Health strategies will be crucial in promoting a sustainable and healthy future. Increased investment, international collaboration, and innovative technologies are necessary to overcome current challenges and fully realize the potential of One Health initiatives.

Exploring Pea Pod Waste as a Resource for Nutritional Products

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Pea (*Pisum sativum*) family Fabaceae, a common green pod-shaped vegetable is widely grown as a vegetable crop during winter months of October–November. The global production of peas was 11.2 million tonnes, significant amount of which is processed. While global average consumption of green peas is 2.3 kg per capita, India is the second largest producer of green peas next to China. About 35%–40% of solid waste (green pea peels or pea pods) is generated, after removal of peas from their pods. As most peas are processed into frozen, canned or dehydrated forms, the outer coat or pod remains unutilized. This outer pod, accounting for 35–40% of fresh weight, is either dumped leading to accumulation of municipal biomass or is used for animal feed. Pea pods have immense health benefits, as they are an outstanding source of nutrients like vitamins, minerals, and dietary fiber, as well as are low-calorie, low-fat, and cholesterol-free. Fruit and vegetable by-products are potentially valuable sources of bioactive compounds, such as carotenoids, polyphenols, vitamins, dietary fiber, etc. These phytochemicals find immense applications in the food, pharmaceutical, and textile industry where they are used for the development of functional or enriched food, for medicinal purposes, and dye manufacturing, respectively. Waste utilization can thus serve to improve human health by means of product development and also helps to mitigate environmental problems which are a vital step toward attainment of sustainable development goals.

Keywords: Pea pod, Utilization, consumption, processed, development

Effect of Potassium and Sulphur on Growth, Yield and Economics of Black gram (Vigna mungo L. hepper) under Rainfed condition

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CITAAS/AB/2024/035

A field experiment entitled "Effect of potassium and sulphur on growth, yield and economics of black gram (Vigna mungo L. Hepper) under rainfed condition" was conducted at Agronomy Farm, Department of Agronomy, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.) during kharif season of 2017-18. The experiment was laid out in spilt plot design with three replications and sixteen treatment combinations. Main plot treatments consisted of four levels of potassium i.e. 0 Kg K_2O ha^{-1}, 10 Kg K_2O ha^{-1}, 20 Kg K_2O ha^{-1} and 30 Kg K_2O ha^{-1}, respectively. Sub-plot treatment consisted of four levels of Sulphur 0 Kg S ha^{-1}, 5 Kg S ha^{-1}, 15 Kg S ha^{-1}, 25 Kg S ha^{-1}, respectively. Experimental results revealed that the application of potassium @ 30 Kg ha^{-1} being at par with treatment of application of potassium @ 20 Kg ha^{-1} registered significantly higher growth parameters and yield attributes over the treatments of application of potassium @ 10 Kg ha^{-1} and no application of potassium, respectively. Application of potassium @ 30 Kg ha^{-1} being at par with treatment of application of potassium @ 20 Kg ha^{-1} registered significantly maximum seed, straw and biological yield ha^{-1}, monetary returns and total uptake of N, P, K and S over treatments K_1 and K_0, respectively. Application of sulphur @ 25 Kg ha^{-1} and application of sulphur @ 15 Kg ha^{-1} being at par and registered significantly maximum growth parameters and yield attributes over the treatments of application of sulphur @ 5 Kg ha^{-1} and no application of sulphur, respectively. Application of sulphur @ 25 Kg ha^{-1} and application of sulphur @ 15 Kg ha^{-1} being at par and registered significantly higher seed, straw and biological yield ha^{-1}, monetary returns and total uptake of N, P, K and S over treatments of application of sulphur @ 5 Kg ha^{-1} and no application of sulphur, respectively.

Keywords: Potassium, Sulphur, Yield, Economics and Black gram

Establishing and identifying a representative core set in grain amaranth (Amaranthus spp.)

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Grain amaranth, scientifically known as Amaranthus spp., is a resilient and versatile crop with a rich history spanning thousands of years. Originating from the Americas, this ancient pseudo-cereal has been cultivated for its nutritious seeds, vibrant foliage, and medicinal properties. Plant genetic resources encompass a wide array of genes that provide the raw material for breeding new crop varieties. Crop researchers have realized this and gathered a huge number of germplasm accessions. A big collection of germplasm is likely to contain a significant number of duplicate accessions. Furthermore, huge collections make it harder to characterize and evaluate germplasm for target traits. To address such concerns, the establishment of a reduced representative set, commonly known as the 'core set', is recommended. To conserve the maximum genetic variation with the fewest number of samples, making it easier and more cost-effective to maintain and study these resources. Core collection is meant to represent the broader genetic variation found in the entire collection, making it easier to study, conserve, and utilize biodiversity without the need to manage the entire collection. In this direction; the current study was done to examine the variability of 1730 germplasm accessions from distinct geographic regions of the country. The study revealed significant variances in qualitative traits in addition to genetic diversity for quantitative traits in germplasm. Out of 08 core sets developed using quantitative traits data following sampling and allocation strategies. Qualitative traits-based statistics such as chi-square test, 'class coverage' and 'Shannon-Weaver diversity index' were used as validation criteria to check the retention of qualitative traits-based classes. Quantitative traits-based multivariate statistics such as SMD%, CR%, VD% and VR% were used to assess the representativeness of core sets. Different core sets were representative of the base collection based on different validation criteria. Logarithmic strategy with a preferred sampling approach-based core set of ~10.0 percent size (180 entries) was identified as the best representative of the base collection.

Keywords: Grain amaranth, core set, validation, class coverage, Shannon-weaver diversity index.

Effect of Chitosan- Zn-Salicylic acid Nanocomposite Particles on Wheat (*Triticum aestivum*): Evaluation of Biochemical and Yield Responses

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Indian population is growing very unprecedented rate. For food security in India, high yield and nutritional quality of grain crops, both are essential. Zinc is a crucial micronutrient generally deficient in food grains grown in India, reflecting their deteriorating nutritional quality. To address these issues, in the present study, a novel tri-component nanoparticle of chitosanzinc-salicylic acid (CS-Zn-SA NPs) has been synthesized by ionotropic gelation method. The average size of synthesized CS-Zn-SA NPs was recorded 13.5 nm by dynamic light scattering (DLS) spectroscopy. The presence of chitosan, zinc and salicylic acid and crosslinking among these components in synthesized nanoparticles has been demonstrated by Fourier transforms infrared (FTIR) spectroscopy and thermogravimetric analysis (TGA). Further, synthesized CS-Zn-SA NPs at various concentrations (50–200 ppm) were evaluated for seed germination via seed priming, yield, grain zinc content and defence enzyme activity through the foliar application. CS-Zn-SA NPs revealed significant seed germination activities, 19.8 % higher grain yield, 45.5 % increased grain zinc content and manyfold defence enzyme activities than the control. The obtained results exposed the potential of CS-Zn-SA NPs as a stimulant for effective seedling development, higher yield, a virtuous micronutrient fortifying agent and defence enzyme promoter.

Microbial Biomass Carbon, Fluorescein Diacetate and Wheat Yield as Influenced by Different Tillage Practices and Nitrogen Management

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CITAAS/AB/2024/038

Wheat is the world's second most important cereal crop. After rice, it is India's second most valuable cereal crop. The rice–wheat system is crucial to global food security because it provides the grain supply for a significant portion of the world's population. The productivity of the rice-wheat cropping system must be increased in a sustainable way to fulfil the rising food demand. Wheat sowing is often delayed in rice-wheat cropping systems due to the short turnaround period. Hence, conservation agriculture (CA) based rice-wheat cropping systems are becoming increasingly popular among the farmers, notably farmers in the IGP's northwestern plains. Addressing the issues of late sowing, higher cost of cultivation, and weed infestations, zero tillage (ZT) as a resource management approach has a significant potential for sustaining wheat production while improving profits. The management of crop residues on the surface of the soil or in the soil is closely linked to the impact of tillage on soils. The incorporation of crop residue into soil or its accumulation on the surface has several beneficial effects on the soil's physical, chemical, and biological properties. N management in full residue zero-till farming systems and its effects is a researchable issue. N losses in the soil-plant system are more when N fertilizer application is not synchronised with crop needs, which results in low N use efficiency. When broad-based blanket fertiliser N recommendations are used, the large field-to-field variability of soil N supply limits the efficient use of N fertiliser. Real time N management can improve the existing NUE by reducing rapid losses of applied N by volatilization and denitrification in the soil, the fertilizer-NUE of irrigated wheat is relatively low. A leaf-color chart (LCC), which is a non-destructive and inexpensive alternative to chlorophyll metre that can rapidly and accurately determine' s crop N status based on colour of the leaves. It allows farmer's to better adjust N application to crop demand or to enhance the present fixed N recommendation for improved N efficiency. Despite all the advantages of LCC-guided N management in wheat farmers still face difficulties in its widespread adoption, particularly when using ZT and other tillage practices. Hence, a systematic study was planned in order to assess the impact of different N management practices under various tillage practices in wheat.

RESPONSE OF LINSEED TO VARYING LEVELS OF IRRIGATION AND NITROGEN

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A field experiment was conducted at College Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat to study the effect of irrigation and nitrogen on growth and yield of linseed. The soil of experimental field was loamy sand in texture, having low in organic carbon (0.41%), available nitrogen (242 kg ha-1) and available phosphorus (32 kg ha-1), medium in available potash (263 kg ha-1) and pH (7.5). The experiment was laid out in split plot design and replicated four times. There were twelve treatment combinations comprising of four irrigation levels viz., I1 (0.4 IW:CPE ratio), I2 (0.6 IW:CPE ratio), I3 (0.8 IW:CPE ratio) and I4 (Irrigation at critical growth stages) and three nitrogen levels viz., N1 (30 kg N ha-1), N2 (60 kg N ha-1) and N3 (90 kg N ha-1) were evaluated in present study. From the results of present experiment it was reported that significantly the maximum plant height of 22.91, 57.19, 61.24 and 63.40 cm recorded at 30, 60, 90 DAS and at harvest, respectively and number of branches plant-1 (7.34) were registered with nitrogen level N3 (90 kg N ha-1). Similarly, the nitrogen level N3 (90 kg N ha-1) produced significantly the highest number of capsules plant-1 (67.50), seed yield (401 kg ha-1) and straw yield (3431 kg ha-1). Each successive increase in the level of nitrogen from 30 to 90 kg N ha-1 significantly increased protein content, nitrogen content in seed and available nitrogen in soil after harvest. The oil content was recorded higher with application of nitrogen @ 30 kg N ha-1.

From the foregoing study, it is concluded that for securing higher yield and net return, the linseed crop should be irrigated at 0.8 IW:CPE ratio with two common irrigations for crop establishment and four irrigations at 18 to 20 days along with 90 kg N ha-1 (45 kg N ha-1 as a basal and remaining 45 kg N ha-1 at 30 DAS) under loamy sand soil of middle Gujarat conditions.

Legume Integration: Enhancing Soil Health for Future Farming

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CITAAS/AB/2024/040

Soil health restoration is crucial for achieving agricultural sustainability, especially given the current challenges of declining soil fertility and health. Over-reliance on chemical inputs along with intensive agriculture practices can deteriorate soil health contributing to environmental issues, such as the release of greenhouse gases. The challenge of feeding the increasing population coupled with food security is a major challenge in the context of present climate change and global warming. Legumes have the potential to address adverse impacts including restoration of soil health. These versatile crops not only are a source of protein-rich grains but also helps in improving soil fertility by fixing nitrogen and harbouring beneficial microbes. Some legumes even solubilize unavailable phosphorus through root-secreted organic acids. By incorporating legumes into existing cropping system, multiple benefits of increasing soil organic matter, reduction of pests, and suppression of weeds including prevention of soil erosion can be achieved. Legumes beings their adaptability to fit in existing cropping system as cover crops or green and brown manures, contribute to substantial biomass and diversification options. Legumes has the capacity to influence both above ground and below ground diversity for maintaining agro ecosystem services. Due to their role in reducing input requirement, legumes have positive impact on environment health by reducing Green House Gases. With their diversity and adaptability, legumes can be included in the cropping system either in multiple cropping or intercropping thus exploiting further for restoration of soil health.

Keywords: Legumes, soil health, sustainable, diversification

Inter correlation between individual, clinical and family factors and dimensions of Quality of life and mental wellbeing of cancer patients of Dharwad

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A study was conducted to know the interrelationship between individual, clinical and family factors and dimensions of Quality of life and mental wellbeing of cancer patients from Dharwad district of Karnataka State. The sample comprised of 75 cancer patients (oral, gynaecological and breast) who are in I stage to IV stage. Quality of life tool developed by Vidhubala et al. (2011) was used to measure QOL. Zigmond and Snaith's Hospital anxiety and depression scale was used to assess anxiety and depression. Cancer loneliness tool developed by Adam's et al. was used to assess loneliness, Hope scale developed by Nowotny was used to assess hope. Stress was assessed using Cohen and Williamson's Perceived stress scale. Correlation method was used for data analysis. The results revealed that, With regard to QoL co morbidities (-0.797**), time since diagnosis (-0.718**), stage of cancer (-0.691**), locality (-0.303**) were negatively correlated with QoL among cancer patients, while type of family (0.463**), size of family (0.463**) were positively correlated with QoL. Results also revealed relationships between independent variables and mental wellbeing of cancer patients where age (0.231*), co morbidities (0.597**), time since diagnosis (0.429**) were positively correlated with stress while type of family (-0.403**), size of family (-0.403**) were negatively correlated with stress. Patients with higher number of co morbidities, more time since diagnosis avanced stage of cancer and who were living in urban locality had poor QoL and mental wellbeing. So there is a need to give awareness on early detection and prompt medical care and treatment and focusing on individual and group counselling to reduce impact on QoL and mental wellbeing.

Keywords: Quality of life, anxiety, depression, Stress, hope, loneliness

Comprehensive Development and Quality Assessment of Liquid Floor Cleaner

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CITAAS/AB/2024/042

Liquid floor cleaners are pivotal in maintaining cleanliness and hygiene across various environments, from households to industrial settings. This study aimed to develop and evaluate a liquid floor cleaner with optimal cleaning performance and safety characteristics. Conducted in Dharwad, Karnataka, during 2015-16, the research involved formulating the Liquid floor cleaner with standardized chemical composition. The developed Liquid floor cleaner was tested for various quality parameters. Physically, it was green in color and had a lemon grass fragrance. Chemically, it exhibited a neutral pH (7.0-7.5), which is safe for skin and environmentally friendly. The cleaner was soluble in both water and organic solvents, had a low surface tension of 0.10 dynes/cm and produced a foam height of 0.25 cm. Stability tests showed that the product remained homogeneous and effective for up to three months under storage conditions, with no adverse effects in hard water. The cleaner was also effective in removing oil and grease and showed no alcohol-insoluble matter. Antimicrobial testing demonstrated significant antibacterial properties, with Minimum Inhibitory Concentrations (MIC) of 1.56 µl against Staphylococcus aureus and 6.25 µl against Escherichia coli. This suggests that the cleaner not only performs well in cleaning but also contributes to a hygienic environment by inhibiting bacterial growth. In conclusion, the liquid floor cleaner developed in this study meets high standards for cleaning efficacy, stability, and safety. It is suitable for both residential and industrial applications, providing effective cleaning and antimicrobial benefits.

Keywords: Liquid Floor Cleaner, Formulation, Quality Testing, Antimicrobial Activity, Stability, Cleaning Performance.

Insect Pest and Natural Enemy's complex on Cabbage and Seasonal Pest Incidence in Manipur

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CITAAS/AB/2024/043

Cabbage is a key vegetable crop in Manipur, but its yield is often reduced due to various insect pests. A study conducted at the Entomology farm of ICAR-RC-NEH Region, Manipur, during the rabi seasons of 2017-18, 2018-19, and 2019-20, focused on the insect pest complex, natural enemies, and seasonal incidence affecting cabbage. The research identified a total of 20 insect species infesting cabbage, belonging to seven orders: 9 Lepidoptera, 3 Hemiptera, 2 Coleoptera, 1 Diptera, 1 Hymenoptera, 3 Orthoptera, and 1 Dermaptera. The cabbage butterfly was the first pest to appear, followed by the Diamondback moth and aphids. Natural enemies were abundant on cabbage and cauliflower, largely due to the absence of chemical pesticides. Notable natural enemies included four coccinellids: *Coccinella septumpunctata, Menochilus sexmaculatus, Coccinella transversalis*, and *Micraspis discolour*; syrphid flies; green lacewings; and spiders. Additionally, the parasitoid *Apanteles glomeratus* targeted cabbage butterfly larvae, and tachinid flies were also observed. Insect incidence varied significantly with transplanting dates. The earliest transplanting date (15 October) had the lowest populations of Diamondback moth and aphids, while the latest transplanting date (15 December) saw the highest populations. Analysis over three years indicated a significant difference in pest incidence related to planting dates, with fewer pests in early-transplanted crops and more in late-transplanted crops. Cabbage butterfly incidence remained fairly consistent throughout the growing season regardless of planting dates. Major insect pest populations peaked between January and February, and their numbers were negatively correlated with mean atmospheric temperature, relative humidity, and rainfall during 2019-2020.

Keywords: Seasonal Incidence, major insect pests, natural enemies, cabbage.

Artificial Intelligence (AI) in Smart Agriculture: A Comprehensive Study on Responsible Innovation and Sustainability

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CITAAS/AB/2024/044

Artificial Intelligence possesses the capacity to profoundly transform the agricultural sector and promote responsible innovation and sustainability. It has the ability to tackle significant challenges encountered in agriculture, including issues related to food security, environmental impact, and resource management. Through the utilisation of artificial intelligence (AI) technologies, farmers and individuals involved in agriculture can enhance the allocation of resources, reduce waste and environmental damage, enhance decision-making processes, and ultimately promote more effective and sustainable farming methods. Artificial intelligence (AI) allows farmers and agricultural stakeholders to efficiently allocate resources, reduce waste and environmental damage, enhance decision-making processes, and ultimately promote more effective and sustainable farming methods. The study highlights the significance of responsible innovation and sustainability while implementing AI in agriculture. The statement emphasises the importance of developing and using AI in agriculture in a responsible and sustainable way, while considering ethical concerns, protecting data privacy, and addressing long-term environmental effects. The paper emphasises the significance of cooperation among researchers, policymakers, and stakeholders in order to advance responsible and sustainable innovation in AI applications in agriculture.

Keywords: Artificial Intelligence, Smart Agriculture, Sustainability, Technology

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Catalysts of Change: The Influence of Trained Opinion Leaders on Agricultural Innovation in Rural Areas

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This study explores the role of opinion leaders in disseminating agricultural information within rural communities, particularly focusing on their ability to accelerate the adoption of vegetable nutrition gardens through training interventions. The research applies a quasi-experimental design to assess the behavioural changes in opinion leaders and their subsequent influence on fellow farmers. Social Network Analysis (SNA) and Propensity Score Matching (PSM) were utilized to identify opinion leaders and measure the impact of training on adoption rates. Results indicate that comprehensive training significantly altered opinion leaders' behaviour, increasing their contact frequency and reducing inter-response times, leading to enhanced awareness and adoption of vegetable nutrition gardens among villagers. The findings suggest that opinion leaders, when properly trained and supported, can effectively serve as conduits for the purposive diffusion of agricultural innovations.

Keywords: Opinion leaders, Agricultural innovation, social network analysis, Propensity score matching

ANALYSIS OF LIVELIHOOD SYSTEMS OF SMALL AND MARGINAL FARMERS IN RAINFED ECOSYSTEM

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India is an agrarian country where 65% population depending upon agriculture directly or indirectly for their livelihood. Among the rainfed agricultural countries in the world India ranks first in terms of both extent and value of produce. A livelihood system is the total combination of activities undertaken by a typical household to ensure a living. Most rural households have several income earners, who pursue a combination of crop and livestock, farm, off-farm and non-farm activities in different seasons to earn a living (FAO, 2005). By keeping this in view, a study was conducted in rainfed areas of Gadag and Bagalkot districts of Karnataka during the year 2022-2023. Ex- post facto research design was followed with the total sample size of 160 which constitute 80 small farmers and 80 marginal farmers. The study depicted that, majority of marginal farmers (18.75%) are involved in the 'Agriculture+Livestock' livelihood system as a major source of livelihood. Followed by (13.75% and 12.5%) engaged in 'Agriculture+Labour' and 'Agriculture+Livestock+Others' as livelihood system, respectively. With regards to small farmers , majority of the respondents(32.5%) are involved in the 'Agriculture+Livestock' livelihood system as a major source of livelihood, followed by (17.5%) 'Agriculture+Livestock+Labour' and (13.75%) 'Agriculture+Labour as their livelihood system. The study concluded that majority(25.63%) of the marginal and small farmers followed Agriculture+Livestock as a major livelihood system followed by Agriculture+Livestock+Labour and Agriculture+Labour with same percent i,e (13.5%).

Keywords: Livelihood systems, small and marginal farmers, Rainfed ecosystem

Export Performance and Trade Competitiveness of Millets from India

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The present study entitled "Export Performance and Trade Competitiveness of Millets from India" was undertaken with objectives to analyze the growth and instability in export, comparative advantage in export of millets, direction of trade, predict future millets export to importing destination. The secondary data was collected from ITC Trade Map data spanning from 2013 to 2023. Revealed Comparative Advantage, Revealed Symmetric Comparative Advantage, Revealed Competitiveness and Trade Specification Coefficient index were used to examine export competitiveness. The study revealed that export of millets from India was mainly focused on UAE, Nepal, Saudi Arabia, Tunisia, Libya and Egypt. Transitional probability matrix indicated that Tunisia is the most stable market among the importers of millets followed by Saudi Arabia, Nepal, Egypt and UAE. On the other hand, Libya has shown 'zero' probability of retention, indicating that these countries are unstable importers. The index value of revealed comparative advantage, revealed symmetric comparative advantage, revealed competitive advantage and trade specification coefficient index suggested that India has comparative advantage and competitiveness in export of millets to different parts of the world. Among the top five exporting nations, India has the highest comparative advantage during the study period followed by USA. Prediction of future millets export showed that UAE and Egypt show decreasing trend. While Nepal, Saudi Arabia, Tunisia, Libya and other countries group shows the increasing trend.

Keywords: Export, Millets, Comparative Advantage and Direction of Trade.

Harnessing CRISPR-Cas Genome Editing for Effective Insect Pest Management

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CRISPR-Cas9 is a revolutionary genome-editing technology that enables the precise cutting of a specific DNA section, resulting in double stranded break and subsequent inactivation of the gene. The technique has been currently employed for generation of a white-eye mutant phenotype in mango fruit fly, *Bactrocera dorsalis*, wherein the mutants have a reduced overall body dimensions, reproductive fitness, and impaired copulation. A similar white-eye mutant phenotype was also observed in melon fruit fly, *Zeugodacus cucurbitae*. Similarly, it was reported that restriction of OBP-13 (Odorant binding protein-13) gene reduced the perception of Methyl eugenol in mango fruit fly, B. dorsalis. CRISPR/Cas9 based genome editing was also successfully used for genetic control in Lepidopteran insects. For example, editing of pheromone biosynthesis activating neuropeptide (PBAN) gene disrupts mating in the Fall armyworm, *Spodoptera frugiperda*. Similarly, mating disruption was stronger in females where DES9, key pheromone synthesis gene was mutated and fertility of males impacted when tssk 2, gene related to spermatogenesis was restricted. The same technology was also used for detection and management of invasive pests. Therefore, it greatly facilitates the development of novel genetic control insect strains that can be used in area-wide and species-specific pest control programs.

Keywords: CRISPR/Cas9; genetic population control; genome editing; Mutation; pest management

Review on the role of Small Finance Banks in Financial Inclusion and Rural Development

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Small Finance Banks (SFBs) are a new type of financial services that facilitate access to credit, savings, and other essential financial tools. In India, with a vast rural population and a significant unbanked segment, financial inclusion has been a persistent challenge. This paper delves into the genesis, objectives, and impact of SFBs on financial inclusion and rural development in India. This study employs a descriptive research design to analyze the role of small finance banks (SFBs) in rural and semi-urban India. Secondary data, primarily from the Reserve Bank of India (RBI) and other government sources, have been used to gather information on the number, distribution, and performance of SBBs. The findings show that SFB growth has been instrumental in improving rural credit, particularly in the agricultural sector, where they provide affordable loans in areas often neglected by commercial banks. With continued efforts in financial literacy and community engagement, SFB are poised to play a crucial role in enhancing the livelihoods of rural communities and contributing to India's overall economic development.

Effect of Organic Sources of Nutrients on Nutrient Balance, Performance and yield of Rainfed Cotton in Vertisols under Semiarid Condition

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A field experiment was initiated during 2019-20 and the present study was conducted during kharif season of 2023-2024 at research farm of AICRP for Dryland Agriculture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (Maharashtra), to assess the impact of organic sources of nutrients on crop performance, nutrient balance and yield of rainfed cotton (Gossypium spp.) in Vertisols under semi-arid conditions. The various organic sources of nutrients used were FYM, vermicompost and gliricidia green leaves. The nine treatments consisting of various combinations of organic sources of nutrients along with three replications were evaluated in randomized block design. The results revealed that the significantly higher increase in seed cotton yield and yield components like height of plant, branches plant-1, number of bolls plant-1, length of roots, fresh weight of roots and boll weight were observed with application of 50% N through FYM + 50% N through gliricidia treatment and was at par with application of 50% N through vermicompost + 50% N through gliricidia and recommended dose of fertilizers (RDF), compared to all other treatment combinations. Similarly, the nutrient balance after five years of experiment indicate that there were nutrient gains in almost all the treatments, however, the higher gain of N and K was observed with application of 50% N through FYM + 50% N through gliricidia while higher gain of P was observed with application of 50% N through FYM + 50% N through vermicompost. Hence, it can be concluded that integrated application of 50% N through FYM/ vermicompost + 50% N through gliricidia resulted in improvement in nutrient balance and yield components with higher seed cotton yield in Vertisols under semi -arid rainfed conditions.

Keywords: Organic sources, Seed cotton yield, Growth attributes, Nutrient balance

Integrated nutrient management for sustaining cauliflower productivity

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Cauliflower (*Brassica oleracea var botrytis* L) is a heavy feeder of nutrients and it responds very well to all organic nutrient through Farm Yard Manure (FYM), Vermi-compost along with bioenhancer, and their combinations. Therefore efficient management of Integrated Plant Nutrient supply System (IPNS) is a prerequisite for achieving higher productivity of cauliflower. The experimental materials comprised of two cauliflower hybrid varieties along with five organic treatment and combinations along with control plot. The study was conducted in College of Community Science, Meghalaya, Central Agricultural University. were planted in a randomized block design (RBD) with three replications with spacing of 60 cm X 60 cm and the plot size was 3 m X 2m during rabi 2023-2024 along with application of organic manure such as FYM@25 t/ha, Vermicompost @10t/ha and Bioenhancer@20ml/litre and in combinations. Agro-physiological characters such as plant height (cm), number of leaves per plant, were recorded along with yield and yield attributing traits were estimated. Application of Nitrogen via various organic manure along with bioenhancer and their combinations increased the curd yield, quality depending on soil fertility has increases the quality of produce. Yield was maximum in the treatment combination of T5V1 (16.61 kg/plot) followed by T3V1 (14.87 kg/plot). Judicious combination of organic manures based on soil available nutrients give higher yield as compare to alone.

Keywords: Cauliflower, Organic Manure, Bioenhancer, Yield

To Optimized in vitro Propagation Protocol for Punica granatum cv. Bhagwa

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In this study, we present advancements in the in vitro propagation of Punica granatum cv. Bhagwa, a premium pomegranate cultivar renowned for its high yield and soft seed. The research focuses on refining tissue culture techniques to achieve efficient clonal propagation, which is crucial for both commercial cultivation and genetic conservation. To studies on optimization of a micropropagation protocol from double nodal segment and meristem tip explants testing various combinations of plant growth regulators and media formulations to enhance shoot regeneration and root development. Key variables, including cytokinin and auxin concentrations, as well as culture conditions such as light and temperature, were systematically evaluated. For the establishment of nodal explant various nodes viz. Ist, IInd, IIIrd and IVth nodes were tried, among all IInd and IIIrd nodal segments shows maximum regeneration potential (79%) on the *Murashige* and Skoog (MS) medium 1.8 mg/l BAP and 0.4 mg/l NAA. The meristem tip explants shows maximum shoot regeneration (44.4%) on the *Murashige* and Skoog (MS) medium containing 5 mg/l BAP. For shoot multiplication *Murashige* and Skoog (MS) medium containing BAP 0.2 mg/l and NAA at 0.1 mg/l and addition of adenine sulphate 60 mg/l significantly improved shoot multiplication, 82 % nodal explants initiated multiple shoots and on the other hand 54 % meristem tip explants shows multiple shoots. While rooting was most effective (64%) on a half-strength MS medium supplemented with 1.8mg/l IBA and 0.4mg/l NAA. These optimized conditions yielded high-quality plantlets, which were successfully hardened in the potting mixture containing vermiculite and cocopeat at 1:1 ratio. This work provides a robust framework for the large-scale propagation of Punica granatum cv. Bhagwa, offering valuable insights and practical protocols for nursery production and conservation efforts. Our findings contribute to the efficiency of pomegranate cultivation and underscore the potential for in vitro techniques to support the sustainable development of high-value fruit crops.

Dairy and Climate Change: Sustainability in the Spotlight

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Dairying is the source of food security to around 196.9 million undernourished people in India. As the world grapples with the urgent need to address environmental challenges, the sustainability of dairy production has come under increasing scrutiny. The temperature has been rising over the years and in India it has increased by 0.729°C in 2021 as compared to the baseline climatology corresponding to the period 1951-80. This study explores the complex relationship between dairy farming and climate change, focusing on the industry's environmental impact, the steps being taken to mitigate it, promoting sustainable dairy farming and enhancing resource efficiency. Of the total national emissions, energy contributes maximum proportion of 67.5% followed by farm-gate emissions (23.8%), livestock (12.8%), pre-post production (8.9%), waste (5.5%), crops (4.2%) and land-use change (0.06%) respectively. Around 17.5% of the total bovine population in India producing 230.58 million tonnes of milk, contributes to 9936.4 kilotons (30.9% of the world) of methane and nitrous oxide emissions. The production of raw milk of cattle and buffalo emit 118912.9 and 85560.6 kt of CO2eq with emission intensity of 1.09 and 0.91 kg CO2eq / kg of milk produced respectively under Indian conditions. The total energy use in agriculture has increased by around 3% in last three decades wherein a major proportion is contributed towards fodder production for dairy farming. However, the reduction in emissions has been achieved by only 0.04% in the same period. In order to achieve the net zero emissions by 2070 (India), more effective mitigation strategies need to be implemented and enforced including methane inhibitors like 3-nitrooxypropanol (3-NOP), anaerobic digesters to capture methane from manure and convert it into biogas for energy use, precision agriculture techniques for fodder production, using feed production as a carbon sink, green consumer awareness for selling dairy products, low-carbon fuels like hydrogen and biomass, adoption of electric farm equipment.

Keywords: Climate change, sustainable dairy farming, greenhouse gas emissions, methane reduction and mitigation policies

Conservation agriculture with special reference to vegetables -A step for green credit

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Conservation agriculture (CA) is "a farming system that promotes maintenance of a permanent soil cover, minimum soil disturbance and diversification of plant species". It enhances biodiversity and natural biological processes above and below the ground surface, which contribute to increase water and nutrient use efficiency and for improved and sustained crop production. Conservation agriculture practices have been shown to have positive impacts on vegetable production. The integration of conservation agriculture with IPM practices has been particularly effective in increasing yields and improving B:C ratio. Overall, conservation agriculture offers a sustainable and resource-efficient approach to vegetable production, benefiting both farmers and the environment. The Green Credit Program is an innovative market based mechanism designed to incentivize voluntary environmental action across diverse sectors by various stakeholders like individuals, communities, private sector, industries and companies. It is designed to foster a sustainable lifestyle and environmental conservation as part of 'LIFE' initiative announced by the Prime Minister in United Nations Climate Change Conference of the Parties- COP26. The Green Credit Program encompasses eight key types of activities aimed at enhancing environmental sustainability such as tree plantation, water management, sustainable agriculture, waste management, air pollution reduction and mangrove conservation and restoration.

Thus, use of several conservation agricultural practices like minimum soil disturbance, cover crop, crop rotation, crop residue mulches, intercropping have shown beneficial effect in improving the yield, returns and soil health. The integration of GCPs further incentivizes the adoption of CA by providing financial support to farmers and businesses engaging in sustainable practices. CA practices go hand in hand with the practices of green credit program which might be beneficial for the farmers in future. However, the conservation agriculture practices suitable for crop and region need to be developed based on the research. Creating awareness among the farmers regarding CA practices through demonstrations, training and other dissemination technologies.

Deciphering the phytoremediation potential of chickpea plants grown under combined presence of salt and polycyclic aromatic hydrocarbons

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Plants are subjected to several abiotic stresses alone as well as in combination. Soil salinity is one the major abiotic stress negatively affecting crop productivity. On the other hand, globalization and industrialization have resulted in release of several pollutants in environment such as polycyclic aromatic hydrocarbons (PAHs) of which anthracene is the model PAH. PAHs are ubiquitous, carcinogenic, mutagenic in nature, hence are pollutants of concern. Being ubiquitous, they are present in saline soils also, hence plants are subjected to dual stress of salt and PAHs. Plants have ability to reclamate polluted area via phytoremediation. Hence the present study aims to unravel the phytoremediaton potential of chickpea plants. A 21 days pot experiment was conducted. Three types of soils were prepared viz. saline soil (60 mM NaCl), anthracene (5mg/L) contaminated soil and salt-anthracene contaminated soil. In the prepared soil, chickpea seeds of genotype GPF2 were grown. After 21 days, metabolic profile of chickpea seedlings grown under different environments was done using Gas chromatography/Mass spectrometry (GC/MS). The results obtained revealed that several different metabolites were produced by chickpea seedlings subjected to salt stress, PAH stress and their combination. However, no traces of anthracene was found in chickpea plants grown under anthracene stress and combination of NaCl and anthracene. Hence, the present study concludes that chickpea plants have the ability to remediate the saline area contaminated with PAHs by accumulating and degrading the pollutant within plants.

Combining Ability and Gene Action Studies for Fruit Yield and its Component Traits in Okra [*Abelmoschus esculentus* (L.) Moench]

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CITAAS/AB/2024/056

Okra commonly known as Lady's finger is queen of vegetables. The study focuses on assessing the combining ability in okra (*Abelmoschus esculentus* L.) across 12 traits, encompassing characteristics like earliness and fruit yield. The choice of parents for hybridization plays a critical role in breeders efforts to enhance complex quantitative traits such as fruit yield and its components, necessitating thorough genetic evaluations of existing germplasm and newly developed lines. Criteria for parental selection hinge on the magnitude and nature of gene actions, aiming to breed recombinants with desirable traits post-hybridization.

In the study, 26 F1 hybrids were developed from 12 genotypes of okra, involving 7 lines and 5 testers. Evaluation occurred in a randomized block design with 3 replications during Kharif 2021. Twelve quantitative traits were analyzed from five randomly selected plants of each parent and F1 generation. Analysis included ANOVA for Line x Tester interaction and assessment of combining ability following Kempthorne suggestions in 1957. The effects of General combining ability (GCA) and specific combining ability were estimated (SCA).

Non-additive gene activity prevailed in the study, with specific parents showing strong general combining abilities. Certain hybrid combinations displayed promising effects on fruit yield per plant, warranting further investigation. The analysis highlighted the significance of both additive and dominant genetic components in fruit yield, with dominance variance notably influencing certain traits. Overdominance and gene symmetry were observed, alongside a predominance of dominant alleles. High narrow-sense heritability was noted for most traits studied

MOONG BEAN AS GREEN MANURING AND RESIDUE INCORPORATION INFLUENCES YIELD AND ECONOMICS OF WHEAT (*TRITICUM AESTIVUM* L.) UNDER RICE WHEAT CROPPING SYSTEM

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It has been found that the loss of N was less in those treatments where green manuring along with incorporation of residues (T1, T2, T3 and T4). These might be due to improved nutrient balance of the soil as a result of residues incorporation and green manuring and improved soil physical properties due to residue incorporation and green manuring. The return of rice and wheat residues could recycle up to 20%-30% of the N absorbed by the crops. The treatments with crop residues incorporation (rice or wheat residue or both) + green manuring (T1 to T4) or crop residues (rice or wheat residue or both) (T5 to T8) or green manuring (T1) proved highly efficient in respect of economic return, B: C ratio and total energy output when compared with control (T1), however, Incorporation of residue was the best in terms of improved soil health, increased wheat yield, monetary return and B: C ratio. It may be concluded that incorporation of rice and wheat residues in combination with green manuring increased the grain yield, straw yield, biological yield and harvest index.

Keywords: green manure, wheat, incorporation, organic manure and residues.

Optimising Hydroponic Technique for the cultivation of *catharanthus roseus* (L.) G. Don. and Pogostemon cablin (Blanco) Benth. for Enhanced Production

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CITAAS/AB/2024/058

Interest in the cultivation of medicinal plants has increased tremendously in the last decade. Medicinal plants are specifically used for their contents of bioactive compounds, which are the products of plant secondary metabolism with proven beneficial effects on human health. Recently, The cultivation of medicinal plants through hydroponic techniques has gained significant attention due to its potential to optimize growth conditions and enhance production yields. Hydroponic cultivation of medicinal plants may provide sustainable access, with research demonstrating increased secondary metabolite content in some species compared to both wild and soil-grown plants. This research aims to explore and optimize hydroponic methodologies for the cultivation of medicinal (*Catharanthus roseus*) and aromatic (*Pogostemon cablin*) plants, focusing on improving overall plant health, bioactive compound content, and ultimately, the efficacy of the harvested plant materials. The study involves the systematic investigation of key hydroponic parameters, such as nutrient solution composition, pH levels, and environmental factors, to identify the optimal conditions for the targeted species and also to assess the impact of hydroponic optimization on the quality and quantity of bioactive compounds in the harvested plants. This study also presents a comprehensive comparison between hydroponic cultivation and conventional soil-based cultivation methods to produce given plant species. By elucidating the relationships between hydroponic variables and species productivity, this study aims to provide perception for the development of sustainable and efficient hydroponic systems, tailored to the specific needs of the plants cultivation. Additionally, economic and environmental considerations, such as operational costs are examined to provide a holistic perspective on the sustainability of both cultivation systems. The findings of this research will contribute valuable insights into the potential benefits and challenges associated with each cultivation method, aiding growers, researchers, and stakeholders in making informed decisions regarding the optimal approach for cultivating these plant species. This comparative analysis aims to bridge the knowledge gap in the field, facilitating advancements in cultivation practices for the pharmaceutical and herbal medicine industries.

Keywords: Catharanthus roseus, Pogostmon cablin, Bioactive compounds, Hydroponics.

AI Powered Horizons Shaping the Future Directions of Neuroscience

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CITAAS/AB/2024/059

The use of artificial intelligence (AI) technologies into neuroscience has triggered a paradigm change, changing the research, diagnosis, and treatment landscape for neurological illnesses. This chapter investigates AI's transformative impact on neuroscience, describing how machine learning algorithms, deep neural networks, and computational models are changing our understanding of the brain and its functions. AI allows for the extraction of relevant insights from complicated neurobiological data, aiding the development of novel biomarkers, disease causes, and treatment targets. Moreover, brain-computer interfaces, personalized medicine, and neuroimaging are all experiencing rapid innovation thanks to AI-driven methods, opening the door to more accurate diagnosis and customized treatments. The main uses of AI in neuroscience are explained in this chapter; these include predicting cognitive states, understanding brain connectivity, and optimizing treatment regimens. Additionally, it examines the moral ramifications, difficulties, and potential paths of AI-powered neuroscientific research, highlighting the necessity of interdisciplinary cooperation and conscientious AI application to realize AI's full promise in deciphering the workings of the brain and improving human welfare.

Keywords-Artificial Intelligence (AI), Neuroscience, Machine Learning, Brain-Computer Interfaces, Personalized Medicine, Neural Circuits, Brain Connectivity, Cognitive States.

Diversity of Honey bee forage resources in different land use pattern of Sirsi region in Central Western Ghats of Karnataka.

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CITAAS/AB/2024/060

Investigation conducted on bee flora and developed the floral calendar of honey bees across four land use patterns in the Sirsi region of Central Western Ghats, Karnataka, namely, Arecanut cropping, Bettaland, Homegarden, and Miyawaki forest. Total of 160 plants were identified as bee resource plant species, with each land use pattern hosting 40, 32, 43 and 45 species respectvely. Plant families Fabaceae, Astaraceae, Myrtaceae, Acanthaceae, Lamiaceae, Rubiaceae and Anacardeaceae provided significant bee forage resources. The maximum number of bee forage species bloomed during summer, followed by winter and monsoon. The floral abundance was more during the months of February, March and April. The highest similarity was between Miyawaki forest and Bettaland. Each pattern had unique plants and five species were common among all land use patterns. Nectar-yielding plants were dominant across all patterns, followed by both nectar and pollen yielding plants. Homegarden and Arecanut plantation had the most floral abundance. Seventeen species bloomed year-round. These plants provide a steady supply of nectar and pollen, offering a reliable source of sustenance for bees. Among the four land use patterns, bee colony of Homegarden was more resourceful due to presence of diverse range of bee forage resources. It emphasizes the importance of promoting diverse ecosystems and maintaining plant populations to support the bee populations and ensures effective pollination services. Comprehensive bee floral calendar with 101 species was developed, showing a peak from January to May and reduced availability from June to September. Major honey flow marked by 57 species, minor with 22, and during dearth period with 25 forage species.

Key words: Honey bee, Bee resources, Miyawaki forest, Home garden, Arecanut garden, Betta land, Nectar, Pollen

Effect of Pre-sowing Treatments on Seed Germination of Walnut (Juglans regia)

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CITAAS/AB/2024/061

Walnut (*Juglans regia*) is a temperate nut crop and it belongs to Juglandaceae family. Its common name is akhrot. Walnuts are rich in proteins, fats and minerals which is a good source of energy. It contains all forms of Vitamin B and it is majorly rich in Vitamin B-6 as compare to other nuts such as Almonds, Brazil nut, Chestnut, Filbert and Pecan nut. In walnut poor germination is a limiting factor for large scale production and cultivation under cold arid conditions. The poor seed germination in walnuts has been correlated with physiological dormancy. Different plant growth regulators have been tried to improve the seed germination of many fruit species with good success. The present investigation was carried out at College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar (Uttarakhand). The experiment was layed out with 10 treatments i.e. T1- Control, T2- GA3 100 ppm, T3- GA3 150 ppm, T4- GA3 200 ppm, T5 - Thiourea 1000 ppm, T6- Thiourea 1500 ppm, T7- Thiourea 2000 ppm, T8- Kinetin 100 ppm, T9- Kinetin 150 ppm, T10- Kinetin 200 ppm in Randomized Complete Block Design with 3 replications. The results obtained from present experiment revealed that among all the treatments seeds treated with T4 (GA3 200 ppm) shows minimum days taken for initial germination (91.667%) and maximum germination rate (0.166 per day), germination per cent (66.523%), survival per cent (72.417%), shoot length (9.620 cm), shoot diameter (7.633mm), number of leaves per seedling (21.667), leaf area (85.033cm2), shoot fresh weight (36.207g), shoot dry weight (19.563g), root length (24.510cm), root diameter (5.960mm), root fresh weight (103.660g), root dry weight (56.680g), total fresh weight of seedling (111.923g) and total dry weight of seedling (52.947g). While, the maximum days taken for seed germination and minimum seed germination per cent and seedling growth was recorded in T1 (control). Thus, GA3 200 ppm was found highly effective for the improvement of walnut seed germination and seedling growth.

Desalination of ocean water techniques

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CITAAS/AB/2024/062

Demand of water is increasing day by day due to increase in population, urbanization and industrialization. To meet global demand of water desalination techniques are being used. About 61% seawater desalination and 30% brackish water desalination is done. Approximately half of the world's desalination is done by membrane desalination, mostly reverse osmosis desalination is done. Second most used method is thermal desalination, which uses multi-stage flash distillation and multi effect distillation. The review paper gives information on desalination technologies. Excess salts are removed from ocean water or brackish water converted to potable or usable water. Desalination methods are mainly of two types thermal processes and membrane processes. Thermal processes are multistage distillation, multiple effect distillation, vapour compression evaporation solar water desalination. various categories of membrane processes like reverse osmosis, electro dialysis and membrane distillation methods are mentioned.

Keywords: Population, desalination, sea water, potable water, desalination techniques.

Effectiveness of Extension Strategies for Disseminating Knowledge to Rural Women on Potability of Water

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CITAAS/AB/2024/063

The study was conducted to assess the effectiveness of extension strategies for disseminating knowledge on potability of water. A total of 200 respondents were selected from eight villages of Ludhiana district by snow-ball sampling technique. One control group and three experimental groups were formulated for the study. Three practices i.e. procurement of drinking water, quality testing of drinking water and their purification methods were studied under potability of water. Three extension strategies were developed and implemented as intervention. These strategies were, use of lecture, demonstration and discussion (Strategy I), use of WhatsApp video messages (Strategy II), and use of lecture, discussion and WhatsApp video messages (Strategy III). Knowledge of the respondents was assessed through a self-structured knowledge test. Every individual respondent was personally interviewed twice during study period i.e. before intervention and after a gap of three months from intervention. The results of the study showed that before intervention, 98 per cent respondents from experimental group had a low level of knowledge however 82.7 per cent respondents shifted to high level of knowledge category after implementing strategies. All three extension strategies significantly changed the knowledge of respondents on potability of water. While strategy I and strategy III were equally and the most effective. Thus, it is suggested that personal contact methods solely or in combination with ICT-based methods should be used for creating awareness and imparting knowledge to the people on different topics of concern.

Keywords: Effectiveness, Extension strategies, Knowledge level, Potability of water

Analyzing the effect of germination on nutritional characteristics of kodo millet flour and its role in rusk development

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Millets, the underutilized groups of cereal grains are considered as rich source of energy, carbohydrate and protein. Due to the presence of vitamins, minerals, essential fatty acids, phytochemicals and antioxidants that can help to eradicate several nutritional deficiency diseases, they are now termed as 'nutri-cereals' They contain appreciable quantities of phytochemicals such as phenolic acids, flavonoids, catechins, phytic acid and phytosterols. Owing to their important contribution in food security and potential health benefits, millet grains are now main topic of research for food scientists. This study thus aimed to develop kodo millet flour (KMF) via varying germination time (0h, 24h, 48h, and 72h) of kodo millet and preparing a bakery product (rusk) using the optimized KMF at varying concentrations of 0, 20, 30 and 50%. The germinated KMF were subjected to physiological studies, namely germination loss and germination efficiency. Proximate analysis (moisture, ash, protein, fat, fibre, carbohydrate and energy) and color characteristics of KMF and the baked product (rusk) were also performed. A significant change ($p \leq 0.05$) was observed in all the analyses thus helping in determining the effect of different germination periods on various properties of dehusked kodo millet (*Paspalum scrobiculatum*) of variety, Kherapa, and further optimize a particular germination time for better quality flour which would be used to form rusk. The results of this study thus suggested that germination of kodo millet could be effectively used to prepare kodo millet flour and further use it to prepare various baked products having good consumer acceptability.

Keywords: Millet, Germination loss, Germination efficiency, Kodo millet, Rusk

Study of heavy metal contamination in soils across various land use systems in the Terai region of West Bengal

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The Terai agro-climatic region of West Bengal is characterized by diverse land covers, including extensive croplands, scattered forests (with several national parks and sanctuaries), and tea gardens. Despite the presence of towns, cities, and rural areas, this region lacks significant industrial zones, which has limited research on soil pollution. This study aims to address this gap by assessing heavy metal contamination in soils in a part of the Terai region under different land uses. The Jalpaiguri district of West Bengal, India, was selected for the study, and 200 soil samples were collected from four distinct land uses (50 samples each). Air-dried soils were analysed for bioavailable forms of various heavy metals. Soils from urban and peri-urban areas (UPA) showed significant levels (exceeding critical limits) of bioavailable heavy metals, including Zn ($\bar{x}$ = 1.88 mg kg-1), Cu ($\bar{x}$ = 1.37 mg kg-1), Mn ($\bar{x}$ = 2.25 mg kg-1), Cd ($\bar{x}$ = 0.25 mg kg-1), Fe ($\bar{x}$ = 11.36 mg kg-1), and Cr ($\bar{x}$ = 4.31 mg kg-1). According to the Pi-Nemerow index, UPA soils fell under moderate pollution levels ($\bar{x}$ = 2.58), while the pollution load index ($\bar{x}$ = 1.37) indicated a decline in soil quality in these areas. Despite high spatial variability of heavy metals in UPA soils, the overall trend is concerning as peri-urban crop cultivation (mainly vegetables) which may have also contributed to soil contamination in crop lands, may ultimately accumulate these metals and introduce them into the human food chain.

Keywords: Terai agro-climatic region, Soil pollution, Heavy metal contamination, Human food chain

Impact of Integrated Nutrient Management on the Growth and Yield of Strawberry

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This review explores the significant impact of Integrated Nutrient Management (INM) on the vegetative growth and yield of strawberry cultivation. The study compiles and analyzes various research findings on the application of organic and inorganic fertilizers, biofertilizers, and vermicompost in strawberry cultivation. Results from multiple studies demonstrate that the combined use of organic manures, biofertilizers like *Azotobacter*, and inorganic fertilizers significantly enhances plant height, leaf area, runner production, and overall fruit yield. Specific INM practices, such as the combination of poultry manure with *Azotobacter* and chemical fertilizers, have shown superior results in improving vegetative characters and fruit quality. The review highlights the importance of balanced nutrient supply through integrated approaches, which not only promote sustainable strawberry farming but also improve the economic viability of cultivation by increasing yield and fruit quality. This comprehensive analysis provides valuable insights for researchers and practitioners aiming to optimize strawberry production through sustainable nutrient management practices.

Keywords: Organic Manures, Crop Productivity, Sustainable Farming Practices, Integrated Nutrient Management etc

An Economic Analysis of Direct Seeding Technique of Rice as a Sustainable Agriculture Practice in Sirsa District of Haryana

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Haryana, a significant rice-producing state in India, faces water scarcity, labour shortages, and high production costs. There is an acute need for sustainability in agriculture. The Centre Government and the state Government of Haryana are more worried about sustainability in agriculture. Direct seeding of rice (DSR) is emerging as a sustainable agricultural practice that addresses these issues. The Government of Haryana provides financial help of rupees 4000 per acre to promote the Direct seeding of rice. This paper analyses the economic implications of adopting DSR in Haryana, considering cost savings, yield outcomes, labour dynamics, long-term financial sustainability, barriers to the adoption of DSR, and the effectiveness of financial incentives on DSR. It is concluded that Direct seeding of rice offers substantial economic benefits for farmers in Haryana by reducing production costs, enhancing labour efficiency, water savings of 30-40%, and improving profitability. The results of high weed infestation show that it is the most significant barrier in the DSR method. The study recommends that the Government focus on timely credit of subsidies and incentives in the account of farmers, provide technical support to the farmers, promote research to develop new varieties of rice it for DSR, and farmers should be trained for weed control.

Keywords: Direct seeding of rice, Traditional transplanting methods, sustainability, Financial Incentive.

Trend and Decomposition Analysis of Millets Production in Maharashtra

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Millets are ancient supergrains that serve as nutritional reservoirs for good health. Millets, including pearl millet, finger millet, and tiny millets, are crucial food and fodder crops in semi-arid regions and are becoming increasingly significant globally. Of the nearly one million plant parts that occupy our plants, approximately 30 are required to supply the demands for food, fodder, and fuel. Nonetheless, many plant species remain underutilized or unexplored. Maharashtra is one of millets-producing states in both production and area. From 1960-61 to 2023-24, an examination was undertaken into the state's millet growth performance, instability, and decomposition. Compound growth rates were computed for this purpose by fitting the exponential function, and the coefficient of variation was used to determine instability. According to the instability analysis, millet area was more stable than production and yield. During this time, there was also a significant level of instability, indicating that millets production gradually rose. The decomposition study revealed that yield was one of the most important components in the total development of millet production, followed by the interaction impact. Millets acreage, yield, and output in Maharashtra have improved as a result of better climatic conditions and improved farming practices. As a result, the report recommends that policies be developed to reduce risk in millets production through appropriate technology transfer and extension services. It also states that the strong growth rate of recent years should be sustained by making millets production profitable.

Keywords: Coefficient of variance, Decomposition Analysis, Growth rates, Instability, Millets Production.

GENETIC STUDIES IN F3 POPULATION OF LATHYRUS

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240 progenies along with checks and the parents involved in the crosses (Ratan, Prateek, NLK-06, NLK-12, NLK-40, NLK-48, NLK-73, LL-14-2 and LL-14-5) were evaluated in two replications in progeny rows and the observations on seven traits i.e. days to flowering, days to maturity, plant height, number of branches plant-1, number of pod plant-1, 100 seed weight and seed yield plant-1 were recorded. To estimate genetic parameters between family and within family variances, and to identify superior progenies for forwarding to next generation on the basis of yield and yield contributing characters at experimental farm of Agricultural Botany Section, College of Agriculture Nagpur during rabi 2018 in F3 generation. Analysis of variance indicated that the mean square due to between family were highly significant for all traits, which revealed the presence of significance genetic variability between the families. Intra class correlation (t) lead to the conclusion that differences between individual within family is large and each family differentiated distinctly from the other one at lower level in F3 generation hence, equal weightage to σ2f and σ2w were suggested to be considered for selection in F3 generation. When all the genetic parameters for seven characters where considered, it was found that plant height, number of branches and 100 seed weight exhibited high genotypic coefficient of variation, high heritability along with high genetic advance as percentage of mean. Similarly other characters days to flowering, days to maturity, plant height and number of pod plant-1 exhibited high GCV, moderate heritability and high genetic advance as percentage of mean. This indicated that all these seven characters where influenced by additive gene action operating in the expression of these traits in F3 generation and hence helps as a criteria for making selection. 639 individual plants from 180 families out of 240 families from 10 crosses studied were identified for raising in progeny rows for one more generation so that homozygosity will be attained and superior progenies can be then selected for forwarding to yield traits in the next generation.

Keywords: Lathyrus, Lathyrus sativus, F3Generation, Additive gene action, Progenies, Segregation.

Effect of Non-genetic Factors on Lifetime Milk Production and Productive Life of Murrah Buffaloes

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The success of a dairy industry in India is much dependent on buffaloes and the level of lifetime performance traits. These performance traits depend on several genetic and non-genetic factors which introduce biasness in the estimation of genetic value of performance traits. In the absence of accurate phenotypic value of milk production traits, it becomes difficult to estimate genetic parameters of the traits which determine the optimum selection criterion for planned improvement programme of the animals. Also, genetic evaluation of animals requires the assumption that phenotypic measurements are adjusted for non-genetic factors that can affect production efficiency and reproduction traits (ex. Year/period of calving, season of calving, calving order, age at calving, length of lactation) to obtain accurate estimates of the genetic parameters and the breeding value of animals. This research paper aimed to analyse the effect of various non genetic factors on Lifetime Milk Production (LTMP) and Productive life(PL). The data on performance records of 2959Murrah buffaloes, progeny of 220 sires were collected from the pedigree, breeding and performance records from 1992-2015 maintained at Buffalo Research Centre (BRC), LUVAS, Hisar and Central Institute for Research on Buffaloes, Hisar. The overall least-squares means for PL and LTMP, were 1275.24±31.82, 5586.42±17.96 respectively. Among the different non-genetic factors studied, the farm had significant effect on LTMP. The period of calving had highly significant effect on PL and LTMP both. The PL and LTMP showed an decreasing trend across the periods. Effect of season of calving was non-significant on both longevity traits. Regression of age at first calving (linear) had non-significant effect on both traits. Effect of various non genetic factors help us to provide a deep role of management strategies in improvement of lifetime performance traits in dairy animals and it may also lead to a better progressive strategy for increasing most probable producing ability also of the Murrah buffaloes.

Double Haploids in Maize: Accelerating Genetic Advances through Haploid Induction

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CITAAS/AB/2024/071

Double haploid (DH) technology is an efficient approach for the development of 100% homozygous inbred lines in just two generations, it increases the breeding efficiency and genetic gain in maize crops. It is an emerging technique in developing countries such as India, whereas, it has become an integral part of many commercial maize breeding programs in developed countries such as Mexico. This technique offers economic, logistical, and genetic benefits over the traditional method of inbred line development. This review comprehensively explains the pathway for invivo induction of maternal haploids with a brief introduction about other methods of haploid induction being used in maize breeding, factors affecting, challenges, and future perspectives for DH technology. Furthermore, it discusses the integration of DH technology with modern breeding tools like genomic selection and CRISPR/Cas9 enhancing the precision and accelerating the development of superior maize cultivars. Automation holds great promise to further reduce the cost and time in haploid identification. The major challenge faced during invivo haploid induction is low haploid induction rate of inducer lines and difficulty in identifying haploid kernels while contributions made have increased the HIR by manipulating the stock -6 to produce lines with high HIR and advanced screening method such as cytometry, fluroscence microscopy, SNPs have been developed for accurate haploid detection. Increasing success rates in chromosome doubling protocols and/or reducing environmental and human toxicity of chromosome doubling protocols, research on genetic improvement in spontaneous chromosome doubling, the potential to greatly reduce the production costs per DH line.

Keywords: Maize. double haploid, maternal haploids, hap loid induction rate, colchicine, Cen H3, ig gene and stock-6

Investigations on the sporulation and growth of Stagnosporopsis cucurbitacearum on various solid media

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The in vitro sporulation of Stagnosporopsis cucurbitacearum is of great importance for studies that require pure inoculum and in large quantities. In order to determine the ideal conditions for S. cucurbitacearum sporulation, this study combined various light spectra (UV-A or UV-B light, white light, and continuous dark) with distinct culture media. It also assessed the fungus ability to survive over time when stored at -20°C.The pathogen was inoculated on different solid media with three replications. The inoculated plates were incubated at room temperature for seven days and the colony diameter of each of the treatment was taken and the data thus obtained was statistically analysed. Among the eleven different solid media evaluated after seven days, the mean colony diameter of S. cucurbitacearum was maximum in carrot agar (64.6 mm) followed by malt extract agar (63.5mm). The least growth was recorded on rose bengal agar (19.6m). Mycelium colour of fungus varied from white to light grey. The storage duration at -20°C did not affect mycelial growth or mycelial growth rate. The best sporulation of the fungus was recorded on V8 juice agar media. While mycelium of S. cucurbitacearum is not sporulated in other media.

Keywords: culture media, gummy stem blight, sporulation, UV light.

Integrated Approaches to Manage Sclerotinia Rot in Mustard

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CITAAS/AB/2024/73

Sclerotinia rot, also known as white mold, is a major fungal disease affecting mustard (Brassica spp.) crops, caused by the pathogen *Sclerotinia sclerotiorum*. This disease leads to significant yield losses and quality degradation in mustard due to its extensive host range and the resilience of its sclerotia, which can persist in the soil for several years. The pathogen infects the plant during various growth stages, particularly at flowering, when ascospores land on senescing petals and subsequently colonize the stem, leaves, and pods. The disease manifests through initial symptoms such as water-soaked lesions on stems, leaves, and pods, which later develop into cottony white mycelial growth. As the infection progresses, black sclerotia form within the stem, on the surface of the lesions, and inside the infected tissues, serving as a primary inoculum source for future infections. Environmental conditions such as high humidity, moderate temperatures, and dense crop canopies favor disease development and spread. Managing *Sclerotinia* rot in mustard involves an integrated approach due to the complexity of its life cycle and environmental interactions. Key strategies include crop rotation with non-host crops to reduce soil sclerotia levels, timely application of fungicides during critical growth stages, and the use of resistant or tolerant mustard varieties. Biological control methods, such as the use of antagonistic fungi (e.g., *Coniothyrium minitans*), and cultural practices like improving air circulation within the crop canopy through proper spacing and irrigation management, are also effective in mitigating disease impact. Research continues to focus on understanding the pathogen's biology, developing advanced diagnostic tools for early detection, and breeding mustard varieties with enhanced resistance to *Sclerotinia* rot. Sustainable management practices and collaborative efforts among researchers, farmers, and agricultural extension services are essential to reducing the incidence and severity of this disease, ensuring stable mustard production and food security.

Keywords: *Sclerotinia sclerotiorum*, mustard, sclerotia, antagonistic fungi

Bacillus Metabolites: Innovations in Biocontrol and Sustainable Plant Protection

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Plant pathogenic fungi pose a serious threat to crop production and food security in global agriculture. While chemical fungicides are commonly used for disease management, they can negatively impact non-target organisms, the environment, and human health. As a result, there is growing interest in utilizing microbial species like Bacillus for biocontrol.

Numerous Bacillus species are commonly found in the rhizosphere and soil, where they engage in mutualistic interactions with plants and support their development. Many Bacillus strains have been identified as effective biocontrol agents against various plant diseases, including fungal infections. Their ability to colonize plant roots and produce antimicrobial compounds makes them important allies in managing plant diseases.

Bacillus species are renowned for synthesizing a diverse array of secondary metabolites with antimicrobial properties. These include, lipopeptides as surfactin which breaks down fungal cell membranes, causing internal cell leakage and cell death. Iturin, and fengycin disrupts fungal growth and development by inhibiting cell wall formation, cyclic dipeptides as bacillomycin D breaks fungal cell membranes and induces programmed cell death. Polyketides including difficidin and macrolactin and other bioactive molecules which trigger defense responses in plants, enhancing their resistance against fungal diseases.

In case studies the bacillomycin L and surfactin produced from Bacillus subtilis 916 helped in biocontrol of rice sheath blight induced by Rhizoctonia solani. Crude lipopeptides from culture of Bacillus subtilis strain ET-1 worked against Podosphaera xanthii on Cucumis melo. Control of Fusarium wilt of strawberry done by Bacillus velezensis BS87 and RK1 formulation.

These findings reinforce the potential of Bacillus species as effective, eco-friendly alternatives to chemical fungicides, offering sustainable solutions for managing plant diseases and promoting crop health.

Keywords: Plant diseases, Bacillus spp., Secondary metabolites, Pathogenic fungi, Bio-control.

Occupational stress and coping Strategies among computer operators in software industry

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Stress is a part of modern life, with increasing complexity of life, stress is likely to increase. Stress I built in the concept of role, which is conceived as the position a person occupies in a system. Keeping this in view a study was conducted to know the Occupational stress and coping level among computer operators in software industry of Hubballi and Bangalore city, Karnataka, India. A survey was conducted by pre structured interview method from 60 computer operators in two cities of Karnataka state and information regarding health effects, occupational stress, and background information of the work area was collected. The results revealed that on the whole about 51 per cent of the computer operators were belonged to age group of 25-29 years. About 61 per cent of them had completed their degree. More than 60 per cent of respondents were doing data analysis and mail. About36 per cent of them had obesity. More than 50 per cent of the employees had high level of stress and about 70 per cent of them had moderate level of coping mechanism.

Keywords: Stress, occupation, software industry, coping, computer operator, health status

Field efficacy of insecticides for management of fall armyworm

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CITAAS/AB/2024/76

Abstract The field experiment was conducted at Zonal Agricultural and Horticultural Research station, Hiriyur, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka during Kharif season for four consecutive years from 2019 to 2022 for the management of maize fall armyworm through Natural, Eco-friendly and chemical insecticides in maize. The treatments were organic pesticides Brahamstra @ 200lit/acre, Azadirachtin 10000ppm @2ml/lit and chemical pesticides viz., Emamectin benzoate 5 SG @ 0.6g/lit and 0.4g/lit were imposed at different dosages. At third days after application, pooled data revealed that *Emamectin* benzoate 5 SG @ 0.4 g/lit and 0.6 g/lit were recorded that 22.88 and 26.03 per cent leaf damage respectively. Whereas, *Azadirachtin* 10000ppm @2ml/lit was next best pesticides with 28.81 per cent leaf damage followed by Brahamstra @ 200 lit/acre with 30.55 per cent leaf damage. Similar trend observed at seven and ten days after application of first spray. In second spray also, pooled data revealed that, *Emamectin* benzoate 5 SG @ 0.4 g/lit and 0.6 g/lit were recorded 14.19 and 15.55 per cent leaf damage respectively. Whereas, *Azadirachtin* 10000ppm @2ml/lit was next best pesticides in reducing fall armyworm with 20.88 per cent leaf damage, followed by Brahamstra @ 200 lit/acre which is about 23.63. Similar trend observed at seven and ten days after application. Therefore, *Emamectin* benzoate 5 SG @ 0.4 g/lit and 0.6 g/lit were found to be effective against fall armyworm per cent leaf damage. Thus the use of Emamectin benzoate 5 SG may include individually or incorporated in an integrated pest management for the control of fall armyworm whereas, organic pesticides viz., *Brahamstra* and *azadirachtin* can be prepared by using locally available inputs may help to get rid from pest dama0ge and also, protect us from the hilarious side effects of chemical methods. In turn Plant protection cost also reduced.

Key words: Organic, pesticides, chemical, Brahamstra, azadirachtin, fall armyworm

Impact of various levels of nitrogen on quantitative and qualitative parameters of rose var. “top secret” under poly house condition

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This study aimed to identify the impact of different levels of nitrogen on rose cv. Top secret under poly house condition. Various levels (100, 150, 200, 250, 300 mg/plant/week) of nitrogen on growth parameters in terms of qualitative and quantitative traits of rose var. Top Secret. Plant growth in general increased with increase in nitrogen levels. The experiment was laid out in a Completely Randomized Design (Factorial) concept. Among various levels of nitrogen application, 300 mg nitrogen per plant per week significantly increased all vegetative growth parameters and showed maximum plant height (117.45 cm), leaf area (98.91 cm2) and a number of leaves (62.50). Further, flowering parameters like stalk length (83.53cm), bud diameter (2.45cm), bud length (2.55 cm), number of flowers per plant (7.30) as well as per square meter (53.05) were also significantly maximum in plants given nitrogen @ 300 mg per plant per week. Leaf N (2.94 %), P (0.19%), K (1.87%) and chlorophyll content in leaves (4.41 mg/g) was also higher with 300 mg N per plant per week. Vase life (10 days) and anthocyanin content in petal tissue (2.09 mg/g) were found the maximum in plants given nitrogen @ 250 mg per plant per week, which was at pa r with the treatment of nitrogen @ 300 mg per plant per week. Nitrogen should be applied at the rate of 300 mg/plant/week under protected cultivation as the optimum dose for good plant growth and qualitative flower production in rose var. Top Secret under protected cultivation.

Production and Characterization of Carrageenan-Encapsulated Spray-Dried Protein Hydrolysates from Freshwater Snail (Bellamya bengalensis)

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The objective of this study was to produce encapsulated protein hydrolysates from the freshwater snail *Bellamya bengalensis*. Protein hydrolysates were prepared from the soft tissue of *Bellamya bengalensis* through enzymatic hydrolysis using bromelain, achieving a degree of hydrolysis of 47.96%. The hydrolysates were encapsulated using carrageenan as the wall material at varying concentrations [1%, 3%, and 5% (v/w)]. The resulting capsules were evaluated using Fourier Transform Infrared, particle size analysis, polydispersity index, encapsulation efficacy, zeta potential, surface morphology, thermal properties, color parameters, hydrophobicity, and antioxidant activity. With increasing concentrations of carrageenan, the encapsulated powders exhibited improved yields, encapsulation efficacy, total sugar content, and whiteness, while solubility and antioxidant activity decreased. The yields of hydrolysates were 8.24% at 1%, 10.68% at 3%, and 12.72% at 5% encapsulation. The average particle sizes of the capsules were 127.09 nm at 1%, 187.35 nm at 3%, and 206.9 nm at 5% encapsulation, with corresponding polydispersity indices of 0.23, 0.24, and 0.26, respectively. Zeta potential values were observed at -25.3 mV for 1%, -31.9 mV for 3%, and -33.8 mV for 5% encapsulation. The highest solubility (79.66%) was recorded at 1% encapsulation. Differential Scanning Calorimetry analysis indicated that capsules with 3% carrageenan were more thermally stable, retaining stability up to 70°C. Fourier Transform Infrared spectroscopy analysis suggested effective ionic complexation between carrageenan and hydrolysate peptides.

Keywords: Carrageenan, encapsulation, bromelain, polydispersity, hydrophobicity

Climate Change and simulations Effect of abiotic factors on the seasonal incidence of fruit borer, Helicoverpa armigera (Hubner) on tomato in Palampur valley of Himachal Pradesh

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CITAAS/AB/2024/79

Tomato fruit borer *Helicoverpa armigera* (Lepidoptera: Noctuidae) is one of the most important lepidopteran pests associated with tomato that acts as a limiting factor in harvesting high yields of healthy and quality fruits. The abiotic factors viz., temperature, relative humidity and rainfall are known to have profound influence on the occurrence, population build up and activity of the pest in tomato. Therefore, understanding such relations is critical for implementing effective management strategies against the pest. Thus, a study was conducted in 2022 at Palampur (H.P.), to observe the effect of varying climatic conditions on population buildup of H. armigera. Seasonal incidence studies revealed that the larvae started appearing during 4th week of May (SMW 22). The pest touched the peak with a mean of 4.25 larvae/ plant during 2nd week of June (SMW 24). Weather parameters showed non-significant effect on population buildup of H. armigera. The pest was negatively correlated with relative humidity and min. temperature with r values of -0.229 and -0.017, respectively. Max. temperature and rainfall favoured the pest population, displaying a positive, insignificant correlation, with r values of 0.004 and 0.363, respectively.

Keywords: Tomato, Helicoverpa armigera, seasonal incidence, weather factors, larval population

Sustainable intensification of climate resilient soybean-maize cropping system in humid southern Rajasthan

Hargilas

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The terms ecological intensification (EI) and sustainable intensification (SI) were first coined in the late 1990s (Pretty, 1997 and Cassman et al. 1999). A unifying objective supporting each of these concepts is the need to increase crop yields per unit land, time, and consumable resources used in food production. Whereas EI was originally seen as essential to achieve the dual goals of meeting projected food demand on existing farm land while minimizing negative impacts on environmental quality and conserving natural resources, SI was originally concerned mostly with "regenerative", low input agricultural options as the means to reduce negative impacts of agriculture on ecosystem services. Global trends show that the rapid increase in maize production is associated more with the expansion of maize growing areas than with rapid increases in yield. This is possible through achieving possible higher productivity through maize production practices intensification to meet the sustainable production. Therefore, a field experiment on "Ecological intensification of climate-resilient soybean-maize cropping system" was conducted during consecutive two consecutive years from 2017–2018 to 2018–2019 at Agricultural Research Station, Banswara, Rajasthan, India. Eight treatments of farmer practice, ecological intensification (EI), EI-tillage, EI-nutrient management, EI-plant density, EI-water management, EI-weed management and EI-disease and insect management were applied in soybean-maize cropping during rainy and winter season, respectively. Results revealed that maximum yield of soybean (2367kg/ha), maize (10370kg/ha) and maize equivalent yield (15193kg/ha) in ecological intensification (EI). Whereas minimum yield of soybean (1227kg/ha) was recorded in EI-weed management during rainy season and minimum yield of maize (3815kg/ha) was recorded in EInutrient management during winter season. The minimum maize equipment yield of system (6543kg/ha) was also recorded in EI-nutrient management in winter season. The data pertaining indicated that EI-weed management was found major yield limiting factor for soybean in rainy season, whereas, EI-nutrient management was observed major yield limiting factor for maize in winter season and maize equivalent yield of system was also limited by EI-nutrient management. It can be concluded that the productivity of maize based cropping system may be increased through adoption of ecological intensification practice under humid condition of southern Rajasthan.

Weed control efficiency of different treatments in potato

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The present experiment was carried out at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during winter (Rabi) season of the year 2022-2023 and 2023-2024 in Kufri Bahar cultivar, which was grown with thirteen treatment different combinations of weed control in randomized block design and replicated three times. In comparison to T13, all other weed control treatments had significantly lower weed density for both the years. The lowest density of weeds at harvest was recorded in weed free in both the years. Besides, weed free, the findings showed that among other weed control treatments, the lowest total density of weeds for both years was observed in earthing up of 24.4/m2 and 26.3/m2 , respectively This treatment was statistically at par with Metribuzin 70% WP (0.525 kg ha-1) + rice straw (6 t ha-1) as PE of 27.0/m2 and 29.0/m2 , respectively. The weed control efficiency at harvest for both years was observed maximum in T11 (Earthing up) of 77.1% and 76.4%, respectively among different weed control treatments, followed by T6 as PE {Metribuzin 70% WP (0.525 kg ha-1) + rice straw (6 t ha-1)} of 74.9% and 73.8%, respectively.

Keyword: potato, weed density, weed free, weed control efficiency

Green Solutions for Managing Chickpea Wilt Caused by *Fusarium oxysporum* f. sp*. ciceri* (Padwick) Synder and Hansen.

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Fusarium wilt of chickpea, caused by *Fusarium oxysporum* f. sp. *ciceri* (Padwick) Synder and Hansen, poses a significant threat to global chickpea production, potentially causing up to 70% yield loss under favorable conditions. The pathogen, a facultative saprophyte, is soil-borne and can persist in the soil for up to six years without a host.This research, titled "**Green Solutions for Managing Chickpea Wilt Caused by *Fusarium oxysporum* f. sp. *ciceri* (Padwick) Synder and Hansen.''** "Investigates sustainable management approaches for this pathogen. Chickpea plants exhibiting wilt symptoms were collected and subjected to isolation on Potato Dextrose Agar (PDA). Pathogenicity was verified through the sick soil method in a controlled screen house environment using the susceptible cultivar JG-62.

In vitro assays evaluated the efficacy of various bioagents, essential oils, and phytoextracts. *Trichoderma harzianum* demonstrated the highest mycelial growth inhibition at 60.57%. Among essential oils, neem oil and clove oil exhibited the most significant antifungal activity, with mycelial growth inhibition rates of 94.14% and 94.06% at concentrations of 2500 ppm and 3000 ppm, respectively. Neem leaf extract showed a 94.29% inhibition, whereas garlic and custard apple extracts exhibited lower inhibition at 81.00% and 76.99%, respectively, at 10% and 20% concentrations.

Seven organic amendments were assessed using the sick soil method in pot culture trials. Neem seed cake emerged as the most effective, resulting in the lowest disease mortality (21.45%) and a 69.05% reduction in disease severity. In a comprehensive pot culture experiment, a combined treatment of neem oil, neem leaf extract, and neem seed cake (T_8) proved superior, with the lowest disease incidence (PREM: 17.75% and POEM: 18.75%) and a 72.64% reduction in disease severity compared to controls.

Keywords: Wilt, *Fusarium oxysporum* f. sp. *ciceri, Trichoderma harzianum*, Neem oil, Neem leaves extract, Neem seed cake

EVALUATING THE EFFECTIVENESS OF AGRICULTURAL DRONES IN TAMIL NADU

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CITAAS/AB/2024/83

The Indian UAV (Unmanned Aerial Vehicle) industry, valued at US$ 830 million in FY 2020, is predicted to grow at a CAGR of 14.5% between 2021-2026, with projections from NITI Aayog indicating a potential market expansion to US$ 50 billion over the next 15 years. This study investigates the perceived effectiveness of drone usage in agriculture, focusing on two blocks in Tamil Nadu: Dharapuram (Tiruppur district) and Ottanchathiram (Dindigul district). Using an ex post facto research design, data was collected from a sample of 60 farmers through structured interviews. The findings reveal that the majority of the farmers (77.00 %) find drone operations in agriculture simple, followed by 23 per cent of the farmers perceives them as even easier. In terms of economic impact, 70 per cent of the farmers revealed that agricultural drones help in significant cost savings, while 27 per cent of farmers said average savings in cost of cultivation because of agricultural drones. Most of the farmers (73.00 %) reported that agricultural drones are safety to use and 55 per cent of the farmers said that result of the agricultural drones were observable, followed by 45 percent revealed results are more observable. This study highlights the growing acceptance and potential benefits of drone technology among farmers. These findings suggest that UAV technology holds significant potential for transforming farming operations, enhancing productivity, and driving economic savings. Continued promotion and support for this technology could further its adoption and impact in Indian agriculture.

Keywords: Agricultural drones, UAV, Cost saving, ex post facto.

Molecular analysis of true hybrid progenies in five different crosses of sugarcane involving different cytotypes of S.spontaneum as a female parent

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CITAAS/AB/2024/84

This study assessed the effectiveness of SSR markers in identifying true hybrids among sugarcane progenies from five biparental crosses between Saccharum spontaneum L. female parents with various cytotypes and elite, high-sucrose male clones. Ensuring true hybrids in sugarcane breeding is challenging due to the risk of self-fertilization before crosspollination. Traditional methods like using high pollen sterility clones or emasculation techniques often fail, making post-establishment hybrid identification crucial. SSR markers have revolutionized this process, offering precise, reliable means to distinguish individual clones and their hybrids, surpassing the limitations of morphological and biochemical markers. In this study, seven SSR primers were used to analyse 120 sugarcane progenies from five different crosses. Four of these primers, SMC863CG, SMC477CG, SMC319CG, and SMC248CG, demonstrated reproducible and polymorphic alleles that effectively differentiated between parents and their progenies. By analysing these SSR markers, the study identified 71 true hybrids among the 120 progenies, with an average success rate of 59.17% across all crosses. For the cross "IND 02-1209 × COV 92102," SMC863CG revealed distinct alleles at 382 bp for the male and 600 bp for the female parent, successfully identifying 18 true hybrids out of 23 progenies, reflecting a hybridization success rate of 78.26%. Similarly, the cross "IND 03-1256 × COV 92102," analyzed with SMC477CG, yielded 24 true hybrids from 40 progenies, resulting in a 60.00% success rate. Other crosses demonstrated varying success rates, ranging from 48.15% to 58.33%, culminating in the identification of 71 true hybrids across all crosses with an average success rate of 59.17%. Additionally, evaluations of F1 hybrids based on traits such as Plant Height, Cane Diameter, Single Cane Weight, and Number of Internodes revealed moderate to high variability, suggesting a diverse genetic pool, particularly with Single Cane Weight displaying high variability and skewness. This study highlights the crucial role of SSR markers in accurately identifying true hybrids and maintaining genetic purity in sugarcane breeding. Their use enhances breeding efficiency, improves crop production, and supports the development of sugarcane varieties with desirable traits, surpassing the limitations of traditional identification methods.

Identifying plant growth-promoting rhizobacteria from Kans grass to enhance sustainable agricultural practices

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CITAAS/AB/2024/85

Isolating microbes from the rhizosphere of weeds, typically considered unwanted plants, represents a promising approach to discovering plant growth-promoting rhizobacteria (PGPR) with specialized adaptive traits beneficial to agriculture. In this study, we investigated the rhizosphere of Kans grass (*Saccharum spontaneum*), a weed renowned for its ability to thrive in extreme environments. It is commonly found in harsh regions, including heavy metal-enriched waste dumps, fly ash pond sites, and riverbanks, where it endures multiple abiotic stresses including cold, drought, salinity, and nutrient-deficiencies. By isolating PGPR from the rhizosphere of this resilient species, we aim to characterize and identify microbial strains through 16S rDNA sequencing with potential ecological benefits and applications in sustainable agriculture. Soil samples were obtained from the kans grass's rhizosphere during the vegetative stage and stored for subsequent analysis. Preliminary results demonstrated that, these strains were positive for phosphate solubilization, IAA production, amylase production and significantly enhanced shoot growth in maize. It was indicated by a notable increase in height, observed fourteen days post-germination following treatment with selected PGPR strains. These findings indicated that PGPR isolated from kans grass have the potential to significantly enhance plant growth, particularly in stress-prone environments, highlighting their promising application in sustainable agriculture.

Keywords: Kans grass, plant growth-promoting rhizobacteria, ecological benefits, sustainable agriculture, weeds.

Development of cereal and pulse based diet for geriatric population of Sirsa district of Haryana

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CITAAS/AB/2024/86

The diet of geriatric people should contain nutritious foods, in accordance to their physiological limitations. The diet should meet their food habits, food requirements, food culture, norms and beliefs. A sample of three hundred respondents out of which 150 were from urban and 150 from rural area of Sirsa district, Haryana, aged above 60 years and above was selected randomly. Cereals and pulses are suggested on the bases of data collected from respondents through valid interview schedule on their food frequency and food choices. Products containing suitable amount of macronutrients from cereals and pulses were developed. Deficiency of nutrients among the elderly was criteria for the development of food products. Cereals (rice and wheat), millets (barley, pearl millet and maize), pulses (Bengal gram, green gram and lentil), Vegetables (carrot, peas and fenugreek leaves), oilseeds (sesame seeds) and fat (*desi ghee*) were used for the formulations of food products. Eight products i. e. *chappati, cheela, dalia kasaar, kheer, khichari, laapsi, parantha* and porriadge were developed using different proportions of cereals and pulses. All the developed products were analysed for their organoleptic acceptability using nine point Hedonic scale by ten semi trained panelist from CCS HAU, Hisar and ten respondents from Sirsa district. Results from the sensory evaluation revealed that variant I (cereals + pulses) and variant II (cereals + pulses + vegetables) of *chappati, dalia, kasaar, khichari, laapsi* and porriadge were more acceptable as compared to the control of their respective.

Keywords – Cereals, geriatric, Hedonic scale, organoleptic and pulses,

Supplementation Effect of Zinc with Varietal Different Cereal Based Diet on Growth Performance and Nutrient Utilization of Rhode Island Red Chicks

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Poultry sector with new advancement tool like nanotechnology is demonstrating huge growth in agriculture sector globally. The present study was conducted to assess the effect of zinc supplementation with different cereal based diet on growth performance and nutrient utilization in Rhode Island Red (RIR) chicks. The total 270-day old RIR chicks were selected and randomly divided in nine treatment groups, having three replicates of 10 birds each. The given treatment groups were: T1- standard diet, T2- T1+Nano zinc @30 ppm, T3- T1+inorganic zinc @30 ppm, T4- Standard diet + incorporation of black wheat (10 kg/100 kg of feed), T5- T4+ Nano zinc @30 ppm, T6- T4+ inorganic zinc @30 ppm, T7- standard diet + incorporation of wheat cultivar (10 kg/100 kg of feed), T8- T7+ Nano zinc @30 ppm and T9- T7+ inorganic zinc @30 ppm. The weekly data was recorded for growth performance. The nutrient utilization was evaluated by conducting metabolic trial as per procedure. The overall growth performance revealed that feed intake, feed conversion ratio and performance index showed significant difference ($P \leq 0.05$) in T1, T2 and T3 groups with unaffected weight gain on nano Zn and inorganic Zn supplementation. The nutrient utilization in terms of dry matter (DM) and crude protein (CP) was observed significantly highest ($P \leq 0.05$) in T5 group. It was concluded that incorporation of nano zinc and black wheat may be used to improve growth performance of RIR chicks.

Keyword: Black wheat, Growth performance, Nano zinc, Nutrient utilization, Rhode Island Red

Characterization of antimicrobial properties of bamboo (adjuncted) extract and its application to medical textile fabric.

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CITAAS/AB/2024/88

Nature has embraced a tremendous treasure of eminent values that unarguable, have proven to be indispensable to the development, growth and productivity of human race.Since the origin, humans have been on a burgeoning expedition to apprehend and unlock the meritorious qualities of bio sources, and have succeeded markedly in this feat. Then anti-microbial attribute is one such outstanding characteristic that has been subjected to intense research. The continual efforts to explore, harness and employ antimicrobial properties from bio sources have proven to be profusly useful in the domain of medical science, hygiene industries, and protective clothing to name a few. This work attempts to characterise the antimicrobial properties of three BioSource's namely *Bambusa arundinacea* (Bamboo), Terminalia arjuna (Arjuna). Concisely, the extract of Bamboo leaves was characterized for the antimicrobial activity against E. coli (gram negative) and Staphylococcus aureus (gram positive) bacteria in pure form as well as in adjunction with Arjuna bark and Ratanjot root extract in varying proportions, using well diffusion assay. Further, the Bamboo leaves extract adjuncted with Arjuna bark in a proportion of 90:10 found to exhibit superior antimicrobial properties and therefore, this extract was then used to treat cotton fabric, a putative fabric used in developing medical textile products, and the treated cotton fabric also shown to exhibit noticeable antimicrobial activity against both E. coli and S. aureus bacteria. Intrigued by these results, we further aim to harness the antimicrobial properties from aforementioned bio sources to develop medical textile products (like gloves, apron, masks etc.) with cotton fabric. This piece of research is expected to opens avenues for future investigation into the application to antimicrobial properties of bio-sources to grow microbial resistant/preventative products for medical textiles, not to mention other domains that demands similar products.

Keywords: anti-microbial properties, biosources, medical textile, bacteria

EFFECTIVENESS OF EDUCATIONAL INTERVENTION FOR IMPROVING HYGIENE MANAGEMENT PRACTICES AMONG RURAL WOMEN

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Women are the backbone of the family, there is an enormous need to educate women about maintaining their hygiene. Women are viewed as the family's positive change agents; hence they are essential to hygiene management. Maintaining general hygiene management and sanitation is important for several reasons such as personal, social, psychological, health. Proper hygiene and sanitation prevent the spread of diseases and infections. Proper management of menstrual hygiene can prevent infections, reduce reproductive health issues, increase confidence, self-esteem and improve access to education. Good hygiene practice not only affects the individual but those around them. The sustainable development goal 6, ensure access to water and sanitation for all. Access to safe water, sanitation and hygiene is the most basic human need for health and well-being. The present study was conducted in rural areas of Khammam district at Wyra and Enkoor mandals. Sample size of 160 rural women from four villages were selected, 120 sample for experimental group (for intervention) and 40 control group. Educational Intervention was conducted by administration of the prepared IEC material which focused on the change in the knowledge, attitude, and practice of the rural women on hygiene management. Educational intervention was provided through prepared IEC (Information, Education and Communication) material i.e., includes both print material (posters and leaflets) and electronic material (videos and PowerPoint presentations) followed by discussion session on hygiene management practices for pre/ post testing with the control group. The main of the study is to increase knowledge, attitude, and practice on hygiene management among rural women. The effectiveness of the educational intervention was measured by doing paired t test. There is a significant difference in mean scores of knowledge, attitude, and practice of rural women on Hygiene Management before and after the educational intervention, for pre-test and post-test scores.

Keywords: Educational intervention, IEC materials, rural women and hygiene management.

Models Based on Machine Learning Techniques for Estimating Software Costs

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CITAAS/AB/2024/90

An essential aspect in software development is software cost assessment. It helps with software and project management and helps engineers to organize and oversee their assets. Still, creating a software with an appropriate cost estimating model project is a difficult procedure. This work develops a software cost estimate model with a machine learning methodology. Machine learning techniques are used on two open datasets to estimate the initial cost of software. Outcomes demonstrate how machine learning techniques can be applied to forecast software expense with a great degree of precision.

Keywords: Prediction, Cost Estimation, and Machine Learning.

Understanding entrepreneurial behaviour among agriculture students under Student READY Programme

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The Indian Council of Agricultural Research (ICAR) has implemented a new program called Student Rural Entrepreneurship Awareness Development Yojana (READY) programme for the final year of under graduation in agriculture and allied disciplines since 2016-17. Its main aim is to help the graduates build their entrepreneurship skills and become entrepreneurs instead of seeking jobs. Therefore, it is essential to understand the mindset of the agriculture students towards entrepreneurship. Keeping this in mind, the study was undertaken with the objective, "To assess the perception and entrepreneurship behaviour among agriculture students under Student READY Programme (SRP)". The present study was conducted in seven agricultural universities of South India and from each university one agriculture college was selected. From each agriculture college 50 students who completed their graduation during 2022 and have undergone READY programme were randomly selected for the study. Thus the total sample size constitutes of 350 agriculture students. The study was conducted through online survey mode with the help of Google Forms in pattern of multiple choices questions. The collected data were analyzed by using frequency, percentage, mean score and index. The study revealed that overall perception of village attachment was higher (84.57 %) followed by student project report (83.70 %) and agro industrial attachment (81.50 %). With respect to the overall findings of entrepreneurship behaviour of agriculture students, the results showed that leadership ability (79.38 %) was higher followed by goal setting ability (75.06 %) and innovativeness (73.41 %). The study revealed that, the students opting entrepreneur as a career increased to 29.43 per cent after undergoing the programme which was 18.00 per cent earlier. The overall findings of the study showed that Student READY Programme (SRP) introduced by ICAR had a positive impact in influencing the students and increase the number of entrepreneurs among agriculture graduates in the country.

Keywords: Agriculture, Entrepreneurs, Perception, Students and Undergraduate.

Geo-statistical assessment of heavy metals in soils using GIS in Tannery Industrial Area, Kanpur

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CITAAS/AB/2024/92

A study was conducted to interpolate the analysis of spatial variability of soil chromium, cadmium, lead and zinc in Jajmau industrial area, Kanpur district. A total of 120 soil samples (0-25 cm) were collected grid wise at an interval of 250 m using GPS. After normalization, data were interpolated by Ordinary Kriging (Spherical, Exponential and Gaussian). The performance of methods was evaluated using Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and Goodness of prediction (G) obtained from a cross-validation procedure. The best model is selected based on low MAE, low RMSE and highest G percentage. Spatial variability maps for different heavy metals revealed high concentration of metals near tannery zones. The results showed that Spherical Model was best for chromium and zinc (RMSE value 582.65 and 57.12) whereas Guassian Model was best fitted for lead and cadmium (RMSE value 13.79 and 2.86). Geostatistical analysis with Ordinary kriging interpolation method revealed strong spatial dependency for chromium (N:S ratio 21.6%) and moderate spatial dependency for lead, cadmium and zinc (N:S ratio 52.9%, 51.5% and 28.7%). Cross validation of kriged map showed that spatial prediction of soil properties using semi variogram parameters is better than assuming mean of observed value for any un-sample location. Therefore, it is a suitable alternative method for accurate estimation of soil properties in unsampled positions as compared to direct measurement which has time and costs concerned.

Keywords: Spatial variability, Cross validation, GPS, Semivariogram, Geostatistics

Agribusiness prospects and challenges of kachai lemon (*Citrus jambhiri* Lush.): Evidence from Manipur

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CITAAS/AB/2024/93

Kachai lemon, a variety of citrus belonging to the species *Citrus jambhiri* Lush. is known for its medicinal benefits and has played a significant role in socio-cultural practices among the tribal communities in the region. The Geographical Indication (GI) tag allotment to kachai lemon has encouraged commercial cultivation and enhanced its market potential. Kachai lemon has drawn attention of the scientific community owing to its higher pharmaceutical, nutraceutical, cosmetic and food value and the rising interest has led to the formation of agripreneurs and FPOs for production, value addition and marketing of kachai lemon to scale up operations in an organized manner. For the study, descriptive analysis was carried out to assess the potentials, status and challenges. The present study is an attempt to trace and compile the success stories of agripreneurs, analyze them and present the findings to a wider audience. After compiling these success stories, a SWOC (Strength, weakness, opportunities and challenges) analysis was carried out. The study also tries to identify various brands of kachai lemon available on online marketing platform and identify various companies or traders involved in its distribution. The major challenges faced by the farmers were non-standardized vegetative propagation, limited access to quality planting materials, lack of technical know-how, market facility, storage facilities, low market price, etc. To compete in the global market, development of robust post-harvest processing and marketing infrastructure with support and collaboration from agencies and institution such as APEDA, NERAMAC, MOMA, TRIFED, etc. is crucial to provide necessary resources and market linkages to improve the efficiency and maximize economic benefits.

Keywords: Kachai lemon, Prospects, Status, SWOC, Manipur

Artificial Intelligence for Adept Agri-production System

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CITAAS/AB/2024/94

Artificial intelligence (AI) is the capability of a machine to imitate intelligent human behavior. It encompasses a range of technologies and approaches those enable machines to perform tasks requiring human intelligence. Use of artificial intelligence has revolutionized the agricultural sector. AI equipped agricultural robots perform various field operations with much higher efficiency as compared to manual methods. This technology is successfully applied in various aspects of farming, which ultimately results in enhanced productivity. Application of AI in agricultural operations has a great role in enhancing resource use efficiency, reducing time & manual labour requirement and performs the task with higher precision. It is also useful in reduction of overall cost of production, thus promoting sustainable farming practices.

Some of the important areas of AI use are (i) collection of field information by agricultural robots equipped with sensors & cameras;(ii) sowing and planting operations by agricultural robots equipped with AI; (iii) precise application of agri-inputs like water, fertilizers, pesticides, etc. (iv) application of herbicides or removal of the weeds (v) identification of disease & pest infestations, nutrient deficiencies, irrigation requirements, etc. (vi) identifying ripe products using computer vision and machine learning techniques and (vii) sorting and grading of harvested produces by robots depending on size, shape & quality. Besides, use of AI can help to collect large volume of real time data from the crop fields and can assist the farmers to take informed decisions about various field operations. AI powered driverless tractors perform various field operations with much higher capacity as compared to human operated tractors. These machines are energy efficient too. Integration of artificial intelligence has revolutionized the use of drones for farm operations. Drones provide precise information on soil status, water availability, crop health, disease infestation, harvesting stage, perform spraying, etc.

Hence, the future of AI in agriculture is incredibly promising and multifaceted. AI can augment agricultural productivity, sustainability and efficiency by addressing some of the major challenges of this sector.

Allelopathic effect of fruit crops in agri-horti systems under vertisol

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CITAAS/AB/2024/95

Allelopathy, the biochemical interaction between plants, plays a significant role in shaping the dynamics of agri-horti systems, particularly in vertisol environments characterized by their clay-rich soil and unique water retention properties. This study explores the allelopathic effects of various fruit crops on companion plants within these systems. Fruit crops, while beneficial for their economic value and nutritional contributions, can exhibit both positive and negative allelopathic interactions that influence plant growth, yield, and overall ecosystem health. Among the four fruit crops (mango, guava, lime and aonla), mango resulted in higher negative allelopathic effect on germination whereas guava exhibited lowest at various concentrations at lab. The highest root and plumule length were recorded under guava leaf extract. Among the intercrops, the germination of wheat was least affected as it exhibited highest germination percentage and germination of mustard and soybean were highly affected. The yields of intercrops viz., wheat, gram, mustard, soybean and cow pea were highest under mango orchard as compared to other orchards.

Keywords: Allelopathy, Agri-Horti system, Germination, Yield

Harnessing The Plant Growth Potential Of Thermophilic Bacteria Isolated From Hot Springs Of Central India

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In an effort to harness the untapped potential of hot spring bacteria, 101 unique bacterial strains were isolated from the Anhoni Hot Springs in Central India. These strains were meticulously screened for their stress-tolerant plant growth-promoting (PGP) traits, aiming to enhance sustainable crop productivity and soil health.

Through a rigorous screening process, 28% of the isolates produced indole acetic acid, 65% exhibited phosphate solubilization, and 44% secreted siderophores. Additionally, 50% of the isolates displayed cellulase activity, 71% showed lignolytic enzyme activity, 50% revealed protease activity, and 73% demonstrated amylase activity. Pigeon pea seedlings treated with these bacterial strains exhibited significant improvements in shoot length, root length, shoot weight, and root weight compared to the control group.

These groundbreaking findings suggest that these isolates have the potential to be effective microbial inoculants, capable of enhancing the growth and productivity of pigeon pea in field conditions, thereby contributing to a more sustainable and prosperous future for agriculture.

Keywords: Anhoni hot springs, Plant growth promotion, Crop productivity, Soil health, Thermophiles

Effect of thiamethoxam on foraging rate of *Apis mellifera* L in mustard crop

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Pollination is crucial for maintaining the diversity of ecosystems. In addition to this direct benefit, pollination is essential for achieving high yields of cross-pollinated crops. While various agencies contribute to this effort, insects play an indispensable role in providing this crucial ecosystem service. Therefore, the present study was conducted to assess the impact of thiamethoxam (25 and 50 g a.i. per hectare) on the foraging rate of *Apis mellifera* colonies in mustard crops. The foraging rate was recorded by visually counting the number of flowers visited by *A. mellifera* bees within a fixed period at different times of the day. It was observed that at 1000, 1200, and 1500 hours, the mean foraging rate during the pre-treatment observation period did not vary significantly among the different treatments. The mean foraging rate at 1000h reduced to the tune of 24.06 and 36.92 per cent on D1 and the corresponding values 7.90±0.35 and 6.50±0.50 flowers/min in thiamethoxam @ 25 and 50 g a.i. ha^{-1}, respectively, were found significantly lower than pre-treatment values. At 1200h, the mean foraging rate was 9.20±0.25 and 8.20±0.49 flowers/min, respectively in thiamethoxam @ 25 and 50 g a.i. ha^{-1}. The similar trend was observed in foraging rate recorded at 1500h. The highest reduction was recorded in the thiamethoxam @ 50 g a.i. ha^{-1}. At D10, it was recorded that in thiamethoxam @ 25 g a.i. ha^{-1} the foraging rate at all the times i.e. 1000, 1200 and 1500h was statistically at par with corresponding pre-treatment values and thiamethoxam @ 25 g a.i. ha^{-1}. Overall it was found that thiamethoxam applied as foliar application affects the colony development and its performance.

Keywords: Apis mellifera, Thiamethoxam, Foraging rate, Mustard

Assessment of Advanced Convolutional Neural Network Architectures for Automated Tomato Plant Disease Detection

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This study provides a comprehensive evaluation of Convolutional Neural Networks (CNNs) for classifying diseases in tomato plants using image-based methods. The research aims to assess the effectiveness of various CNN architectures, including VGG, ResNet, Inception, and similar models, in automatically detecting different diseases that affect tomato crops. The comparison and analysis are based on multiple performance metrics, such as accuracy, precision, recall, and F1-score. The study examines diverse datasets containing images of tomato plants in various conditions, including Early blight, Late blight, Leaf mold, Bacterial spot, Septoria leaf spot, Tomato mosaic virus, Two-spotted spider mite, Target spot, and Tomato yellow leaf curl virus, along with healthy plants, totaling 10,000 images. The results indicate that DenseNet201 achieved the highest validation accuracy at 98.80%, outperforming EfficientNet-B3 (94.10%) and EfficientNet-B7 (89.00%). On the other hand, VGG16 (84.20%) and VGG19 (83.00%) showed the lowest accuracy in identifying diseases. DenseNet201 also demonstrated superior sensitivity and specificity, with an error rate of just 0.92%, while other models exhibited error rates between 4.76% and 10.76%. The findings provide valuable insights into the efficacy of CNNs in automating disease identification in tomato plants. This research contributes to the advancement of precision agriculture by offering reliable tools for early disease detection and intervention, thereby enhancing crop management strategies and reducing yield losses caused by plant diseases.

Keywords: Convolutional Neural Network; ResNet; DenseNet201; Image Processing; Confusion matrix

Role of women farmers in enhancing nutrition security at household level in rural communities of Telangana State

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In rural communities of Telangana state, women are pivotal in achieving nutrition security due to their central role in household food management and dietary practices. Women play a crucial role in ensuring nutrition security in rural communities of Telangana state, as they are often responsible for managing household food resources, making dietary decisions, and implementing local nutrition practices.

Nutrition-sensitive agriculture (NSA) was an approach to farming that prioritized both food production and nutrition outcomes. This approach recognized that food security and good nutrition was not the same thing, and that agriculture had an important role to play in addressing malnutrition. Rural communities, where agriculture was a mainstay of livelihoods, stood to benefit significantly from NSA.

To explore the knowledge and attitudes of rural women towards Nutrition-Sensitive Agriculture (NSA), an experimental study was conducted in rural areas of Telangana State. An intervention module was developed to educate rural women on agriculture, nutrition, and health, and frequencies and percentages were used to analyze the results.

The study's findings were valuable in identifying knowledge that supported the integration of nutrition-sensitive agriculture among rural women and in improving their nutritional status.

This study examined the multifaceted contributions of women in these communities, including their influence on food selection, preparation, and nutrition education. By analyzing traditional practices, community engagement, and access to resources, the research highlighted how women's efforts directly impact the nutritional well-being of their families. The findings underscore the need for targeted interventions and support to empower women, enhance their roles in nutrition security, and address the challenges they face. Promoting gender-sensitive strategies can improve food security and nutritional outcomes in rural Telangana.

Keywords: Agriculture, Attitude, Intervention, Knowledge, Nutrition garden and Nutrition Security

Utilization of modern IT/ digital tools for congruous macro-nutrient management and enhance productivity of potato

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CITAAS/AB/2024/100

Potato (*S. tuberosum* L.) is third most important crop of world which can play a key role in food and nutritional security of ever-increasing global population. In India, potato is grown in entire Indo-gangatic plains during the rabi season. Owing to its short duration cash crop and high bulking potential in plains, crop require appreciable amount of macro-nutrients NPK in readily available form and in sufficient amount. In order to get more tuber yield, farmers are often resorting to apply over fertilization of some nutrient and under fertilization of other which has resulted in inappropriate fertilization of NPK and consequently static yields. So, the present investigation was initiated with the objective to reveal the extent of inappropriation of macronutrients followed in potato growing soils of Punjab. Information about average yield and fertilizer application rate was collected from 100 potato growing locations. It was observed that potato growers applied inappropriate amount of NPK. Application of more phosphorus (34.8 to 65.3 kg ha^{-1}) and less nitrogen (-68.4 to -85.8 kg ha^{-1}) and potassium (-38.3 to -66.8 kg ha^{-1}) has been practiced in these areas. The investigation further revealed that an increase in tuber yield ranged between 2.04 to 4.51 t ha^{-1} can be achieved by following recommended nutrient management. Therefore, extension of adequate knowledge and awareness about these most important input components is utmost important for achieving optimum yield and better economic returns. ICAR-CPRI have developed friendly mobile application (FDCP & AUMG) and web based decision support system (NRRP - Pb) to calculate fertilizer dose to be applied for potato production. The apps are useful for potato growers cultivating potato for table, processing as well as seed potato production purposes. These apps are in languages viz. English, Hindi and Punjabi. Such apps will help farmers to quantify amount of fertilizer to be applied to their potato crop on the basis of sources of available fertilizers in the market. These apps have very smart interface which is used to calculate fertilizer recommendation by the implementation of soil health card scheme of Govt. of India.

IMPACT OF ALTERNATE WETTING AND DRYING IRRIGATION (AWDI) ON WATER SAVING AND YIELD OF TRANSPLANTED RICE THROUGH FIELD WATER TUBE

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CITAAS/AB/2024/101

A large-scale demonstrations was conducted on Alternate Wetting and Drying Irrigation (AWDI) on water saving and yield of Transplanted Rice in Mettur-Noyyal confluence sub basin areas of Tamil Nadu by the Tapioca and castor research Research station, Yethapur for the past four years (2019-2023). The on farm demonstrations was carried out Salem and Namakkal district including four villages with 241 farmers holdings covering the areas of 290 ha. For adopting the safe AWDI, the depth of ponded water on the field is monitored using a 'Field Water Tube' which is made of 40-cm long plastic pipe having a diameter of 15 cm which is perforated with holes on all sides. The AWDI technology consumed ranges between 871 mm to 950 mm of irrigation water, higher water use efficiency (6.22 to 7.53 kg/ha/mm) and no of irrigations was recorded between 22 to 30.By adopting AWDI in rice recorded highest rice yield of 7045 kg/ha compared to conventional method (5927 kg/ha) among the all the experiments. The highest gross returns (Rs. 116247 /ha), net return (Rs. 77438 /ha) and BCR (2.99) were recorded in adoption of AWDI. The Alternate Wetting and Drying Irrigation (AWDI) will be an appropriate technology for water saving in rice. This technology saves up to 49 percent of irrigation water without any yield penalty and 12 irrigations can will be reduced under AWDI when compared to farmers practice.

Keywords: Rice, Alternate Wetting and Drying Irrigation, Field Water Tube, Water Use Efficiency

Effect of industrialization and urbanization on agriculture

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Industrialization and urbanization becomes a bane for the agriculture now days. With increase in industrialization and urbanization, the growth of agriculture sector decline continuously. Large area of land is covered under industry and infrastructure, which results in shortage of agriculture productive lands. The waste products of industry and urban areas are flowed in water bodies such as river, lakes and ponds which pollute them and make them unsuitable for any kind of use. The harmful effluents released from industry contaminate the air with harmful gases and suspended material. These gases and suspended particles affect the growth and development of plants and animals. The suspended particles are inhale during breathing and cause blockage in veins and arteries of animals and humans. To feed the ever increasing population of our country, the farmer put high pressure on shrinking land to get higher output. For this, farmer use modern technology and chemicals which reduce the productivity and fertility of soil. The polluted water of lakes and ponds become poisonous for the water living entities and results in death of plants and animal species. The waste effluents of urban areas and industry have high concentration of heavy metals which are very poisonous for animals and plants which survive under water and on land. The growth of plants and microbes in soil is reduced due to increase in concentration of heavy metal in soil. The effects of industries and urbanization need to be decreased to get a healthy environment for plants and animals. Special management practice needs to be developed to suppress this increasing problem to survive on earth.

Keywords: industrialization, urbanization, suspended particles, productivity, fertility, heavy metals, etc.

Investigation of Physical and Engineering Properties of paddy Varieties for Design of a Power Operated Paddy Drum Thresher cum Winnower

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The physical properties of the paddy grain were determined by taking three varieties (Devbhog, Mahamaya and Rajeshwari) at five moisture levels (7, 10, 14, 18, and 22% db) to design the different components of the machine. The data were analyzed statistically using Completely Randomized Design (CRD). The physical properties of the paddy grain such as length, width, thickness, sphericity, terminal velocity, coefficient of friction, angle of repose, bulk density and true density were found to be increased with an increase in moisture content while the porosity decreased with increase in moisture content. The effect of moisture content on various physical properties of paddy grains; five levels of moisture content varying from 7 to 22% (d.b.) were examined. It was observed that as the moisture content increased from 7 to 22% (d.b.), there were increases in the average length Devbhog, Mahamaya and Rajeshwari paddy varieties ranged from 7.99 to 9.035 mm, the width from 2.02 to 2.63 mm, and the thickness from 1.503to 2.1 mm, coefficient of static friction (from 0.351 to 0.419), terminal velocity (from 4.145 to 5.869 m/s), andangle of repose (from 23.014^{o}to 32.369^{o}. Furthermore, the bulk density and true density for Devbhog, Mahamaya and Rajeshwari paddy of the grains were found to increase from 549.44 to 628.54 kg/m^3 and 937.72 to 1085.54 kg/m^3, respectively, with increasing moisture content, while the porosity decreased from 45.05 to 29.287%.

Keywords: Moisture content, Porosity, Devbhog paddy, terminal velocity, bulk density

Economic Analysis of Mechanical and Manual Transplanting of Rice (Oryza sativa L.)

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CITAAS/AB/2024/104

Telangana is the rice bowl of South India, and Rice is considered as a staple food and occupies about two third of total cropped area in the state. The agro climatic condition of Telangana is best suitable for rice production. Most of the rice cultivation in the state done by traditional manual transplanting method which involves number of labourers. Shifting of agricultural labourer towards urban areas for better remuneration creates labour shortage during peak time of transplanting. Under such circumstances, an affordable and flexible way of rice transplanting without compromising grain yield is the need of the time.

In this context, Thirty Front line demonstrations were conducted by Krishi Vigyan Kendra, Jammikunta, Karimnagar district, Telangana state from 2018-19 to 2020-21 to demonstrate mechanically transplanted rice cultivation in a few areas of Karimnagar district using a self-propelled walk behind six-row mechanical transplanter.

The data from the demonstrated plots like plant height (cm), number of productive tillers per hill, panicle length, number of grains/panicle and grain yield (kg/ha) were collected and were compared with a control plot where only manual transplanting was done. Also, cost of cultivation for both the demonstrated and control plots was found out and economic analysis was done. From the analysis, it has been found out that the gross return for mechanical and manual transplanting was Rs. 135956 and Rs. 128629 respectively and net return for mechanical and manual transplanting was Rs. 95106 and Rs. 82204 respectively for both the methods of transplanting. Benefit cost ratio was also calculated where it was found to be 3.32 and 2.77 respectively for mechanical and manual transplanting.

Mechanical transplanting with rice transplanter can be used successfully as an economic, viable and alternative option for obtaining higher yield and reducing cost of cultivation as the manual transplanting involves more labour and drudgery.

Keywords: Rice, mechanization, front line demonstrations, mechanical transplanting

Mitigation of Postural Stresses in Tobacco Cultivation and Development of Safety Intervention

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The ergonomic analysis of tobacco cultivation activities inferred the postural stresses by the Rapid Entire Body Assessment (REBA) scores for transplanting, weeding, and harvesting tobacco leaves were 8.0, 8.16, and 8.2, respectively, which were in the category of "High risk, investigation and implements change". An attempt is made to develop a two-row battery-operated tobacco transplanter for ergonomic compliance. The physiological parameter (HR) ranged from 84.99 to 120.17 beats/min with a mean HR of 105.39 beats/min, categorized the work under the medium workload. The O_2 consumption and energy expenditure ranged from 0.5 -1.0 to 1.0 – 1.5 lit/min and 10-20 to 20 – 30 kJ/min, respectively. The average REBA score was 7.12 (Medium risk, further investigation, change soon) and the risk index score was 1.70 (RI >1). The developed two-row battery-operated tobacco transplanter improves the posture during transplanting operation with lesser exertion and fewer repetitive movements. It increases productivity and decreases the labour requirement for transplanting.

Keywords: Transplanting, tobacco planter, REBA, HR, tobacco cultivation.

Studies on the effect of plant growth regulators on quality attributing characters of sapota [*Manilkara achras* (Mill.) Forsberg] cv. Cricket Ball under Agro-climatic condition of Chhattisgarh Plains

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CITAAS/AB/2024/106

On farm studies were carried out during the year 2020-21 and 2021-22 at experimental field of Horticulture instructional Farm, Department of Fruit Science College of Agriculture, IGKV, Raipur (C.G.). The experiment was laid out in Randomized Block Design with twenty five treatments combination replicates thrice. Te experiment was conducted on twenty years old trees of sapota cv. Cricket Ball with foliar spray of different concentrations of plant growth regulators applied at 50 per cent flowering and pea stage of fruit growth. Observations were recorded during both years of successive experiment on various chemical parameters such as, total soluble solids (21.65 ^{0}Brix), total sugar (16.80%), reducing sugar (10.40%), non-reducing sugar (6.40%), ascorbic acid content (13.43 mg/100g), fruit moisture (75.41%), pH (5.39) and pulp/ Seed ratio (24.96) of sapota fruits were proved to be best showing a higher status with the treatments NAA @ 200 ppm. However the acidity content (0.112%) of sapota fruit was noticed minimum under the same treatment.

Keywords: NAA, GA_3, total soluble solids, foliar spray, chemical parameters

Study on Data Acquisition Tools for Site Specific Input Applications

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Site specific management in agriculture is an emerging concept favouring resource optimization through need specific application of chemical inputs. In the environmental and economical perspectives, the site specific management stands as an innovative strategy for resource optimization. Site specific management comprises of three main stages, data acquisition, data processing and application. The initial stage, data acquisition is the crucial stage which may be of two types viz., prescription map based (offline) and real time (online), recent trends combines these two to have a third type hybrid. For each type different data acquisition tools can be used. Tools such as GreenSeeker, SPAD chlorophyll meter, Opti-Science CCM Plus chlorophyll meter, multispectral sensors, Leaf Colour Chart were discussed in this study with their inter relationships with each other. Also, the mode of operation – manual, drone and machine mountings varies with each tool. With this the study explores the various data acquisition methodologies and their pros and cons with respect to site specific management of major crops.

Keywords: Variable rate technology; Precision farming; Resource optimization; Input management

QUALITY TESTING AND COST ANALYSIS OF WEANING FOODS PREPARED FROM MULTIGRAIN FLOUR AND MILK POWDER

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Children after 6 months need to shift from breast milk to weaning food to fulfill the increased nutritional requirement with growth. The present study involved development of three different samples of weaning foods prepared with multigrain flour (combination of rice flour, wheat flour and gram flour in the ratio of 2:1:0.5) mixed with milk powder (5%, 7.5% and 10% of the total flour mixture). To determine overall acceptability of the samples, sensory evaluation was done on a 9 point hedonic scale after preparing the samples for consumption by adding either water or milk. In first case, sample 3 was found to be the most preferred sample while in second case, sample 1 was found to be the best in sensory quality. Further, the physico-chemical properties of the developed samples such as moisture content, ash content, protein content and total carbohydrates were assessed during storage at room temperature (25-32˚C) for 2 months in airtight laminated aluminium film packing material. All the developed weaning food samples were found to be stable during 50 days of storage. Moreover, the prepared weaning food samples had a lower cost as compared to the commercially available weaning foods. The developed weaning foods will be helpful in fulfilling the nutritional requirement of the vulnerable sections of society.

Keywords: Weaning food, sensory quality, physicochemical characteristics

Quality enhancement of *Hylocereus costaricensis* (Red pitaya) wine: Effects of Pectinase, Juice Blending, and Unsaturated fatty acids.

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Red dragon fruit (*Hylocereus costaricensis*), known for extensive nutritional quality and vibrant pigment was incorporated in fruit wine production using Saccharomyces cerevisiae (MK680910). Initial trials with *Hylocereus* spp. and water (1:1) resulted in a wine with 6.93% alcohol with alcoholic fermentation of 28±2 days. However, the introduction of pectinase treatment increased alcohol concentration to 7.92% and improved antioxidant activity (49.2% DPPH inhibition), flavonoids (362 µg/mL), and total phenolics (78.19 µg/mL). However, pectinase treatment led to noticeable colour change (ΔE = 3.17), reducing consumer appeal. Subsequent trials involved blending *Hylocereus costaricensis* with white grape juice (1:1). Further, the resulting wines showed improved characteristics: *Hylocereus* spp. + white grapes wine had (8.50% alcohol, 35.9% DPPH inhibition, 326 µg/mL flavonoids, and 58.11 µg/mL total phenolics). With pectinase, these metrics were further enhanced (47.5% DPPH inhibition, 354.3 µg/mL flavonoids, 70.99 µg/mL total phenolics) and alcohol reached 9.50%, though colour degradation was still observed (ΔE = 2.64). FTIR (Fourier-transform infrared spectroscopy) analysis of fine emphasized on the presence of aromatic, aliphatic and ether compounds more in wine produced by pectinase treatment. Although, sensory evaluation favoured the wine without pectinase took 20 days for alcoholic fermentation. Optimization of unsaturated fatty acids (Oleic acid, Linoleic acid and α-linolenic acid) using response surface methodology (RSM) by central composite design (CCD) reduced fermentation time to 11 days and improved alcohol content to 9.83%. Therefore, present study developed the standardize conditions for exotic fruit wine production with improved characteristics.

Keywords: Saccharomyces cerevisiae, Hylocereus costaricensis, Pectinase, RSM

Adaptive Machine Learning Algorithms for Dynamic Disease Forecasting in Rapeseed-Mustard

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CITAAS/AB/2024/110

Effectively forecasting of Alternaria blight is vital for reducing yield losses in rapeseed-mustard crop and also to ensure superior seed quality. In order to understand the complex interaction between weather conditions and pathogen proliferation, sophisticated weather-based prediction models are required. However, choosing the optimal model poses challenges due to the complex correlations between climatic variables and disease intensity. This study investigates into these relationships so as to refine predictive accuracy. Researchers developed and compared four predictive approaches, including three shrinkage models and a machine learning tool, to forecast Alternaria blight across eight sowing dates, started from October 1st to November 19th over five crop seasons (2018-19 to 2022-23). The models—Artificial Neural Networks (ANN), LASSO (Least Absolute Shrinkage and Selection Operator), Elastic Net (ENET), and Ridge regression were trained on five years of disease data, with allocated 70% for training and 30% for validation. Inputs included daily weather variables and disease severity metrics, incorporating both weighted and unweighted weather indices. Performance metrics—R^2, RMSE, nRMSE, MAE, and EF indicated that ANN outperformed the other models in predicting disease severity. The models' overall ranking was ANN > LASSO > ENET > Ridge. Crucial findings highlighted morning relative humidity (RH) as pivotal for early (Oct 1-15) and late (Nov 12-19) sown crops, whereas afternoon RH and sunshine hours were critical for crops sown on October 22. For crops sown on October 29 and November 5, sunshine hours and wind velocity emerged as key predictive factors. These insights enhance the way for more precise and timely disease management strategies, potentially enhancing crop yields and profitability.

Keywords: Alternaria blight, Rapeseed-Mustard, disease forecasting, ANN, LASSO, ENET, Ridge

Effect Of Dietary Supplementation Of Cashew Nut Meal On Rumen Fermentation In Sheep

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The high cost of conventional feedstuffs and limited land for fodder production necessitates the search for and exploration of alternative feedstuffs for sustainable livestock production. To address this, cashew nut meal (CNM) was evaluated for its effect on rumen fermentation parameters in rams. Four rams (above 1 year old) were randomly assigned in a 4×4 Latin square design, with four periods of 15 days each, to assess the effect of different inclusion levels of CNM (T0, T1, T2, and T3) on rumen fermentation. In the trial, animal in the control group (T0) was fed a diet containing a compounded feed mixture (CFM) without CNM, while in T1, T2, and T3, soybean meal (SBM) protein was replaced with CNM at levels of 20%, 40%, and 60%, respectively. Super Napier hay was used as the sole source of roughage. The dry matter (DM) and organic matter (OM) intakes were similar and did not differ significantly among the experimental groups (T0, T1, T2, and T3). Rumen fermentation parameters, such as total nitrogen, ammonia nitrogen, trichloroacetic acid (TCA) precipitable nitrogen, and total volatile fatty acids (TVFA), peaked 4 hours post-feeding in all groups. However, no significant differences ($p>0.05$) were observed in rumen fermentation characteristics among the groups. The results of this study indicate that cashew nut meal can be incorporated into the compounded feed mixture of sheep at levels up to 30% (w/w), replacing soybean meal protein by up to 60% on a protein-equivalent basis, without any adverse effects on rumen fermentation parameters.

Reducing the Carbon Hoofprint: Effective Mitigation Strategies for Cattle Methane Emission

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CITAAS/AB/2024/112

Methane emissions from cattle account for 14.5% of global anthropogenic methane emissions, totaling 2.3 billion metric tons of CO2-equivalent (GWP100) in 2020 (IPCC, 2021). The livestock sector is the largest source of methane emissions, with beef and dairy cattle contributing 70% and 25%, respectively (FAO, 2020). Methane is produced in the rumen of cattle as part of the digestive process, and is released through manure, flatulence, and belching.

Mitigation strategies can reduce methane emissions from cattle. Feed modification: Altering the diet of cattle to include feed additives, such as omega-3 fatty acids, can reduce methane production by 10% (Hristov et al., 2013). Feed optimization can also reduce emissions by 5% (*Beauchemin* et al., 2020). Manure management: Implementing effective manure management practices, like anaerobic digestion, can capture methane emissions, reducing them by 15% (USEPA, 2020). Breeding and genetics_: Selective breeding programs can identify and promote cattle breeds with lower methane emissions, achieving a 5% reduction potential (Boadi et al., 2004). Livestock productivity_: Improving cattle productivity through better nutrition and health management can reduce the overall emissions per unit of meat or milk produced by 20% (Herrero et al., 2016). Grazing management: Optimizing grazing practices, such as rotational grazing, can reduce methane emissions by 10% (O'Mara et al., 2011). Methane-inhibiting agents: Using agents like 3-nitrooxypropanol can inhibit methane production in the rumen, achieving a 30% reduction potential (Martinez-Fernandez et al., 2018).

Implementing these strategies can achieve a 50% reduction in methane emissions from cattle by 2030, aligning with the Paris Agreement's goal to limit global warming to 1.5°C above pre-industrial levels. A comprehensive approach considering factors like cost-effectiveness, animal welfare, and environmental impact is essential for successful mitigation.

National Agricultural Strategies for Advancing Natural Farming as a Key Driver for Rural Development and Ecological Balance

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The increasing global demand for sustainable agricultural practices has pushed natural farming into the spotlight as a vital solution to combat environmental degradation, enhance food security, and ensure economic stability. This review paper explores the integration of natural farming within national agricultural strategies, emphasizing comprehensive extension services and government policies that can promote its widespread adoption. The paper analyzes key elements such as the role of farmer education, training programs, and support networks in fostering the shift toward natural farming. Furthermore, it investigates how governmental policies, including subsidies, market incentives, and research funding, can bolster the implementation of natural farming practices. This review also highlights challenges faced by smallholder farmers, such as the lack of technical knowledge and financial constraints and offers recommendations for overcoming these barriers. The paper concludes that by aligning national agricultural strategies with natural farming principles, countries can contribute to sustainable rural development, environmental conservation, and improved livelihoods for farmers. The major findings of the article also suggest a holistic, well-coordinated approach is essential for promoting natural farming at a national level, and ensure that agricultural policies must be aligned with ecological goals and the needs of farmers.

Keywords: Natural farming, Sustainable agriculture, Strategies, Policies, Rural development.

IOT and its Application: A Technological Breakthrough for Dairy Supply Chain

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The Internet of Things (IoT) represents a significant technological breakthrough in the dairy supply chain, offering unprecedented opportunities for efficiency, quality control, and sustainability. By integrating IoT technologies, dairy operations can achieve real-time monitoring and management of critical factors such as milk quality, inventory levels, and environmental conditions throughout the supply chain. This ensures that milk is maintained at optimal standards during storage and transportation, enhancing overall product quality.

IoT also plays a pivotal role in demand forecasting and supply chain optimization. By analyzing data from various sources, including past sales and market trends, IoT systems can predict consumer demand with greater accuracy, enabling better planning and reducing wastage. The ability to balance supply with demand in real-time ensures that production rates are aligned with market needs, minimizing the risk of overproduction or shortages.

Centralized dashboards, powered by IoT, provide a comprehensive and integrated view of the entire dairy supply chain. These dashboards allow stakeholders to make informed decisions quickly, based on real-time data from various points in the supply chain. This level of visibility enhances traceability, ensuring that every step of the process—from farm to consumer—is transparent and accountable. Such traceability is crucial for meeting regulatory requirements and maintaining consumer trust.

Moreover, IoT contributes to resource efficiency in dairy operations. By monitoring energy and water usage, IoT devices help optimize these resources, leading to cost savings and more sustainable practices. Predictive maintenance, another key application of IoT, ensures that equipment is serviced before failures occur, reducing downtime and extending the lifespan of machinery.

Overall, the integration of IoT into the dairy supply chain is transforming the industry, enabling more efficient, transparent, and sustainable operations that benefit producers, consumers, and the environment. This technological advancement is poised to reshape the future of dairy production and distribution.

Keywords: Dairy Supply Chain, Internet of Things, Real-time Monitoring, Supply Chain Management, Predictive Analytics, Resource Efficiency

Effect of integrated nutrient management in growth & yield of aromatic rice of Odisha.

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A field experiment was conducted during the kharif season in the year 2023 at Regional Research & Technology Transfer Sub Station, Kirei, Sundargarh, Odisha to evaluate an integrated nutrient management(INM) practices for enhancing grain yield of aromatic paddy variety Kalajeera in Odisha. The experiment consists of 7 treatments viz. Farmers practice: 30 kg Urea and FYM 4q/ha, 100% STD, 75% STD + 2t VC/ha, 75% STD + FYM 5t/ha + Zinc sulfate @ 25 kg/ha, 50% STD + FYM 5t/ha + VC 2t/ha, 75% STD + FYM 5t/ha + VC 1.5 t/ha, 50% STD + FYM 5t/ha + VC 1.5t/ha. The experimental results revealed that the treatment combination of 75% STD + FYM 5t ha^{-1} + Zinc sulphate resulted the increased Plant height, leaf-area index (LAI), dry matter and the highest grain yield (2.92 t ha^{-1}) followed by the application of 50% STD + FYM 5t/ha + VC 2t/ha. However application of 75% STD + FYM 5t/ha + Zinc sulfate @ 25 kg/ha is recommended over all other treatments in considerations of sustaining the soil fertility of soil in long run.

Keywords: INM, STD, VC, Grain yield, Leaf area index.

CHARACTERIZATION OF STRIPE RUST RESISTANCE IN *Triticum aestivum* L.

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Stripe rust, caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*), is a significant global threat to wheat. During the 2019-20 and 2020-21 growing seasons, 67 wheat germplasm lines were evaluated at the seedling stage against various stripe rust pathotypes (46S119, 110S119, 238S119, and a mixture) under controlled conditions. The seedling reaction tests revealed that 28 lines exhibited resistance to all tested *Pst* pathotypes, attributed to major resistance genes such as *Yr5, Yr10, Yr15, Yr24*, and *Yr26*, either individually or in combination. These lines were further evaluated in the field across two locations, Ludhiana and Gurdaspur, over two years. Based on the area under the disease progress curve (AUDPC), the lines were categorized into clusters, with 28 lines classified as highly resistant (AUDPC 0-100). Lines with AUDPC values of 100-200 displayed partial resistance, likely due to the presence of adult plant resistance (APR) genes such as *Yr70, Yr17, Yr40, Yr36, and Yr47*. Biochemical analysis revealed that activity of defensive enzymes (PAL,TAL) along with the activity of antioxidant enzymes (Peroxidases, Polyphenol oxidases) were upregulated in the genotypes PBW725, BWL1789, BWL6990 with concomitant decrease in H2O2 and MDA content suggesting that these enzymes (defensive and antioxidant) plays an important role in imparting resistance in cultivars against stripe rust pathogen. Moreover the activity of PR proteins like glucanases and chitinases behaved differently in different genotypes with a maximum increase recorded under inoculated condition in PBW725 indicating there active participation in disease resistance. Histopathological studies were conducted for two lines namely PBW725 and PBW343 from 12 to 120 h time period, where the spore germination occurs similarly in both line at 12 and 24 h post infection (pi). Further in PBW 343, a susceptible line, forms appressoria that enter stomata and forming sub-stomatal vesicle and finally colonized the tissue with developed haustoria. In PBW 725 (resistant line) where the germ tube was aborted at earlier stages and no further colonization was observed.

CROP YIELD FORECASTING METHODS: A COMPREHENSIVE REVIEW

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Agriculture is essential to the survival of people, economies, and ecosystems worldwide. A key measure of agricultural productivity is crop yield, defined as the amount of produce harvested per unit area. Crop yield is influenced by various factors, including climate, soil health, water availability, farming practices, and technological advancements. Crop yield forecasting is the process of predicting how much crop will be harvested during a growing season. This helps farmers, businesses, and governments plan ahead, manage resources, and prepare for market demands. Several methods are used to make these predictions. Historical data analysis looks at past harvests to find patterns, while remote sensing uses satellite images and drones to check the health of crops and soil. Weather data is also used in models that simulate how different conditions, like temperature and rainfall, affect crop growth. In recent times, machine learning has become an important tool in forecasting. It uses large amounts of data, such as weather, soil conditions, and past yields, to make more accurate predictions. As technology continues to evolve, the accuracy and accessibility of crop yield forecasting are expected to improve, making it an even more integral part of global agriculture. Advanced forecasting models will play a crucial role in addressing the challenges of feeding a growing population while managing the impacts of climate change and resource constraints.

Keywords: Remote Sensing, Machine learning

ISOLATION OF PHOSPHATE SOLUBILIZING BACTERIA AND STUDY OF THEIR BIOCHEMICAL CHARACTERISTICS.

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Eight isolates obtained from rhizospheric soil were designated as PSB- 1, PSB-2, PSB-3, PSB-4, PSB-5, PSB-6, PSB-7 and PSB-8 which showed the characteristics of Pseudomonas. All the isolates were Gram negative, rod shape and produced yellow pigment. Biochemical characterizations were studied viz. gram reaction, KOH test, catalase test, starch hydrolysis, gelatin liquefaction, H_2S production, oxidase test, IAA production, phosphate solubilization and HCN production. All isolates showed the positive reaction for KOH test, catalase test, gelatin liquefaction, oxidase test and phosphate solubilizing activity some of the isolates show both positive and negative to starch hydrolysis, H2S production, and IAA production. The bacterium failed to produce hydrogen cyanide (HCN). Solubilization of insoluble tricalcium phosphate bacterium PSB-5 showed the best result maximum reduction in pH from 7 to 3.50 with 51.30 mg/100 ml P2O5 solubilization. Whereas, minimum reduction in pH recorded by PSB-1 (4.60) with 18.60 mg/100 ml P2O5 solubilization as compared to control. Solubilization of insoluble dicalcium phosphate bacterium PSB-1 showed best result maximum reduction in pH from 7 to 5.50 with 69.10 mg/100 ml P2O5 solubilization. Whereas, minimum reduction in pH recorded by bacterium PSB-6 (6.10) with 45.90 mg/100 ml P_2Os solubilization as compared to control. Similarly, solubilization of insoluble rock phosphate among all isolates PSB-1 showed best result maximum reduction in pH from 7 to 5.40 with 38.16 mg/100 ml P2O5 solubilization. Whereas, minimum reduction in pH recorded by bacterium PSB-8 (5.98) with 15.06 mg/100 ml P2O5 solubilization as compared to control used rock phosphate as insoluble phosphate as insoluble phosphate source respectively.

Role of extension on use of Trichoderma in organic waste enrichment in Pigeonpea ecosystem

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KVK place a very important role in transforming the agriculture technology to rural fields. Organic farming *trichoderma* used as biocntrol agent for seed and soil protection. KVK kalaburgi given wide information on wide seed protection. iPulse bowl Kalaburgi district of north Karnataka having more than 4.6 lakh hectors of Pigeonpea crop in Kharif season. Innovative technological work on bioagent Trichoderma *harizanum* using agricultural waste as a substrate for the management of soil borne disease and growth promotion in plants a study takenin cluster village. *Trichoderma harizanum* isolate of UAS Raichur used for study. The organic wastes of Redgram i.e., Redgram pod husk, twigs, stem part, root parts, leavesand green gram pod waste, leaves and dried twigs used as substrates for mass multiplication. The mass multiplied enriched compost used for 2 ha watermelon and tomato 2 ha field of KVK cluster village on 2022-23. The mycelia growth and activity of Trichoderma was observed at different days interval. The fast Trichoderma growth noticed in broken husks of Redgram and green gram (14 days) followed by redgram twig part wastes (18 days) and slow mass mulplication of trichoderma noticed in stalk and stem part of Redgram (23 days) and normal growth of Trichoderma noticed in dried leaves of redgram and green gram (15 days). Moisture and humidity management is very important parameter followed during the enrichment process. The growth and sporulation of Trichoderma harizanum was completely assessed and 100 % substrate mycelia coverage of Trichoderma takes 49 to 55 days. The potentiality of Trichoderma and its fast growth in different organic waste of Redgram and green gram mainly depends on type of substrate and lignin content and moisture, humidity percentage in substrate.The easy availability of organic waste of Redgram and green gram helped farmers to develop Trichoderma enriched compost to grow soil borne disease free horticulture crop production trial field in tomato and watermelon cultivation in cluster village. Biocontrol agent a component in organic farming widely used for control of wilt disease in Pigeonpea cropping system.

Digital Technology (ICT) In Agriculture

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In these days of hi-tech information and communication technology, the phenomenon of Global Village is being experienced on an increasing scale. ICT innovation plays a key role in improving agricultural production and the value chain. Food trace ability systems using ICT has become very important risk management tools that allow food business operators or authorities to contain food safety problems and promote consumer confidence. ICT-enabled marketing and access to markets play a major role, especially for information on market prices and demand. ICT-enhanced marketing and certification also strengthens the capacity of small-scale producers to increase revenue by improving their position on local and international markets. GIS and Agro Meteorological Technologies have been introduced into programmes from the very beginning for various purposes including land-use planning, crop forecasting and early warning systems, among others. Space technology is also essential to monitor threats from the growing number of natural disasters. In addition, use of mobile phones has become more common for exchanging information such as for disease surveillance and pest tracking. There is also growing prevalence of ICT solutions for the later stages of the agricultural value chain (e.g. post-harvest, transport, storage). It has been said that using ICT would be major form of agricultural technology dissemination in the near future. Thus ICT has tremendous potential to penetrate at the grass root level and boost the extension effectiveness through various media like radio, television, video cassettes, Internet, Video conferencing etc.

ICT For Market Access

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ICT platform adds market knowledge and give farmers greater confidence in understanding the demand and enhance ability to the control production and manage supply chain. It also helps farmers to deal directly with large wholesalers or traders or directly with the processors rather than small-scale intermediaries. ICT play an important role in facilitating agricultural growth because they increase the efficiency of market interactions and provide access to real time information mainly by enhancing farmers access to markets and their pricing power through the use of trading platforms over the internet through Web/Mobile applications. In this regards ICTs can provide a unique opportunity to facilitate agricultural related technological adoption and access provision of information on markets and market prices weather, transport and agriculture techniques. Market access ICT services comprise any service that provides beneficiaries especially farmers, with access to information on pricing of agricultural products and connecting to suppliers, buyers or logistics providers. Market access services also covers ICT solutions that help the typically larger up streams and down streams firms, such as processors or exporters to manage their operations and the quality of their produce better called down stream administrations.

PREVALENCE OF HEALTH ISSUES AMONG WOMEN BUS CONDUCTORS IN HUBBALI-DHARWAD NWKRTC

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The prevalence of health issues among women bus conductors in Hubbali-Dharwad NWKRTC underscored the significant impact of their demanding work environment. As bus conductors they faced long hours, irregular shifts, and physically strenuous tasks, which contributed to a range of health problems. The study aimed to highlight the specific health challenges these women encountered and to identify effective interventions to improve their working conditions and overall well-being. Addressing these health issues was crucial not only for enhancing the well-being of the conductors but also for ensuring the efficiency and safety of public transportation services. The total sample comprised 100 women bus conductors from the Hubbali-Dharwad NWKRTC. The unit of the study was an organization namely the North-West Karnataka Road Transport Corporation (NWKRTC) Hubballi-Dharwad. The data were collected through a pre-structured questionnaire method at various depots and the results were analyzed using SPSS version 13.0. The study identified that 40% of women bus conductors suffered from eye irritation, 28% from headaches, 24% from allergies and 23% from swelling of the legs and hands. Conversely 78% had no vomiting issues followed by 74% had no ear problems and 55% had no gynecological issues. The study concluded that women bus conductors faced health issues such as eye irritation, headaches, allergies and swelling due to their demanding roles. The eye irritation resulted from prolonged focus on ticket machines, headaches from mental pressures, allergies from dust and weather and swelling from carrying ticket machines and standing for long periods. These findings underscore the need for targeted interventions including ergonomic improvements and better working conditions, to enhance their overall well-being.

Keywords: Health issues, women bus conductors, NWKRTC, Ergonomic improvements, public transportation.

The biodegradable films and coatings from algae for edible food products

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The biodegradable films and coatings from marine algae is an emerging alternative raw material for coating or packing edible food products. Its rapid growing industry and shows up to 20% growth per day, because of easy cultivation and the incredible area of the sea. Marine algae or seaweeds can ensure a sustainable raw material for producing biodegradable films and coating material. These are easily degraded by the decomposing microrganisms; therefore no packaging waste remains, which reduce environmental pollution. The product coated or packed with biodegradable material can consume with packaged product. Also it can improve the properties of the food and can be used as a nutritional supplement. The study revealed that, biodegradable material can serve as carriers of antimicrobial and antioxidant compounds. A review on uses of different biodegradable films and coating from algae for edible food products are discussed in this paper.

Keywords: Biodegradable film, edible coatings, fish or food products, algae, seaweed

Incidence of *Salmonella* in Seafood safety and risks

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Several factors contribute to increase consumers' exposure to food safety risks. Seafood is a food category that can be contaminated by various foodborne pathogens, included Salmonella. Salmonella infection (salmonellosis) is a common bacterial disease that affects the intestinal tract. Salmonella bacteria typically live in animal and human intestines and are shed through stool (feces). Salmonella can be found in a variety of seafood, including fish and shellfish like crabs, clams, lobsters, mussels, scallops, shrimps, and oysters. The contamination can happen in the aquatic environment, during aquaculture, or during processing and storage. Human and animal waste can contaminate the water, and feces can also get on raw seafood during dressing. Contamination can occur after harvesting during handling and processing. According to Field laboratories of the U.S. Food and Drug Administration collected and tested 11,312 import and 768 domestic seafood samples over a 9-year period (1990 to 1998) for the presence of Salmonella. The overall incidence of Salmonella was 7.2% for import and 1.3% for domestic seafood. Nearly 10% of import and 2.8% of domestic raw seafood were positive for Salmonella. The overall incidence of Salmonella in ready-to-eat seafood and shellfish eaten raw was 0.47% for domestic one shucked oyster and one shark cartilage powder. The incidence in the 2,734 ready-to-eat import seafood was 2.6% cooked shrimp, shellfish or fish paste, smoked fish, salted/dried fish, and caviar. The incidence in import shellfish consumed raw was 1% in oyster, 3.4% in clams, and 0% in mussels. The incidence in raw, import fish was 12.2% (Heinitz et al., 2000). Recent years significant progress has been made to reduce the number of seafood-related outbreaks worldwide will require continued and coordinated efforts by many different agencies. An integrated approach involving public health, veterinary and food safety experts, with multidisciplinary skills, which can be applied to water quality monitoring, disease surveillance, consumer education, and seafood harvesting, processing, and marketing is essential in order to ensure the priority of food hygiene. As per the standard for fish and fish products it should be nil.

Keywords: Salmonella infection, salmonellosis, foodborne pathogens, seafood, food safety

Sea Turtle Conservation Measures in the Indian Scenario

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Sea turtles are critical components of marine ecosystems, and their conservation is of global importance. In India, with its extensive coastline of over 7,500 km, five of the seven species of sea turtles are found: the Olive Ridley, Green, Hawksbill, Loggerhead, and Leatherback turtles. The Indian coastline, particularly the eastern coast, hosts some of the world's largest mass nesting sites, or arribadas, for Olive Ridley turtles, notably in Odisha. Despite their ecological significance, sea turtles in India face numerous threats, including habitat loss, coastal development, accidental bycatch in fishing gear, poaching, and climate change. This poster examines the current status of sea turtle populations in India, with a focus on conservation measures implemented at various levels. Recent research highlights the success of community-led conservation initiatives, particularly in Odisha, where local fishers play a crucial role in protecting nesting sites. Government-led efforts, such as the establishment of marine protected areas (MPAs) and the use of Turtle Excluder Devices (TEDs) in trawl fisheries, have shown promise in reducing bycatch. However, challenges remain, such as enforcement of laws, addressing illegal trade, and mitigating the impacts of climate change, which alters nesting sites and hatchling sex ratios. The poster also explores emerging research on the effects of climate change on sea turtle populations, emphasizing the need for adaptive conservation strategies. By synthesizing the best available data from recent studies, this work underscores the importance of integrating scientific research, policy-making, and community engagement to enhance the effectiveness of conservation measures. The Indian scenario serves as a case study for balancing development and conservation, with implications for global sea turtle conservation efforts.

Keywords: Sea Turtles, Conservation, India, Olive Ridley, Climate Change, Marine Protected Areas, Turtle Excluder Devices.

Seaweeds: An its application in human health

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Currently, seaweeds are being global attention due to their health benefiting properties. The last three decades, seaweeds have been used as nutraceuticals or functional foods, as they give dietary benefits. They are being consumed as a seaweed-based product as well as their extract enriched products. According to global epidemiological studies, countries where seaweeds are regularly consumed have significantly less instances of obesity and dietary-related disease. Seaweeds are the great source of vitamins, essential minerals, dietary fibres, protein, essential amino acids and polyphenols. In India, around 77 million and 1.1 million people are suffering from diabetes and cancer respectively. Among every four Indians, one suffers hypertension. As seaweed shows some health promoting properties i.e., anticancer, antiviral, antifungal, antidiabetic, antihypertensive, immunomodulatory, anticoagulant, anti-inflammatory, antioxidant, UV protective, neuroprotective, dyslipidaemia, bone-health, heart-health, gut health, thyroid function and mental-health benefits, consumption of seaweeds may help overcome such health-related issues. Despite its nutritional value and abundant supply, India's seaweed consumption is remarkably low, highlighting an urgent need to incorporate more of this superfood into our diets..

Keywords: Seaweeds, seaweed utilization, medicinal benefits, nutraceutical, functional food

COMPATIBILITY OF BEAUVERIA BASSIANA AND METARHIZIUM ANISOPLIAE WITH SELECTIVE INSECTICIDE USED AGAINST MAJOR LEPIDOPTERAN PEST OF COTTON

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The present investigation was conducted to test the toxicological impact of chemical pesticides on entomopathogenic fungus. This study reports the in-vitro toxicity of ten insecticides Thiomethoxam 25% WG, Spinosad 45% SC, Fipronil 5% SC Profenophos 40% EC + Cypermethrin 4% EC, Emamectin benzoate 5% SG, Chlorantraniprole 18.50% SC, Quinolphos 20% AF, Acephate 50% + Imidacloprid 1.8% SP, Difenthiuron 50% WP and Flonicamid 50% WG at different concentration for their effect on growth Beauveria bassiana and Metarhizium anisopliae by growing them on insecticides treated media. Profenophos 40% EC + Cypermethrin 4% EC and Quinolphos 20% AF was found incompatible with Beauveria bassiana and Metarhizium anisopliae. Flonicamid 50% WG was most compatible with Beauveria bassiana while Acephate 50% + Imidacloprid 1.8% SP was most compatible with Metarhizium anisopliae.The highest larval mortality of H. armigera (89%) was recorded at 0.50x 108 spore per ml and Spodoptera litura (93%), 10º spores per ml after 3, 5, 7 and 10 days after treatment in case of M.anisopliae. While in the case of B. bassiana the highest larval mortality of H. armigera was recorded at 0.250 x 108 spore per ml and Spodoptera litura, 107 spores per ml after 3, 5, 7 and 10 days after treatment

Effect of *Vrikshayurveda* based fermented organic manure (Herbal *Kunapajala*) on quality attributes of gladiolus cv. Jessica

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Intensive farming in India has led to the degradation of soil and ecological balance, with flower crops being particularly susceptible due to their high nutrient demands. This growing concern has sparked a movement towards sustainable agricultural practices, leading to the adoption of organic methods. One such approach involves the use of *Vrikshayurveda* based fermented organic manure, known as Herbal *Kunapajala*. This manure is prepared by fermenting a variety of vegetation, such as nettle grass or locally available plants like Neem, Calotropis, and Pongamia etc., combined with cow dung, cow urine, spoiled jaggery, sprouted urd pulse, mustard or neem cake, and paddy straw water. This organic mixture is rich in essential nutrients vital for plant growth, offering a sustainable alternative to conventional farming methods. To explore the efficacy of *Kunapajala,* an experiment was carried out on growth and quality attributes of gladiolus cv. Jessica at Model Floriculture Centre, GBPUA&T, Pantnagar, Uttarakhand. Thirteen treatments, including three *Kunapajala* compositions (KJ1, KJ2 and KJ3), were compared to a control (RDF). The results revealed that T_7-(10% of KJ2-50% nettle grass+ 50% seasonal weeds), exhibited maximum plant height 72.04cm, number of leaves 7.93, at 90 DAP and this treatment also shows best for early spike emergence (71.60 days), flowering duration (13days), spike length (69.75cm), number of florets per spike (12.33) and maximum vase life (10.11 days). Treatment T_7 exhibited maximum weight of corm (45.48 g) and No. of cormels per plant (9.67). Based on the results, T_7-10% of KJ2(nettle grass+ seasonal weeds) at a dose of 150 mL/m^2 significantly improved flower yield, spike quality, and corm attributes. These results highlight the potential of ancient organic farming practices to enhance crop health and productivity, reducing reliance on chemicals for sustainable agriculture in India.

Impact of Continuous Manuring and Fertilization on Soil Quality Dynamics in Black Cotton Soil Under Sorghum-Wheat Cropping Sequence

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The field experiment investigated soil quality dynamics in black cotton soil under a sorghum-wheat cropping sequence during the Rabi season of 2022-23. Conducted at the Long-Term Fertilizer Experiment (LTFE) research farm of the Soil Science Department, Dr. Panjabrao Deshmukh Krishi Vidyapeeth (PDKV), Akola, the study utilized a Randomized Block Design (RBD) with 12 treatments, each replicated three times. Treatments included varying levels of manure and fertilizers as, T1-50 % NPK, T2-100 % NPK, T3-150 % NPK, T4-100 % NPK S free, T5-100 % NPK + Zn @2.5 kg ha -1, T6-100 % NP, T7-100 % N, T8- 100 % NPK+FYM@5 t ha-1, T9- 100 % NPK, T10- FYM @10 t ha-1, T11- 75 % NPK + 25 % N through FYM, T12- Control (No manures and fertilizer). The study focused on the impact of continuous manuring and fertilization on nitrogen, phosphorus, and potassium availability in the soil.

Results indicated that long-term nutrient application significantly influenced the availability of these essential nutrients. Available nitrogen content varied from low to medium, with the highest levels observed in the 100% NPK+FYM@5 t ha^{-1} treatment and the lowest in the control. Phosphorus content ranged from very low to moderately high, also peaking in the 100% NPK+FYM@5 t ha^{-1} treatment. Potassium content varied from very low to very high, with the highest increase observed in the 100% NPK+FYM @5 t ha^{-1} treatment compared to the control. The findings highlight the importance of balanced nutrient application for maintaining soil fertility and enhancing crop productivity in long-term cropping systems.

Keywords: continuous manuring, nutrient availability, soil fertility, crop productivity, sorghum-wheat sequence

Evaluating the interaction of zinc and copper on biochemical activities of vegetatively grown *Bacopa monnieri* (L.)

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To find out the effect of foliar application of zinc and copper alone/combinations on biochemical activities of *Bacopa*, an experiment was conducted during two successive years (2019-2020) of field experiment at GBPUA&T, Pantnagar. The treatments of $ZnSO_4$ and $CuSO_4$ given as (BM0: CONTROL; BM1:1ppm Cu; BM2:2.5ppm Zn; BM3:5ppm Zn; BM4:0.5ppm Cu+5ppm Zn; BM5:1ppm Cu+2.5ppm Zn; BM6:1ppm Cu+5ppm Zn). Two foliar application was given in 30 days of interval and samples were collected and analysed after 10 days of each spray. The experimental results revealed that the biochemical traits shown significant increment mostly with 1ppm $CuSO_4$, 2.5ppm $ZnSO_4$ and 5ppm $ZnSO_4$ in photosynthetic pigments over control during 2019-2020. The plants response to 2.5ppm $ZnSO_4$ significantly increased the Nitrate reductase activity and Protein content when compared with control in both year. The highest total phenolic content noticed when plants subjected to 5ppm $ZnSO_4$ than control during 2019 whereas the highest values achieved at 1ppm $CuSO_4$+5ppm $ZnSO_4$ over control in 2020. The maximum value of flavonoid noticed when plants subjected to 1ppm $CuSO_4$ and 5ppm $ZnSO_4$ over control during 2019 while, higher values pronounced with 2.5ppm $ZnSO_4$ when compared with control. Most of the results showed that Zn concentration increased with 1ppm Cu+5ppm Zn treatment and Cu content recorded rise at 2.5ppm Zn treatments during 2019. Similar trend observed Zn content rise almost in 1ppm CuSO4+5ppm ZnSO4 level but 1ppm CuSO4+ 2.5ppm ZnSO4 and 1ppm CuSO4 recorded highest Cu content that of control during 2020. The plant response to 2.5ppm Zn treatment gave the highest content of bacoside-A. These results suggested that Zn and Cu directly elaborate importance on the biochemical parameters and improves the quality of *Bacopa* in production of Bacoside.

Keywords: Flavonoid, Phenol, Bacoside

Species Composition of Paddy Stem Borer in Himachal Pradesh

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Rice (Oryza sativa L.) is a vital global food crop, but its production is significantly hindered by insect pests, particularly stem borers, which can cause substantial yield losses. They are notorious for their detrimental impact on rice at various growth stages, including vegetative and reproductive stages, manifesting as "dead heart" and "white ear" symptoms. This study aimed to collect comprehensive data on stem borer species by surveying and identifying stem borer species across key rice-growing districts of Himachal Pradesh. By conducting field surveys in Kangra, Mandi, Una, Sirmour, Solan, and Chamba districts, and rearing the collected larvae at the Rice and Wheat Research Centre, CSK Himachal Pradesh Krishi Vishvavidyalaya, the study analyzed species presence and distribution during the maximum tillering and dough stages. The study identified *Scirpophaga fusciflua* as the most prevalent stem borer species across multiple districts, including Kangra, Mandi, Una, and Chamba. In contrast, *Scirpophaga incertulas* and *Sesamia inferens* were more localized, with *S. incertulas* present in Una, Sirmour, and Solan, and *S. inferens* confined to Kangra. Specifically, in Kangra, *S. fusciflua* constituted 75.47% and 82.35% of the stem borer population during the maximum tillering and dough stages, respectively, while *S. inferens* was less prevalent. In Mandi, only *S. fusciflua* was recorded. In Una, both *S. fusciflua* and *S. incertulas* were found, with *S. fusciflua* representing 68.75% and 66.67% of the population during the respective stages. *S. incertulas* was observed in Nalagarh (Solan), while *S. fusciflua* was predominant in Sihunta (Chamba). The study highlights the dominance of *S. fusciflua* in most districts and provides insights into the altitudinal preferences of the different species. This research addresses a critical gap by detailing stem borer distribution and species in Himachal Pradesh, enhancing our understanding of regional pest dynamics and aiding in the creation of targeted pest management strategies which will thereby aid in reducing rice yield losses.

Speed Breeding in Wheat using Doubled Haploidy Approach

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Conventional breeding programs often require many years and generations to develop homozygous lines. To speed up this process, the production of doubled haploids (DHs) is a crucial biotechnological tool. This technique not only achieves homozygosity but also stabilizes transgenes or mutations in the genome in a significantly shorter time. The use of doubled haploids in wheat and barley has been invaluable for plant breeders, leading to the release of numerous new cultivars. Among the various techniques for efficient haploid production, chromosome elimination and in vitro anther culture are the most effective and widely used in wheat and barley, respectively.

In wheat, chromosome elimination doubled haploidy using *Imperata cylindrica* has been employed to develop doubled haploid lines. The florets of F_1 plants are hand-emasculated 2-3 days before anthesis and pollinated with fresh pollen from *I. cylindrica*. The uppermost internodes of the pollinated wheat spikes are injected with a 100 ppm solution of 2,4-D 24 hours after pollination for two consecutive days. After harvesting, the spikes containing pseudoseeds with embryos are cultured on MS medium. Out of 245 florets of wheat F_1 pollinated with *I. cylindrica*, 78.4% formed pseudoseeds, 12.22% formed embryos, and 15.30% regenerated into haploid plants.

Overall, the doubled haploidy approach has significantly advanced the breeding of wheat and barley, providing a faster and more efficient pathway to develop new, stable cultivars. This method continues to be a cornerstone in modern plant breeding, offering promising prospects for future agricultural innovations.

Socio economic characteristics and livelihood status of fisherwomen involved in post-harvest activities of marine fisheries

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Fishing is the major source of livelihood for the people who are living along the coastal line. Women accounts 47.00 per cent of global fisheries work force. Active marine fishing was undertaken by men after the fish lands it is the women who will take care of the catch. Their involvement was more in post-harvest activities like grading, cutting, cleaning, drying, salting and marketing *etc.,* Involvement of women in these activities provide additional income to their families. Yet their involvement is unrecognized ad unorganised. Hence the present study was conducted to know the livelihood status of fisherwomen involved in marine fisheries. The study was conducted in Uttara Kannada district of Karnataka during 2023-24. 120 fisherwomen were selected through purposive random sampling method. Interview schedule was used to collect the data, frequency, percentage, mean, SD, indices were used to analyse the data. Study revealed that half (50.00 %) of the respondents belonged to young age, cent per cent of them belonged to backward caste, most of them were illiterates, vast majority (95.00%) were married and had nuclear families, two third of the respondents medium level of annual income. Medium level of mass media usage and organizational participation. Low extension participation. Great majority (95.00 %) of the respondents involved solely in fisheries activities, very few of them involved in business, wage labour, dairy and poultry activities along with fisheries. To measure the livelihood five capitals were considered, under each component sub-components were considered. Among these five financial capital indices was high with 67.69 followed by physical capital (66.57), human capital (61.04) and social capital (51.82). Less than half (40.83 %) of the respondents' families had medium level of livelihood followed by low level (37.50 %) and high level (21.67 %). Fisherwomen the study area solely depending on fisheries activities and less than half of them had medium level of livelihood so government and local extension official, department officials should encourage them to take up other livelihood activities along with fisheries and government should provide awareness about policies and various schemes.

Keywords: Livelihood status, socio economic characteristics, marine fisheries, fisherwomen

Sustainable Screen Printing: Utilizing Nepeta cataria for Eco-Friendly Dyeing of Cotton Fabrics

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The primary means of coloration before the advent of synthetic dyes are natural dyes derived from sources such as roots, leaves, bark, flowers, wood, nuts, seeds, insects and minerals. Synthetic dyes quickly dominated the market due to their ability to meet global demands, However, their widespread use has raised significant health and environmental concerns which made the scientists to focus their research on natural dyes. This study reconnoitres the use of leaf extract of *Nepeta cataria* (Catnip) as a natural dye for screen printing. The dye was extracted through an aqueous process and utilized as a colouring pigment in the print paste. Four different mordants like ferrous sulphate, alum, copper sulphate and stannous chloride were devoted to achieve a diverse range of hues. The printed fabrics were rigorously evaluated for colour fastness. Results demonstrated that each mordant produced distinctive shades like dark brown with ferrous sulphate, light yellow with alum, dark brown with copper sulphate, and the light brown with stannous chloride. Excellent fastness properties were exhibited with the combination of Catnip leaf dye and copper sulphate mordant, highlighting the dye's durability and potential for practical use. In addition to offering a sustainable alternative to synthetic dyes, this study highlights the versatility of *Nepeta cataria* as a natural dye source, capable of producing a spectrum of colours with simple variations in mordants. This research contributes to the growing body of knowledge on eco-friendly textile practices and underscores the importance of reviving natural dyeing techniques in the pursuit of sustainability in the fashion and textile industries.

Keywords: *Nepeta cataria, mordants, natural prints, fastness properties*

EVALUATING BONE HEALTH DURING AGEING IN DOGS

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The current study was carried out on apparently healthy dogs which were brought to the Referral Veterinary Polyclinic, ICAR-Indian Veterinary Research Institute, Izatnagar and dogs from neighbouring areas of Bareilly. A comprehensive clinical examination, hematological examination, biochemical examination, urinalysis, oxidant-antioxidant indices, radiographic examination in the first phase. In the second phase, an ameliorative investigation for the changed oxidative stress characteristics by administering Vitamin D3 was done. Dogs were grouped into 2 groups based on their age with eight animals in each group i.e. less than 8 years and greater than or equal to 8 years. The RBCs count, Hb, packed cell volume, total leukocyte count and % lymphocytes were all significantly lower ($P<0.05$) whereas platelets count, % neutrophils and % eosinophils were all considerably higher ($P<0.05$) in geriatric dogs. Significantly greater levels of total protein, globulin, ALT, ALP and BUN were found. The A:G ratio, albumin and glucose levels, on the other hand, were considerably ($P<0.05$) lower in geriatric dogs. Urinalysis revealed a significantly ($P<0.05$) decreased urine specific gravity. Urine pH was found to be non-significant with the advancement of age in dogs. The loss of bone mass may be linked to a drop in albumin levels as albumin is necessary for bone matrix production and bone health. Increased serum total alkaline phosphatase may imply faster bone turnover, suggesting age-related bone loss caused by increased bone turnover. Oxidative stress indicators change significantly with age and vitamin D3 treatment has been shown to improve antioxidant defence responses.

Tiny but Mighty: Microalgae's Role in Aquatic Health

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Although minute in size, microalgae are photosynthetic organisms, making them vital to the sustenance of ecosystem health in aquatic systems. This paper investigates the crucial role of these microalgae in both freshwater and marine environments. Microalgae play an important role as primary producers, thus serving as the foundation of aquatic food chains that move various lives. They contribute a large part to global oxygen production and have an immense significance in the recycling of nutrients, thus maintaining water quality. Microalgae also act as natural bio-remediators, absorbing excess nutrients and contaminants. Due to their sensitivity to environmental changes, they are valuable bioindicators that can be used to monitor an ecosystem. In addition, microalgae hold vast potential for use in biotechnology, spanning from biofuel production to pharmaceutical development. This thus underlines the enormous importance of understanding the potential of these small organisms for efficient management in water ecosystems, their preservation, and the sustainable use of their resource potential.

Keywords: Microalgae, Aquatic ecosystems, Bioremediation, Aquatic Health

Standardisation of bunch trimming in banana for export quality fruit yield and profitability

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The present investigation was carried out during the year 2019-20 to 2021-22 at Agriculture Research Station, Achalpur under Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India to evaluate the effect of bunch trimming on yield, quality and economics of banana crop. The experiment was conducted in RBD comprising of five treatments of retention of hands (6, 7, 8, 9 and 10 hands immediately after opening of last hand) and replicated four times. Pooled data of three years reveled that non-significant effect due to different treatments were found in plant height, stem girth, number of leaves, peel weight and pulp to peel ratio in banana. Significantly maximum length (20.19 cm), girth (13.80 cm) and weight of fruits (170.28 g) along with pulp weight (115.50 g) were recorded in retention of 6 hands per bunch. Whereas, significantly the maximum number of fruits/bunch (151.22), bunch weight (23.78 kg) and yield (105.59 t/ha) were noticed in banana by retention of 10 hands per bunch. Excellent export quality standard fruits, maximum net return and B:C ratio were observed in retention of 9 hands per bunch followed by 8 and 7 hands per bunch.

Keywords- Bunch trimming, retention of hand, yield, bunch weight, profitability

SINGLE BUD TRANSPLANTING TECHNIQUE IN TURMERIC TO MINIMIZE THE SEED COST

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Turmeric (*Curcuma longa*) is one of the most remunerative crops of North East region. During the off-season, its price in Tripura increases to Rs. 200/kg. Farmers of Tripura are hesitant to plant turmeric despite the crop's favorable price in the market because of the high cost of production and the scarcity of high-quality planting materials. In conventional method of planting, seed rhizome requirement varies from 1500 to 2500 kg/ha depending on seed size and spacing. Approximately 45% of the entire cultivation cost goes toward seed acquisition. Because of this reason, Tripura's area used for turmeric cultivation is gradually shrinking. Therefore, to alleviate the burden on farmers due to high production cost, KVK Sepahijala had taken up FLD in two villages of Sepahijala District during 2023-2024 to demonstrate the single bud transplanting technique in turmeric. Rhizome are cut into small pieces of 5-6g containing single bud and treated with mancozeb (0.3%) for 30 min and sown in potrays using growing media containing (Sand: Soil: FYM@1:1:1) in march and kept under polyhouse. After 30-40 days well developed seedlings are transplanted in main field .95% survivability has been recorded in single bud transplanting technique of turmeric. This technique has recorded higher yield of 67.5q/ha with B:C ratio of5.5:1 as compared to yield (65.4/ha) of conventional method and B:C (3.9:1). Higher Net return of Rs 386500 was recorded in single bud transplanting technique and net return of Rs 351800 was obtained in conventional method. In single bud transplanting technique, the cost of cultivation (Rs.86000) is reduce to 34% of conventional method (Rs.120240).

Keywords: Single bud transplanting, Turmeric and rapid multiplication.

A review on value added fish products.

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Value-added fish products represent an important segment in the seafood industry, aiming to enhance the economic value and marketability of fish by transforming them into ready-to-cook or ready-to-eat products. These products are developed through various processing techniques such as filleting, marinating, breading, smoking, canning, and fermentation, which improve sensory attributes, shelf-life, and nutritional quality. The production of value-added fish products involves the application of scientific principles to optimize product quality, safety, and sustainability. For example, advanced marination and curing techniques are employed to enhance flavour and texture, while innovative packaging technologies such as vacuum and modified atmosphere packaging are used to extend shelf-life by inhibiting microbial growth. Additionally, the use of bio-preservatives and antioxidants plays a critical role in maintaining product quality and ensuring food safety. The development of value-added fish products also focuses on minimizing waste and utilizing by-products, contributing to a more sustainable seafood industry. By converting lower-value fish species and by-products into high-value items like fish protein hydrolysates, fish oil supplements, and surimi-based products, the industry can maximize resource utilization and reduce environmental impact. Furthermore, value-added fish products provide to evolving consumer preferences for convenient, healthy, and sustainably sourced seafood options. Innovations in product formulation, such as incorporating omega-3 fatty acids, reducing sodium content, and using plant-based coatings, align with consumer demand for nutritious and environmentally friendly products. Overall, the creation of value-added fish products plays a pivotal role in enhancing the economic viability and sustainability of the seafood industry.

Keywords: Fish products, value addition, by-products, ready to eat products, ready to cook products.

Vertical farming - A scientific and futuristic approach for gerbera cultivation

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In the present context of escalating population and shrinking agricultural area, vertical farming is reputed as the viable option for assuring self-sufficiency and nutritional security. However, deploying the appropriate type of soil-less system, growth substrate and nutrient formulation seems inevitable to achieve greater productivity and flower production as these factors influence the stability of the vertical structure, root growth and nutrient uptake. Keeping these points in view, an investigation was carried out at ICAR-Indian Institute of Horticultural Research, Bengaluru to standardize the package of practices for vertical farming of gerbera var. Arka Nesara. The outcomes of the study are as follows: aggregate wick system on pots improved the leaf area (148.65 cm^2), flower stem quality and vase life (9.2 days) of gerbera with an appreciable yield of 30.16 flowers/ plant/ year; growth substrate comprising Arka Fermented Cocopeat, FYM and rice husk (1:1:1 v/v) significantly enhanced the numbers of leaves (13.64/ plant), flowers (29.62/ plant) and stalk length (48.81 cm); and the nutrient formulation containing 75 g calcium nitrate, 46 g potassium nitrate, 5 g potassium sulphate, 3 g ammonium phosphate, 14 g magnesium sulphate and 25 g potassium phosphate (in 1 l) exhibited superior vegetative growth, earlier flowering (128.36 days) and improved yield (34.17 flowers) when supplied at 600 ppm during vegetative phase and 1000 ppm during flowering phase. The water use efficiency also amplified by 83.46 % under wick system as compared to drip system. Furthermore, it was observed that the structures facing the east direction obtained superior results followed by west. Most importantly, the vertical system with 22 plants/ m^2 maximized the productivity by 2.5 times than the conventional system with 7-10 plants/ m^2. However, the government and institutional intervention through subsidies and funds acts as huge thrust in the successful adoption of vertical farming by farmers.

Keywords: Growing media, Hydroponics, Nutrition, Soil-less system and Wick system

107Soil and water pollution and human health

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Healthy soil is essential for human health. While soil is not something we physicians consider very often in our daily work, soil is in fact, a key component of our planet's infrastructure and it is foundational to human health. Healthy soil is essential for the production of safe, healthy, sufficient food. Healthy soil supports richly diverse ecosystems that provide services critical to human survival, most notably pollination. Healthy soil stores water and protects waterways, thus preventing floods and waterborne diseases. Healthy soil captures vast quantities of carbon and slows the pace of climate change. Soil pollution is defined as contamination of soil at higher than normal concentrations by waste materials of human origin that have adverse effects on human and ecosystem health. Soil pollutants include heavy metals and toxic organic chemicals such as pesticides, biological pathogens, and plastic waste. Air pollution is the most visible and best-studied form of pollution, and images of smoke puffing out of train engines and fumes coming out of exhaust pipes are common and easily recognizable. In contrast, soil pollution is not so easily observable, and the adverse effects of soil pollution on human health are much less well characterized and are not adequately quantified. Soil is important for human health in a number of ways. Approximately 78% of the average per capita calorie consumption worldwide comes from crops grown directly in soil, and another nearly 20% comes from terrestrial food sources that rely indirectly on soil. Soil is also a major source of nutrients, and it acts as natural filters to remove contaminants from water. The thin crust of the Earth's surface supports all terrestrial life and is involved in the regulation and provision of many key ecosystem services that are essential to the environment and to human health and well-being. Soil is the foundation of the agri-food system and the medium in which nearly all food-producing crops grow—about 95% of the food we eat comes from the soil. After the oceans, soil is the largest active carbon store and one cubic metre of soil can store up to 600 L of water, allowing crops to grow even during dry periods.

Keywords: Land degradation, Climate change, Pollution, Human Health

Role of wheatgrass in colon cancer prevention

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Colon cancer is common gastrointestinal cancer. Role of wheatgrass as an alternative preventive therapy in colon cancer needs to be explored experimentally. Present study aimed at establishing minimum dose of wheatgrass with maximum protection for prevention of colon cancer in rats.

Materials and Methods: 36 male Sprague Dawley rats were split in 6 groups with each group having 6 animals. Weekly 30mg/kg body weight1, 2- dimethyl hydrazine (DMH) was injected subcutaneously for 16 weeks to animals of cancer group. 6 animals in each group were given normal saline,120 mg alone wheatgrass and 80,100,120mg/kg body weight wheatgrass with DMH to 6 animals in each group. Biochemical and histological changes were done by standard methods.

Result: Lipid peroxidation (LPO)levels were significantly increased in those rats which were treated with DMH only (group 2) in comparison to control (group 1) while Glutathione (GSH) levels, catalase and Superoxide dismutase (SOD)were decreased significantly. LPO levels in DMH + wheatgrass groups were reduced with increasing dosage of wheatgrass from 80mg to 100mg and GSH, SOD and catalase decreased. 100mg and 120mg dosages of wheatgrass showed significant reduction in LPO and increase in GSH, SOD and catalase as compared to DMH group but not much difference between two groups.

Vulnerable Employment among Rural Youth in Karnataka State: A Study of Sustainable Livelihood Capitals

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Agriculture in India sustains over half the population, faces a critical challenge as its youth disengage from this sector due to low incomes and high risks, which impedes agricultural reform and competitiveness in the global food market. In 2021, a study was conducted in Karnataka's Mandya and Ramanagara districts, focusing on assessing the vulnerable employment among 120 randomly selected rural youth in agriculture through constructing a vulnerable employment index. The study revealed that the overall composite vulnerable employment index was 0.63, with human capital being the highest contributor to vulnerable employment (0.80), followed by financial capital (0.78), physical capital (0.68), natural capital (0.63), and social capital (0.57). Notably, 67.50 per cent of surveyed youth face moderate to highly vulnerable employment, primarily due to deficiencies in human capital (72.50%), financial capital (72.50%), natural capital (79.16%), and social capital (77.50%). However, there is a glimmer of hope in the relatively lower vulnerability in physical capital (48.33%). This research highlighted the urgent need to address vulnerable employment among rural youth in agricultural endeavour by investing in relevant skills training and education, providing access to financial resources, ensuring sustainable management of natural capital, and fostering strong social capital through mentorship programs and community engagement.

Study on nutrient content of Cabbage and Lettuce using hydroponic technique

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This study is aimed to determine the effect of aqua cultural sludge (ACS) and cow urine as an organic nutrient solution (ONS) on the growth and yield to evaluate the impact of water usage on the development and nutrient uptake of *Brassica pekinensis* L.(Chinese cabbage) and *Lactuca sativa* L. (Lettuce) cultivated in a hydroponic system. The treatment used contains a combination of ACS, nutrient solution (AB mix) and cow urine. The highest plant growth, yield and the highest foliage fresh weight was observed in treatment with cow urine, with values of 1kg (Chinese cabbage), 300 g (lettuce). It was concluded that a mixture of ACS and cow urine has the potential to reduce the inorganic fertilizers use as a nutrient solution in a hydroponic system.

Keywords: Aqua cultural, cow urine, hydroponic, nutrient solution.

Agricultural processing machinery/technologies: An approach to amplify the Farmers' income

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Agro processing equipments/technology contribute an important role in food and feed preservation for the continual survival of man. It has led to the development of multipurpose machines/ technologies such as maize sheller, garlic stock cutter cum grader, bael fruit pulper, automated photochemcial treatment chamber, aonla pricking machine, carrot washer, fruits and vegetable washer, carrot twig cutter, potato chips, drying of shatawer and hand operated potato peeler. Agricultural processing machines involve the different types of unit operations such as cleaning, grading, sorting, drying, milling, storage of food grains in the processing of crops after harvest to prepare them for on-site marketing or processing and packaging. The agro processing equipments as mentioned above were tested for its performance and it was found that the capacity of power operated maize sheller was 75.8 kg/h followed by garlic stalk cutter cum grader (175.3 kg/h), multipurpose juice and pulp extracting machine (54.75 kg/h for aonla processing and 53.8 kg/h for kinnow processing and 56.6 kg/h for carrot processing), bael fruit pulper (200 kg/h) and spice grinder (29.1 kg/h) while benefit cost ratio (B:C ratio) of Power operated maize sheller was 4.7 followed by garlic stalk cutter cum grader (10.64), multipurpose juice and pulp extracting machine (12.46 for aonla processing and 10.98 for kinnow processing and 1.44 for carrot processing) and spice grinder (4.25). Technology in agricultural processing has led to improve the quantitative and qualitative values through servicing and development of agricultural processing equipment for farmers as well as small entrepreneurs.

INSECTICIDAL RESURGENCE OF RED SPIDER MITE, Tetranychus macfarlanei ON OKRA AT AKOLA

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Red spider mite, Tetranychus macfarlanei Baker and Pritchard is predominantly occurs on okra at Akola, Maharashtra. Frequent use of higher dose of insecticides against insect pest on okra results in destruction of natural enemies; and eventually result in the resurgence of mites. An experiment was conducted during Kharif, 2017 and 2018 at experimental plot of Department of Entomology, Dr. PDKV, Akola to know the possible effect of Imidacloprid 17.8 SL, Thiodicarb 75 WP, Lambda- cyhalothrin 4.9 CS, and Quinalphos 25 EC at recommended and double than recommended dose on resurgence of T. macfarlanei under field conditions, if any. 2.5 cm^2 area of six leaves from each randomly selected five plants was observed with magnifying hand lens on a day before spray and on 3, 5 and 7 days after each spray application. Square root transformed data was analyzed by ANOVA technique. Least mite population was observed in unprotected plot compared to protected plots which indicated that the mite have potential to resurge against major insecticides. In Kharif, 2017 highest resurgence was reported in quinolphos 25 EC @ 4 ml/ lit (83.07%). Whereas, in Kharif, 2018 imidacloprid 17.8 SL@ 0.4 ml/ lit showed highest resurgence of 428.2%. Highest resurgence of mite population was observed when commonly used insecticides, quinolphos and imidacloprid sprayed at double dose than recommended. Shaw and Wallis (2008) reported overuse of carbaryl lead to outbreaks of aphids and spider mites. According to Szczepaniec and Raupp (2013) the increased population of Eurytetranychus buxi was associated with imidacloprid. Patil et al. (2018) revealed that, in T. urticae field recommended doses of sulphur induced heavy resurgence (16 .55%) with resurgence ratio of 1.05.

A Sustainable Approach: Biochar and its potential use in agriculture

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There are about 15 billion tons of carbonaceous waste produced worldwide each year. If this waste could be used efficiently to generate energy and provide long-lasting environmental benefits, it could make a major contribution to global development. Biomass pyrolysis is emerging renewable energy and material conversion technology that can produce carbon-based biochar and syngas (a mixture of carbon monoxide and hydrogen) for fuel and environmental benefits. Since biochar can be stored in the ground, this renewable energy and material conversion technology are sustainable, and it also has the potential to increase crop production by enhancing the ability of plants to extract nutrients from the soil. Biochar produced from waste biomass may also decrease the negative effects of agricultural land use on the water cycle. This document reports on the status of biochar research discusses the environmental and economic benefits associated with biochar production and also summarizes the potential and opportunities for biochar use in agricultural systems.

Keywords: Biochar, Agriculture, Climate Change, Pyrolysis

Effect of growing media and chemical fertilizers on growth and yield of sweet pepper (*Capsicum annuum* L. var. grossum) cv. Orobelle under naturally Ventilated polyhouse

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An experiment was carried out to study the Performance of soilless growing media in relation to different fertigation levels on sweet pepper (*Capsicum annuum* L. var. grossum) cultivar orobelle grown under naturally ventilated polyhouse in the year 2021 at Experimental Farm Chhapang of Dr. Khem Singh Gill Akal College of Agriculture, Eternal University, Baru Sahib. The trial was laid out in Randomized Block Design with three replications and twelve treatment combinations comprising of four growing media Vermicompost + Sand + (3:1), Sawdust + Vermicompost + Sand + (1:3:1), Cocopeat + Vermicompost + Sand + (1:3:1) and FYM + Sand + Soil + (1:2:1) and three fertigation levels 100kg NPK/ha, 150kg NPK/ha and 200kg NPK/ha. The result revealed that growing media Vermicompost + Sand + (3:1) and fertigation level 200kg NPK/ha recorded maximum vegetative characters (days to first flowering, plant height, plant spread, leaf area, number of leaves per branch and internode distance) and qualitative characters (pericarp thickness, ascorbic acid and TSS), while 150kg NPK/ha fertigation level showed best result in carotenoids. Among different treatment combination Vermicompost + Sand + (3:1) + 200 kg NPK/ha performed best for vegetative and qualitative characters (pericarp thickness and TSS), while Vermicompost + Sand + (3:1) + 150 kg NPK/ha recorded maximum carotenoid and ascorbic acid under this investigation.

Keywords: Growing media, Fertigation, Ascorbic acid, FYM

STUDIES ON SEED GERMINATION OF KHIRNI (*Manilakara hexandra* L.) SEEDLINGS UNDER LABORATORY CONDITION

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Studies were carried out on seed germination and subsequent growth of Khirni (*Manilkara hexandra* L.). seedlings under laboratory condition at Seed Technology Laboratory, Late Shri Vasantrao Naik Marahwada Agricultural University, Parbhani (M.S.), India during the year 2006-07 and 2007-08. Among the various seed soaking treatments given to Khirni seed, GA_3 200 ppm seed soaking treatment for 24 hours was the best for increasing germination percentage and subsequent growth of Khirni seedlings under laboratory condition. While the treatment control i.e. no soaking recorded least germination percentage and subsequent growth of Khirni seedlings.

Keywords: GA_3, seed germination, subsequent growth, Khirni, laboratory.

Enhancing Crop Resilience: The Role of Genetic Engineering in Biotic and Abiotic Stress

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In the face of a rapidly changing climate and escalating global food demand, enhancing crop resilience to both biotic and abiotic stresses is a critical challenge in modern agriculture. Genetic engineering has emerged as a powerful tool to address this challenge by enabling the precise modification of crop genomes to improve tolerance to various environmental stresses, including drought, salinity, extreme temperatures, and pest and disease pressures. This approach offers significant advantages over traditional breeding methods by allowing the direct introduction of desirable traits, often from unrelated species, to confer stress tolerance. Abiotic stresses, such as drought and salinity, severely limit crop productivity by disrupting physiological processes like photosynthesis, nutrient uptake, and water use efficiency. Genetic engineering has facilitated the development of crops with enhanced tolerance to these stresses by introducing genes that regulate osmoprotectants, antioxidant defense mechanisms, and stress-responsive signaling pathways. For example, transgenic crops expressing genes for the production of osmoprotectants like proline and glycine betaine have shown improved drought and salt tolerance by maintaining cellular homeostasis under stress conditions. Additionally, the manipulation of genes involved in the synthesis of stress hormones, such as abscisic acid (ABA), has been employed to improve stress perception and response mechanisms in plants.

Biotic stresses, including those caused by pathogens, insects, and herbivores, also pose significant threats to crop yield and quality. Genetic engineering has enabled the introduction of resistance genes that confer enhanced protection against these biotic factors. For instance, crops engineered to express Bacillus thuringiensis (Bt) toxins have exhibited resistance to insect pests, reducing the need for chemical pesticides and promoting environmentally sustainable agriculture. Furthermore, advances in CRISPR-Cas9 gene-editing technology have allowed for precise modifications of crop genomes to enhance resistance to specific pathogens, offering a targeted approach to biotic stress management. The integration of genetic engineering with conventional breeding and other biotechnological approaches holds great promise for developing resilient crop varieties capable of withstanding the dual threats of biotic and abiotic stresses. This will be essential for ensuring food security and agricultural sustainability in the era of climate change.

ASSESSMENT OF EFFICACY OF 0.5% GLUTAMIC ACID FORTILFIED LEAF FED TO CSR DOUBLE HYBRID LARVAE AT FIELD LEVEL IN J&K AND HP

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The field level experiment was conducted during autumn season (September-October) 2023 at Jammu & Kashmir (J&K) and Himachal Pradesh (HP). The autumn season is characterised with poor leaf quality due to attack of pests (leaf webber), diseases (Powdery mildew and leaf spot), early leaf senescence along with fluctuating environmental conditions. The average cocoon yield during autumn season is 20-25kg/ 100DFLs whereas in spring (May-June) 40-45 kg/100 DFLs. To overcome these conditions silkworm larvae were supplemented with 0.5% Glutamic acid during autumn season to improve the cocoon yields at farmer level. A total of 10 farmers as treatment and 02 farmers as control were selected at Pulwama & Shopian of Jammu & Kashmir and Ghumarwin of Himachal Pradesh. In both the test sites CSR double hybrid (FC2xFC1) was supplied to farmers from their respective state departments after chawki rearing and scientists of Central Silk Board provided 0.5% Glutamic acid to farmers and demonstrated the application method during 4th and 5th instar. In treatment, silkworm larvae were fed with 0.5% Glutamic acid once in a day during 4th and 5th instar whereas in control no application was recommended and normal silkworm rearing practices were followed. The average cocoon yield/ 100 DFLs recorded 40.22 kg and 36.62 kg in treatment and control respectively at Himachal Pradesh with an improvement of 8.95%. The average revenue gain per farmer is Rs. 2160/-. In case of Jammu & Kashmir the average cocoon yield/ 100 DFLs recorded 54.60 kg and 51.50 kg in treatment and control respectively with an improvement of 5.68%. The average revenue gain is Rs. 1860/- per farmer.

Keywords: Autumn, Glutamic acid, Mulberry, Silkworm

Genetic Polymorphism in 220 bp Fragment of HSP 70 Gene in Kankrej Cattle of Semi-Arid region, North Gujarat by PCR-SSCP

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Heat Shock Proteins (HSPs) known as molecular chaperones are essential for cells' ability to recover from stress and serve as the primary defence mechanism within cells. They are extremely conserved and essential to the response to heat stress and cellular thermotolerance. Even though there are numerous HSP genes, in livestock species, heat tolerance is primarily associated with HSP 70. This gene polymorphisms have been linked to heat tolerance, milk production, fertility and cattle susceptibility to disease. They can be utilised as genetic markers to help choose animals that are more resilient to climate change, have stronger immune systems and perform better overall. Pertaining to the current need, a 220 bp fragment of bovine HSP 70 gene was subjected to Polymerase Chain Reaction- Single-Strand Conformation Polymorphism (PCR-SSCP) technique to identify the polymorphism Kankrej cattle (n=100) of semi-arid region, North Gujarat. Simultaneously, ambient temperature and relative humidity were recorded to calculate temperature humidity index and physiological parameters such as rectal temperature, respiration rate and pulse rate were also recorded in morning and evening during different seasons viz. winter, spring and summer seasons. PCR-SSCP pattern was associated with the thermotolerance traits in Kankrej cattle using the univariate GLM model of SPSS 26. HSP 70 gene (220 bp fragment) was found to be monomorphic documented on SSCP gel with only one genotype (AA) in all Kankrej cattle. It is concluded that genotype (AA) and its association with thermotolerance traits were found to be non-significant which indicate that the genotype (AA) is thermotolerant and adapted for heat stress particularly in this semi-arid region. Thus, this genotype of HSP 70 polymorphism is expected to be potential candidate to strongly predict cattle heat tolerance, aiding in selection as well as breeding programme for thermotolerance in cattle.

Modern aspects of crop production technologies Cost effective chemical and non chemical weed management in irrigated finger millet (*Eleusine coracana* L.)

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Field experiments were conducted to study the effect of different weed management practices in finger millet under irrigated condition at Regional Research Station, Tamil Nadu Agricultural University, Paiyur, Krishnagiri District, Tamil Nadu, India in two seasons of Summer during 2021-2022 and 2022 - 2023 in randomized block design with three replications. The treatments are Oxyfluorfen 0.05 kg/ha PE fb Power weeder on 30 DAT (T_1), Oxyfluorfen 0.05 kg/ha PE fb Manual operated weeder on 30 DAT (T_2), Isoproturon @ 0.5 kg a.i/ha fb Power weeder on 30 DAT (T_3), Isoproturon @ 0.5 kg a.i/ha fb Manual operated weeder on 30 DAT (T_4), Bispyribac-sodium 20 g/ha as EPOE on 15 DAT fb Power weeder on 30 DAT(T_5), Bispyribac-sodium 20 g/ha as EPOE on 15 DAT fb Manual operated weeder on 30 DAT (T_6), Power weeder on 15 and 30 DAT (T_7), Manual operated weeder on 15 and 30 DAT (T_8), HW on 15 and 30 DAT (T_9) and Weedy check (T_{10}). Among the treatments preemergence application of Oxyfluorfen 0.05 kg/ha PE + Power operated Mechanical weeder on 30 DAT performed better than other weed management methods. Recorded higher weed control efficiency of 66.0%, more number of effective tillers 6.8 plant-1 of 3698 kg ha-1 and straw yield 5877 kg ha-1 with BC ratio of 2.44.

Keywords: Irrigated finger millet, Herbicides, Oxyfluorfen, Isoproturon, Bispyribac-sodium, Power operated mechanical weeder, Manual operated weeder, Hand weeding

Organic Farming as a Climate Change Adaptation and Mitigation Strategy

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Climate change is one of the most serious challenges facing nations, governments, business and citizens over future decades. Climate change directly influences food production and will act as a multiplier of existing threats to food security and malnutrition. Rising global mean temperatures have already intensified droughts, heat waves, and storms, and altered life cycles and geographical ranges of pests, weeds, and pathogens, making crop and livestock production more difficult. According to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change IPCC (2007), the agricultural sector is estimated to account for 10–12 per cent or 5.1–6.1 Gt global greenhouse gas emissions and is responsible for 47 per cent and 58 per cent of total anthropogenic emissions of CH_4 and N_2O, respectively. Organic farming as a systematic approach for sustained biological diversity and climate change adaptation through production management, minimizing energy randomization of non-renewable resources; reduced GHG emissions and carbon sequestration is a viable alternative. As fossil fuel-based fertilizers and most synthetic pesticides are prohibited in organic farming, it has a significantly lower carbon footprint. Studies show that the elimination of synthetic nitrogen fertilizers alone could lower direct global agricultural greenhouse gas emissions by about 20 per cent. By increasing organic matter in soil continuously over time, organic agriculture improves water percolation by 15-20 per cent, replenishing groundwater and helping crops perform well in extreme weather like drought and flooding. A decades-long organic farming trial found that organic yields can be up to 40 per cent higher than non-organic farms in drought years. The purpose of potential organic farming is therefore to attempt a gradual reversal of the effects of climate change for building resilience and overall sustainability by addressing the key issues. Research is needed on yields and institutional environment for organic farming, as a mitigation and sequestration potential.

Key words: Carbon sequestration, Climate change, Greenhouse effect, Organic farming

THERAPEUTIC EVALUATION OF PACKED RBCs TRANSFUSION IN SEVERELY ANAEMIC DOGS

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Transfusion medicine has undergone advancements since its initiation in the early 20th century. Component transfusion being a goal directed therapy, aims to replace the specific component in affected animals and red blood cell (RBC) transfusions are a potentially life-saving therapy employed during the care of many critically ill dogs to replace losses in haemoglobin to maintain oxygen delivery to vital organs. In present study, whole blood units were collected aseptically from jugular vein of nine dog donors after their proper screening into commercially available double blood bag system containing CPDA-1 as anticoagulant. Component separation was carried out to produce pRBCs and platelet rich plasma with the help of single step spin centrifugation using cryofuge. A total of nine severely anaemic dogs reported at University hospital of LUVAS, Hisar, Haryana over a period of six months from April to September, 2023 underwent red blood cell transfusion. Two dogs treated with packed RBC died, whereas seven dogs recovered from critical phase. Recovered dogs showed significant ($p<0.05$) increase in various hematological parameters like Hb (g/dl), PCV (%) and TEC($\times 10^6/mm^3$) from pre-transfusion (Day 0) to post-transfusion (Day 3). The initial haemoglobin for pRBC was 3.19±0.46g/dl that increased significantly ($p<0.05$) to (4.63±0.51g/dl) and 4.99±0.56 g/dl) on Ist and 3rd day after transfusion respectively. The mean increase in PCV (%) after three days of transfusion was 7.6%. It's concluded that the transfusion of packed RBCs is clinically reliable option for management of severely anaemic dogs.

Keywords: Component therapy, red blood cell, blood transfusion, anemia, dogs

Effect of abiotic factors on emergence of objectionable weed Phalaris minor seeds

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The study was conducted on fresh seeds of objectionable weed Phalaris minor during 2023-24 to assess the effect of abiotic factors such as light, temperature, and burial length on emergence. The results revealed that maximum germination was recorded at alternating temperature of 15/20°C (95.33%) whereas minimum (62.00%) was recorded at 25/30°C. Less germination (74.66%) was recorded under 24 hours complete darkness as compared to 16 hours light followed by 8 hours darkness (89.77%). No hard seeds were found at any temperature or light/darkness. The radicle emergence was started after 72 hours under16 hours light followed by 8 hours darkness while it was started after 84 hours under complete darkness under alternate temperature of 15/20°C and 20/25°C. The alternating temperature of 15/20°C recorded the highest radicle emergence (65.11%) followed by 20/25°C (62.72%). The lowest radicle emergence (44.55%) was observed at higher temperature i.e. at 25/30°C (62.00%). Between the two light regimes i.e. 16 hours light/ 8 hours darkness recorded higher radicle emergence (63.92%) over complete darkness (51.00%).The field emergence as well as speed of emergence decreased as the burial depth increased from 4 cm to 8 cm and maximum emergence (32.00%) and speed of emergence (5.98) was observed at 4 cm while emergence (6.67%) and speed of emergence (0.41) at 8 cm. The above results may be used for control measure of Phalaris minor weed.

Keywords: Objectionable weeds, Phalaris minor, emergence, alternate temperature, light, abiotic factors

Growth Parameters of Groundnut as Influenced by Phosphorus and Sulphur Levels

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The field experiment was conducted during the Kharif season of 2021 at drought plots area, Crop Physiology Field Lab, Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar. The soil of the experimental site was sandy in texture, alkaline in reaction, low in organic carbon, available nitrogen and available sulphur, medium in available phosphorus and high in available potassium. The experiment was laid out in split plot design with four phosphorus levels (control, 40, 50, 60 kg P_2O_5 ha^{-1}) in main plots and four sulphur levels (control, 25, 50, 75 kg S ha^{-1}) in sub-plots with three replications. Among phosphorus levels significantly higher plant height at 30 DAS (14.45 cm), 60 DAS (38.60 cm), 90 DAS (53.90 cm) and maturity (56.31 cm) were recorded with 60 kg ha^{-1} phosphorus level, which were 41.1, 20.3, 9.6 and 11.3 percent higher over control, respectively. Non-significant variation regarding plant height was observed between 50 and 60 kg P_2O_5 ha^{-1}. With increasing dose of phosphorus root length increased at all stages of observation except maturity and the maximum root length was obtained with the application of 60 kg P_2O_5 ha^{-1}, which was significantly higher than control and statistically at par with 50 kg P_2O_5 ha^{-1}. At maturity, phosphorus levels failed to produce significant variation regarding root length. Root length of the groundnut receiving 60 kg P_2O_5 ha^{-1} was 11.9, 10.3 and 7.0 per cent higher over control at 30, 60 and 90 DAS, respectively. Plant height was significantly increased with increasing levels of sulphur up to 75 kg ha^{-1} at all stages of observation, but non-significant variation was observed between 50 and 75 kg ha^{-1}. Sulphur level of 75 kg ha^{-1} recorded significantly higher plant height at 30 DAS (13.74 cm), 60 DAS (36.94 cm), 90 DAS (53.26 cm) and maturity (55.15 cm), which were 38.9, 6.2, 6.2 and 5.3 percent higher over control, respectively. With the increasing levels of sulphur, root length increased at all stages except maturity and the maximum root length, i.e., 59.66 cm, 86.25 cm and 96.12 cm at 30, 60 and 90 DAS, respectively, were observed in the treatment 75 kg S ha^{-1} closely followed by 50 kg S ha^{-1} and these were 6.2, 7.7 and 3.8 per cent higher over control, respectively. So, based on the observed findings, it could be concluded that the application of 50 kg P_2O_5 ha^{-1} and 50 kg S ha^{-1} was most suitable for obtaining the better growth of groundnut.

Keywords: Groundnut, Phosphorus, Plant height, Root length, Sulphur

The Role of Public Administration in Shaping Sustainable Agriculture in Haryana

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Haryana, a major agricultural hub in India, has been at the forefront of agricultural production for decades. However, the state faces significant sustainability challenges, including groundwater depletion, soil degradation, and the impacts of climate change. This paper explores the role of public administration in shaping and advancing sustainable agricultural practices in Haryana implementing policies and programs that promote eco-friendly farming. It probes into the various policies, programs, and administrative measures implemented by the state government to address these challenges and promote environmental, economic, and social sustainability in agriculture. Initiatives such as subsidies for organic farming, training programs for farmers, and the promotion of water conservation techniques are key components. The paper also highlights the critical issues that threaten the long-term viability of the agriculture sector. There is an urgent need for sustainable practices that can maintain productivity while conserving natural resources. The study examines key initiatives such as Zero Budget Natural Farming (ZBNF), micro-irrigation, and organic farming, highlighting their objectives, implementation strategies, and outcomes. It also investigates the challenges and barriers faced by public administration, including bureaucratic hurdles, resource constraints, and farmers' resistance to change. Through case studies from various districts—Karnal, Kurukshetra, Hisar, Sirsa, Panchkula, Fatehabad, Rohtak, Bhiwani, and Gurgaon—the paper illustrates both the successes and limitations of these initiatives. Public administration facilitates these initiatives by providing training, financial incentives, and technical support to farmers, helping them transition to more sustainable practices. Additionally, policies promoting crop diversification and organic farming are analyzed for their effectiveness and impact on sustainability. The paper examines the role of public administration in supporting micro-irrigation systems and water conservation techniques, which aim to optimize water use and reduce dependency on depleting groundwater resources. The paper concludes with implications for policy and practice, suggesting that other regions facing similar challenges can benefit from Haryana's experiences.

Keywords: Crop diversification, Organic farming, Resource allocation, Sustainable agriculture, Water conservation

Nano technology for sustainable development of floriculture industry

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Flowers are highly perishable than other horticulture crops, and losses are also significantly higher than another sector, i.e., up to 30% to 40%. The losses of flowers are depending on pre-harvest factors, harvest factors, and post-harvest factors. If we save 5% to 10% of losses, it will effectively increase income per capita. To overcome these detections, the development of nanotechnology in the floriculture industry is one of the cutting-edge technologies of the 21st century. Nanotechnology is an art and science of manipulating matter at the nanoscale, i.e., nano = one billionth of a meter (10-9). At the nanoscale, the physical, chemical, and biological properties of materials can differ in fundamental and useful ways from the properties of bulk matter. The effective utilization of nanoparticles depends on the nature of the particles, technique of synthesis (top-down and bottom-up), type of nanoparticles (organic dendrimer, inorganic zinc oxide, nano silver, and carbon-based hydrogel), etc. Nanotechnology plays an avital role in crop improvement and their regulation, especially in the floriculture industry, which can be explained as in tissue culture (Ag, ZnO, and TiO_2 as disinfection, morphogenesis, dedifferentiation, somaclonal variation, and genetic transformation-dendrimer) and as ingredients to overcome biotic and abiotic stress. Nano-agrochemicals also help to avoid environmental pollution and reduce the cost of fertilizer, insecticides, and pesticides. Some research is conducted in flower crops to know the use of nanoparticles to improve yield and quality of flowers with different objectives, like more bulb yield in lily, the morphological and biochemical properties, leaf nutrient content, vase life of tuberose, and in vitro cultivation of carnation. Still some effective research is needed to improve the post-harvest life of flower crops and reduce the cost of cultivation.

Keywords: Floriculture loses 30%-40%, Nano particles, Disinfection, Biotic and Abiotic Stress, Nano Agrochemicals.

Changes in enzymatic and non-enzymatic activities of *Cicer arieitnum* L. under different concentrations of salt (NaCl) stress

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Worldwide, one of the biggest threats to crop growth is salinity. One of the main obstacles to sustainable agriculture is salinity, which reduces plant productivity worldwide by interfering with a variety of physiological, biochemical, and molecular processes. Particularly, transpiration, stomatal conductance, photosynthesis, growth, and germination are all hampered by salinity. Salinity causes osmotic stress and reduces turgor pressure and leaf water potential. Because salinity disrupts ion homeostasis and causes ion toxicity, it increases the amount of reactive oxygen species (ROS) in plant cells. As a result, it disrupts membranes, causes nutritional absorption abnormalities, and changes ultrastructure. Salinity thus causes ionic and osmotic stress. One of the most significant abiotic factors limiting agricultural productivity globally is soil salinity. Chickpeas cultivated in NaCl showed a decrease in the content of photosynthetic pigments. This study's primary goal was to assess how salt stress affected the photosynthetic pigments, lipid peroxidation, and enzymatic and non-enzymatic processes in chickpea plants. In order to examine how salinity stress affects chickpea plants' enzymatic and non-enzymatic antioxidant systems, the current study was conducted. Chlorophyll, carotenoid, protein, H_2O_2, MDA, phenol, and flavonoid concentrations, as well as the activities of catalase, peroxidase, and superoxide dismutase, were among the parameters examined. Many fundamental metabolic processes are disturbed when salt is present in plant cells, which has a detrimental impact on the growth and development of plants.

Influence of insect infestation on the bioactive components of wheat grains during storage period

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In temperate regions, wheat is the most important staple food grain and India ranks second producing 112.92 million tonnes of wheat which was 2.9% higher than the prior year. During post-harvesting period, wheat is infested by several insect pests due to its starchy seeds. Wheat grains produce some secondary metabolites namely phenols, tannins and flavonoids which help in imparting tolerance against the infestation. In the present study, ten different chromosomal segmental substitution lines (CSSLs) of wheat (Triticum durum) were infested with Rhyzopertha dominica and were subjected to biochemical analysis including total phenolic, tannin, flavonoid, starch, sugars and crude protein contents at 0, 30, 60, 90 and 120th days after infestation. During the storage period, PN 287 and PN 390 exhibited resistance to insect infestation while PN 295, PN 399, PN 275 and PN 288 were observed to be more susceptible. Total phenolic, tannin and flavonoid contents increased during later stages of storage after infestation. Control grains of PN 287 and PN 390 depicted least phenolic content and it was reported to be minimum even at 90th day after infestation compared to other varieties. The tannin content of grains reached its highest level on the 120th day after infestation. However, PN 287, PN 390, and PN 393 exhibited lower content due to their resistant nature. On the other hand, the flavonoid content remained unaffected until the 60th day, but showed a significant increase on the 90th day of infestation, followed by a decline on the 120th day. Similarly starch content also declined during storage on infestation with lesser grain borer while opposite trend was obtained for total soluble sugars which may be attributed to the degradation of starch during storage period. Thus, starch content was negatively correlated to total soluble sugars. In contrast to this, the crude protein content in the grains of CSSLs lines of wheat remained unaltered when infested with insect pest during different days of storage. Thus, bioactive constituents of wheat grains may act as indicators of resistance against Rhyzopertha dominica and as a consequence of its infestation, bioactive constituents of wheat grains get altered.

EFFECT OF QUERCETIN ON $PGF_{2\alpha}$ INDUCED CHANGES IN MYOMETRIUM OF MICE WITH EXPERIMENTAL DYSMENORRHOEA

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Primary Dysmenorrhea (PD) is one of the most common complaints among adolescent and young adult women and is the leading cause of absenteeism because of possible colic like pain due to contraction of myometrium induced by prostaglandins. Till date, the cause of dysmenorrhea remains unclear. Because of limitations of conventional treatments like NSAIDs and OCP's, herbal medicines are considered as feasible alternatives for the treatment of PD. Keeping all these facts in view the present study was carried out to screen the relaxant activity of quercetin on isolated mice uterus that is pre-contracted with $PGF_{2\alpha}$ and to compare relaxant activity of quercetin with ritodrine, a beta adrenergic agonist and role of COX inhibitor in mice with experimental dysmenorrhoea. The experiment was conducted in six groups. Group 1 was control or non dysmenorrhoeic group whereas Group 2 was experimental dysmenorrhoea group without any treatment. Group 3, 4, 5 and 6 received meloxicam (5 mg/kg) and quercetin (20, 40 and 80 mg/kg, PO) for 28 days followed by induction of experimental dysmenorrhoea. The uterine smooth muscle was pre-contracted with $PGF_{2\alpha}$ ($1.34x10^{-7}$M) and recorded dose dependent relaxation with Quercetin ($5x10^{-9}$ to $15x10^{-5}$ M) and ritodrine ($5x10^{-12}$ to $15x10^{-8}$M). Both quercetin and ritodrine showed dose-dependent tocolytic action on pre-contractile response of $PGF_{2\alpha}$. The histological and ultra-structural changes observed in uterus and altered hormonal levels of $PGF_{2\alpha}$, PGE_2, PGI_2, TXB_2 and NO in plasma and uterine tissue homogenates of dysmenorrhoea were restored to normal by both meloxicam and quercetin. Both meloxicam and quercetin could restore the histological and ultra-structural changes in myometrium. Quercetin has alone restored COX-2 up-regulation in dysmenorrhea. The present study revealed the potential of quercetin in relieving pain induced by $PGF_2\alpha$ in dysmenorrhoea.

KEYWORDS: Dysmenorrhoea, $PGF_{2\alpha}$, quercetin

Exogenous application of GA_3 influences morphological traits and developmental transitions in Or gene introgressed Indian cauliflower

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The present study aimed to evaluate the impact of GA_3 spray on morphological traits and developmental transitions in or gene introgressed CF_{Or} and white CF_{WT} genotypes of Indian cauliflower. The experiment was conducted during winter (rabi) seasons of 2021-22 at Vegetable Research Farm, ICAR-Indian Agricultural Research Institute, New Delhi. A factorial randomised block design (RBD) with three replications was employed, comprising 30 treatment combinations: four GA_3 concentrations viz., G_o-Control, G_1-250 ppm, G_2-500 ppm and G_3-1000 ppm, two genotypes, V_1=CF_{Or} (homozygous) and V_2=CF_{WT} (white) and three growth stages of application viz., S_1=Vegetative stage (VS), S_2= Vegetative stage (VS) + Curd initiation stage (CIS) and S_3= Vegetative stage (VS) + Curd initiation stage (CIS) + Full curd stage (FCS). Observations were recorded for six morphological traits and five developmental transitions. Significant differences were observed for all three factors viz., stage of application, genotypes and GA_3 concentration. The application of 500 ppm GA_3 at VS+CIS stage resulted in the most pronounced improvements in morphological traits and developmental transitions for both genotypes. The highest stalk length was recorded at 81.3 cm for CF_{WT} genotypes and 66.6 cm for CF_{Or} genotype with 500 ppm GA_3. Synchronization of flowering time was achieved with 500 ppm GA_3 in CF_{Or} (158.3 days) and 250 ppm GA_3 in CF_{WT} (158.0 days). The study highlights the potential of GA_3 application in enhancing the morphological traits of CF_{Or} and achieving synchronized flowering with CF_{WT}, providing valuable insights for using CF_{Or} as one of the parents for hybrid seed production of orange cauliflower, particularly focusing on GA_3 management strategies.

Keywords: GA_3 spray, Or gene, Developmental transitions, Cauliflower

Microgreens: Emerging Functional Food for Nutrition Security

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In the current global era, the term "malnutrition" has expanded from chronic hunger to hidden hunger. Hidden hunger is caused by lack of micronutrients, which further results in various deficiency disorders. The alarming rates from various annual reports have initiated us to tackle the situation by enhancing the nutritional quality of diet with diverse foods. One of the viable, cost effective and sustainable approaches is to use the emerging functional food – microgreens, which can be developed from mustard, radish, fenugreek, coriander, mint, etc. Microgreens are tender immature greens of vegetables, herbs and grains usually harvested within 7 – 21 days from seed germination depending on species. Results from various scientific studies has proved that microgreens are excellent sources of ascorbic acid, alpha – tocopherol, and beta carotene than their mature plants and are also rich in minerals such as calcium, magnesium, iron, potassium, zinc, manganese, and selenium. Incorporation of microgreens as basic ingredient in diet both fresh and in cooked form is increasing. Home level production of microgreens, with less consumption of resources, and a very high nutritional quality has recently made them popular. Besides advantages, microgreens find difficulty in storing due to high respiration rate, rapid post harvest decay and delicate leaves wilt easily. This issue of short shelf life needs redressal through standardization of storage conditions and preparation of powders from microgreens. Widening the popularity of microgreens to rural kitchens in production and consumption can prevent the micronutrient deficiencies in families. The production and sale of microgreens presents a viable entrepreneurship opportunity for rural women. Further researches in microgreens can enhance the global food and nutritional security.

Identification of Genomic Regions Controlling Grain Dimension, Grain Weight and Grain Protein using a Doubled Haploid Population of Common Wheat

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The study aimed to identify genomic regions controlling various grain traits in common wheat using a population of doubled haploid (DH) lines from a cross between Canadian wheat genotypes AC Karma and SC8021-V2. The researchers focused on traits such as grain length, width, area, perimeter, thousand-grain weight, and protein content. The DH population comprising 386 DH lines was phenotype over three years and a high-density genetic map with 6,114 SNPs covering all 21 chromosomes was constructed. A total of 59 quantitative trait loci (QTLs) for grain traits were identified on chromosomes 1B, 2B, 2D, 3A, 3D, 4A, 4D, 5A, 5B, 5D, 6A, 6B, and 7A, explaining 3.70 - 21.50% of the phenotypic variation. Notable QTLs included QGPL.ccsu-7A, QTGW.ccsu-6A, and QGW.ccsu-6A, which had major and stable effects. The study also predicted 6,421 candidate genes within these QTL regions, which are being analysed for their roles in metabolic and cellular processes. These findings could help in developing high-yielding wheat varieties by utilizing breeder-friendly markers for the identified QTLs.

Keywords: Wheat; SNP markers, Grain dimension, Thousand grain weight, Grain protein, QTL, Candidate Genes

Morphological, Physiological and Biochemical Responses of Mung bean (Vigna radiata L.) under Imposed Drought Stress

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The present investigation aimed at to study "Morphological, physiological and biochemical responses of mung bean under imposed drought stress". The trial was laid out in FRBD with three replications. There were three main treatments i.e., adequately irrigated, imposed mid stress from 30-45 DAS (flowering stage), imposed end stress from 45-60 DAS (pod filling and maturity stage) using three genotypes viz., MGG-385, Sikha and Virat. The results revealed that significant differences between irrigated treatments and genotypes were observed for plant height, leaf area and dry matter production only after imposition of moisture stress at 30 DAS to harvest. The effect of end stress on leaf area and dry matter production and its partitioning was more acute compared to mid stress. Among the genotypes, MGG-385 maintained high leaf area and dry matter accumulation with superior growth and physiological traits viz., LAI, CGR, NAR and LAD and RWC under irrigated and moisture stress conditions. The biochemical parameters like chlorophyll content and protein significantly decreased whereas the highest accumulation of proline was observed under the stress condition compared to irrigation condition. Sikha recorded low SLA and high SCMR, which denotes efficiency in performing under drought condition and as good drought tolerant traits. Reduction of yield components viz., number of pods/plant, number of seeds/pod, pod length as well as seed yield was more pronounced in end season stress. MGG-385 recorded highest harvest index and seed yield whereas Virat recorded lowest seed yield both under irrigated and imposed moisture stress conditions. These results revealed that MGG-385 is highly suitable under both irrigated as well as rain fed conditions. However, for drought prone areas, Sikha is recommended due to its drought tolerance characters.

Keywords: Mung bean, drought, imposed stress

Field reaction of intergeneric sugarcane hybrids (Saccharum spontaneum x Erianthus arundinaceus) against sugarcane borers

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A total of 15 intergeneric sugarcane hybrids (IGHs) derived from Saccharum spontaneum and Erianthus arundinaceus were screened for resistance against sugarcane shoot borer (ESB), Chilo infuscatellus (Snellen) and internode borer (INB), Chilo sacchariphagus indicus (Kapur) (Crambidae: Lepidoptera) for three consecutive years (2021-2023) at the ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India. Out of fifteen genotypes screened under field conditions for ESB, 12 were classified as tolerant (T) and three as moderately tolerant (MT), with ESB incidence ranging from 2.71 to 21.53%. Besides, five IGHs, CYM 08-922, CYM 07-981, CYM 04-388, CYM 09-167 and CYM 06-924 recorded 5% ESB incidence. In another field screening study for INB, 7, 6, and 3 IGH clones were graded as tolerant (T), moderately tolerant (MT) and susceptible (S), respectively. Among the entries, INB incidence and intensity ranged from 3.33 to 47.06% and 0.65 to 2.32%, respectively. Three IGH clones, CYM 08-922, CYM 07-981 and CYM 09-167 recorded 5-10% INB incidence with <1% INB intensity. The studies on damage potential of internode borer on intergeneric hybrids revealed that the INB-affected internodes become significantly reduced in their length and width invariably in all the genotypes, but there was difference in intensity among them. Several IGH clones, including CYM 06-212, CYM 07-649, CYM 07-678, CYM 09-521, CYM 09-1369, CYM 09-565 and CYM 10-172 were severely affected by INB, resulting in shortened internode length and width. However, internodes of CYM 06-924, CYM 07-981 and CYM 08-922 were comparatively less affected. In conclusion, the study identified three potential IGH clones viz., CYM 08-922, CYM 07-981 and CYM 06-924 that showed exceptional tolerant reactions to ESB and INB, and these clones could serve as potential genetic stocks in breeding programme for the development of borer resistant varieties.

Keywords: Intergeneric hybrids, screening, early shoot borer, internode borer, internode morphology

The Nutritional Profile and Health Benefits of Pecan Nut

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Nuts are nutrient dense foods with complex matrices rich in unsaturated fatty and other bioactive compounds. By virtue of their unique composition, nuts have beneficial impact health outcomes. They improve heart, blood, mental, eye, skin, bone and oral health, further, they improve digestive function, memory and metabolism, boost immune system, aid in weight loss, help manage diabetes, prevent different type of cancer. Nuts are edible products of the perennial higher plants with high water content, hard texture, sweet and sour. Also, because of their exotic flavor and taste, considerable attention is paid in different parts of the world. Pecan [Carya illinoinensis (Wangenh) K. Koch] is one of the most popular edible nuts. They are high in nutritional value, and they provide the highest level of phenolic compounds and antioxidant capacity of any of the major tree nuts. Protein content in mature pecan kernels is between 5–12%. Pecans are excellent source of phenolic content, antioxidant, zinc, copper and richest among nuts in vitamin E. Vitamin E, is a strong lipid-soluble antioxidant with so many cancer-fighting properties and is reduce risk of heart diseases, further it helps in maintaining and protecting the skin from harmful oxygen-free radicals. Pecan nut consumption correlates with reduced cardio-metabolic disease risk factors in overweight adults. Further, pecan nut consumption can reduce cholesterol and low-density lipoprotein (LDL) levels in the blood.

Keywords: Pecan nut, Edible, Antioxidant, Metabolism, Lipoprotein.

Hybrid Deep Learning Algorithm for Crop Yield Prediction in Cloud Based Smart Agriculture System

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In this paper, a cloud-based smart agriculture system utilizing hybrid deep learning approaches for crop yield prediction is proposed. The work intends to increase the precision of crop yield predictions Resource management, and decision-making processes and to assist farmers in optimizing resource allocation, reducing crop losses, and improving overall agricultural productivity. This paper presents the design and implementation of a cloud-based smart agriculture system that leverages a hybrid deep learning algorithm for accurate crop yield prediction. The proposed system integrates IoT devices to collect real-time data on environmental factors such as soil moisture, temperature, and humidity, which are critical for crop growth. This data is transmitted to a cloud infrastructure for storage and processing, enabling scalable and efficient data management. A hybrid deep learning model, combining Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN) is developed to analyze historical and real-time data, capturing complex patterns and temporal dependencies. The CNNs are used to extract spatial features from the input data, while the RNNs are used to capture temporal dependencies. The proposed model is employed on a cloud platform, allowing farmers to access the system from any where using a web-based interface. According to experimental data, the suggested hybrid deep learning strategy predicts crop yields more accurately than conventional machine learning techniques, with an accuracy rate of more than 90%. Its reduced MAE and RMSE to 2.17% and 2.94%, respectively, showed that it could accurately predict crop yields. It also shows a better fit between the expected and actual data, with a higher R-squared value. The proposed solution aims to assist farmers in optimizing resource allocation, reducing crop losses, and improving overall agricultural productivity.

Keywords: Cloud-Based Smart Agriculture; Crop Yield Prediction; Convolutional Neural Network, Recurrent Neural Networks, Internet of things, Deep Learning.

Organic farming for Sustainable Agriculture

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The agriculture sector faces significant challenges in meeting the growing food demand of an ever-increasing population. Conventional farming, despite its widespread use, has faced criticism due to its environmental factor. Sustainable agriculture, a more eco-friendly alternative, has gained prominence, with organic farming as a key component. Organic farming, characterized by its avoidance of harmful synthetic additives, has seen a significant rise in popularity due to the perceived health benefits. India, with its vast agricultural sector, has made strides in organic farming, establishing itself as a major global producer. While organic farming offers numerous advantages, including improved soil health, reduced pesticide contamination, and enhanced biodiversity, it also faces challenges. The initial investment in organic practices, limited access to markets, and the potential for lower yields compared to conventional farming can hinder adoption. Despite these constraints, organic farming holds considerable promise in India. The country's favorable climate and diverse agricultural landscape provide ideal conditions for organic cultivation. Moreover, the growing consumer awareness of health and environmental issues can drive demand for organic products. To fully realize the potential of organic farming in India, several measures are necessary. These include providing adequate support to farmers through subsidies, training programs, and access to organic certification. Developing robust supply chains and marketing channels can also help bridge the gap between producers and consumers. In conclusion, organic farming presents a viable and sustainable solution to the challenges faced by the agricultural sector. India's commitment to organic agriculture can not only ensure food security but also contribute to a healthier and more environmentally sustainable future.

Keywords: Organic farming, Organic fertilizers, Sustainability

Predicting Energy Consumption in Smart Homes using Machine Learning Models for Optimizing Efficiency

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Smart homes have revolutionized modern living by integrating interconnected devices and sensors to enhance convenience, comfort, and security for occupants. Energy efficiency is a primary focus in smart homes due to the increasing demand for sustainable living, rising energy costs, and environmental challenges like climate change. In this study, we employ machine learning models extensively including Logistic Regression, Random Forest, KNN, SVM, LGB, Naïve Bayes, CatBoost, AdaBoost and Voting Classifier for predicting the energy efficiency of smart homes. Energy consumption in smart homes has been categorized into two primary classes: Minimal Energy Consumption and High Energy Consumption. The performance of all the applied models in classifying these categories is accessed using accuracy, loss, precision, recall and F1-score. Among all the applied ML models, Random Forest and CatBoost emerged as the top performers, achieving the highest accuracies of 96% and 95%, respectively, across both consumption classes.

BLACK TREASURE: UNLOCKING THE POTENTIAL EFFECTS OF BIOCHAR AS AN ORGANIC AMENDMENT FOR RESTORING SOIL HEALTH AND CARBON CREDIT FOR NEXT-GEN AGRICULTURE IN SOIL

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With a human population of eight billion which is destined to exceed 11.4 Billion by 2100, soil degradation is a global issue which is a risk multiplier in aggravating food and nutritional insecurity. Soil is the foundation for all crop production and to scavenge food security in future. Soil health is an assessment or indicator of ability of a soil to meet its range of ecosystem functions appropriate to its environment. It is generally used to measure the competence of soil to sustain plant and animal productivity, determine structural and functional diversity of microbes, maintain or enhance water and air quality, and support human health and habitation. Soil carbon is a key component of soil health, affecting its chemical, physical, and biological properties. It's also a critical component of climate change offsets. However, human activity, primarily through agriculture and forest management, has led to a loss of about 50% of the carbon stored in soils globally. This loss is known as the "soil carbon debt". But current scenario of loss in status of SOC is predicted to average decrease of 60 metric tons of carbon per square kilometer per year. This is mainly due to adverse climate change, changes in atmospheric temperature, precipitation level, soil degradation and Intensive cultivation of crops without providing proper organic amendment to the soil is the reason behind the fall in SOC content. Suitable measures should be adopted to trade the carbon upon soil and for soil sustainability. Soil amendment with biochar is evaluated globally as a means to improve soil fertility and to mitigate climate change and increases organic carbon status. Unlike natural lands, active management offers the possibility to increase terrestrial stores of carbon in various forms in soil. The potential to sequester carbon as thermally stabilized (charred) biomass using existing organic resource is estimated to be at least 1 Gt yr^{-1} and “biochar,” defined by its useful application to soil, is expected to provide a benefit from enduring physical and chemical properties and sure it helps to maintain carbon stock in soil and sustainability of soil.

Keywords: Soil Organic Carbon, Biochar, Soil health, carbon.

Establishment And Runner Multiplication of Tissue Cultured Raised Strawberry cvs. Winterdawn and Hadar

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Micro - propagated plants of strawberry can produce virus - free plants with intensive runners and can better support the development of these runners and consequently increase the number of high-quality marketable runners. Based on this, an experiment was conducted under Punjab conditions for "Establishment and Runner multiplication of tissue cultured raised strawberry cvs Winterdawn and Hadar." In the experiment no. 1, the tissue culture raised plants were transplanted into the field at three different calendar dates i.e 11 october, 21 december and 12 march to evaluate the best time of transplanting and survival percentange of these transplanted plants. The cent per cent survival percentage (100%), is recorded in the plants transplanted on 21 december raised through direct regeneration followed by plants transplanted on 11 october i.e (75%). Experiment No. 2 comprised two parts. In Part 1, the Hadar cultivar produced a significantly higher number of runners per plant (31.00) compared to the Winterdown cultivar (24.34). The maximum runner length in the Hadar cultivar also showed a significant increase over time, reaching 340.20 cm. Additionally, the Hadar cultivar exhibited the highest number of plantlets per mother plant (84.2) and the greatest petiole length (12.00 cm) when treated with a foliar spray of GA3 at 150 ppm combined with BA at 1200 ppm. In Part 2 of the experiment, a comparison was made between tissue culture-raised plants and commercially propagated plants. The tissue culture plants demonstrated a superior ability to produce more runners (24.1) in a shorter period. Furthermore, the tissue culture-raised plants yielded the highest number of plantlets (48.10) and exhibited the greatest runner length (132.72 cm), significantly outperforming the commercially propagated plants.

Keywords: Commercially raised, Cv. Winterdawn and Hadar, Micro-propagated plants, Runners, Strawberry,

Evaluation of different rootstocks of Khasi mandarin in different altitudes

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Khasi mandarin (*Citrus reticulata Blanco*) is one of the most popular citrus species throughout the north eastern region. The productivity of citrus in this region however is very low (4.1 t ha-1) as compared to the national average (8.8 t ha-1) due to many factors. Most of the mandarin orchards in the region are of seedling origin and little budded and grafted plants are used for commercial orcharding. Rangpur Lime is the most commonly used rootstock for Khasi mandarin, however it cannot be considered ideal for all set of agro-climatic conditions because the rootstock found suitable in one location may or may not be equally effective in another location. It is well known that rootstocks have significant role on yield, precocity, quality, tolerance to biotic stresses and abiotic stress, of the scion cultivar, as have been reported by several workers. However little information is available on rootstock studies at different altitude for Khasi mandarin. Keeping this in view, we made an attempt to evaluate different rootstocks of Khasi mandarin at three different altitude (i.e. <700 m, 700-1000 m and >1300 m above mean sea level). Result indicated that at all altitude, plant height ranged, 154.00-348.00 cm and plant girth 37.52-63.60 mm, with maximum value was recorded in C. jambhiri + Khasi mandarin whereas canopy spread ranged 96.33-152.00 cm (east-west) and 93.33-148.33 cm (north-south) with maximum value recorded in C. latipes which is at par with C. jambhiri + Khasi mandarin. Fruit weight and nos. of fruit ranged between 78.12-146.49 gm and 1.33-57.00 nos. per tree respectively with highest value recorded in C. limonia + Khasi mandarin which was at par with C. jambhiri + Khasi mandarin. On the other hand, quality parameters viz., TSS ranged between 7.07-11.40 ºBrix and acidity 0.50-1.70 % with maximum TSS and minimum acidity was recorded in nucellar seedlings of Khasi mandarin followed by C. jambhiri + Khasi mandarin. From the result, Rough lemon (C. jambhiri) and Rangpur Lime (C. limonia) were found suitable rootstock for Khasi mandarin at different altitudes.

Impact of Irrigation Scheduling Using IW/CPE Ratios and Nitrogen Levels on the Growth, Yield, and Economics of Summer Fodder Sorghum [Sorghum bicolor L. (Moench)]

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A field experiment was conducted during the summer of 2021 on clayey soil at the Integrated Farming System Research Farm, JAU, Junagadh. The study tested twelve treatment combinations using three irrigation schedules based on IW/CPE ratios (I1- 0.6, I2- 0.8, and I3- 1.0) and four nitrogen levels (N1- 60, N2- 80, N3- 100, and N4- 120 kg N /ha) under a split plot design with four replications. Results showed that irrigating fodder sorghum at an IW/CPE ratio of 1.0 yielded the highest values for most growth parameters, including plant height, dry matter accumulation per plant, number of leaves per plant, number of internodes per plant, internode length, stem thickness, and both green and dry fodder yields. In contrast, the 0.6 IW/CPE ratio resulted in a higher leaf-to-stem ratio and earlier flowering. The highest gross and net returns, along with the best benefit-to-cost ratio, were achieved with the 1.0 IW/CPE ratio. Among nitrogen levels, 120 kg N /ha produced the highest growth and yields, followed by 100 kg N /ha. The greatest gross and net returns and the highest benefit-to-cost ratio were also observed with 120 kg N /ha. The interaction between irrigation schedules and nitrogen levels significantly influenced plant height, dry matter accumulation, and both green and dry fodder yields. The treatment combination of I2N4 (0.8 IW/CPE ratio and 120 kg N /ha) produced the highest gross and net returns with the best benefit-to-cost ratio. This study indicates that irrigation at an IW/CPE ratio of 0.8 and nitrogen application of 120 kg /ha (I2N4) optimize growth, yield, and economic returns for summer fodder sorghum.

Keywords: Fodder sorghum, summer, irrigation schedules, IW/CPE ratio, nitrogen levels, growth, yield, economics

Empowering Rural Women: Perspectives on Post-Harvest Intervention and Value Addition

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Agriculture is a fundamental pillar of global economies, providing sustenance and livelihoods for a significant portion of the population. However, the challenges associated with post-harvest losses and the need for value addition have gained increasing attention in recent years. Post-harvest losses not only affect food availability but also contribute to economic losses for farmers and the agricultural industry as a whole. Post-harvest intervention and value addition play crucial roles in enhancing agricultural productivity, minimizing losses, and ensuring food security. As global population growth continues to put pressure on food resources, there is an increasing need to enhance the efficiency and sustainability of agricultural production. As part of the attempt in this direction, low cost food processing technologies can offer admirable opportunities for farm women in production of processed food. The study was conducted under RKVY project implemented at Fatehabad & Hisar districts of Haryana. A sample of 120 rural women from 4 villages 2 each from these districts were selected randomly. Intervention was provided to each (30 each). The data revealed that in control group 46.67 percent respondents had somewhat favorable attitude followed by favorable 30.00% and unfavorable attitude 23.33% respectively. Whereas, in experimental group majority of the respondents had favorable attitude (80.00%) followed by somewhat favorable attitude 20.00 percent respectively. None of the respondents in experimental group had unfavorable attitude. This conclude training impacted positively over women.

Keywords: Intervention, Attitude, Food Resources, Efficiency, Post-harvest

Advancing Agricultural Sustainability and Efficiency through High-Tech Innovations: Bridging Horticulture, Food Processing, and Value Addition.

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As the global demand for food escalates amidst the challenges of climate change and resource constraints, the agricultural sector is increasingly turning to high-tech innovations to enhance sustainability and efficiency. This conference, titled "Advancing Agricultural Sustainability and Efficiency through High-Tech Innovations: Bridging Horticulture, Food Processing, and Value Addition," delves into how cutting-edge technologies are reshaping agriculture. High-tech agriculture, leveraging precision farming tools such as GPS, remote sensing, and data analytics, allows for optimized resource use, significantly reducing environmental impact while maximizing crop yields. Concurrently, the Internet of Things (IoT) is revolutionizing agricultural monitoring by providing real-time insights into soil health, crop conditions, and weather patterns, thereby facilitating more informed and sustainable farming practices. In horticulture, advancements like vertical farming, hydroponics, and aquaponics are transforming cultivation methods, enabling efficient, high-yield production in space-limited environments and minimizing resource consumption. Food processing innovations, including automation, machine learning, and novel techniques such as high-pressure processing (HPP) and microwave-assisted processing, are enhancing efficiency, product quality, and safety while extending shelf life and reducing waste. Additionally, emerging packaging solutions are contributing to sustainability by minimizing environmental impact. The conference also emphasizes value addition, focusing on the enhancement of raw agricultural products through innovative processing, packaging, and marketing strategies to create higher-value goods. By bridging these technological advancements across agriculture, horticulture, and food processing, the conference aims to foster interdisciplinary collaboration, address global food security challenges, and outline pathways for future development in high-tech agriculture.

Keywords: High-Tech Agriculture, Precision Farming, Horticulture Innovations, Food Processing Technologies, Value Addition, Sustainability

Utilization of pest control measures by the pomegranate growers

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The present study was purposively conducted in Chikhli, Deaulgaon Raja and Sindkhed Raja Panchayat samities in the Buldana district on the basis of higher area under the cultivation of Pomegranate crop. The form of present study was mainly to assess "Training need of the pomegranate growers about plant protection measures" Hence, total 15 villages were selected from three panchayat samities

It was revealed that in case of control of Sucking pest (Release of syrphids and coccinellids for suppress sucking pest.) majority of them near about 78.67 respondents are come under most important training need followed by 14.67 per cent and 06.00 per cent pomegranate growers were found in important and less important area of training, respectively. Whereas for control of mealy bug (Release C. montrouzieri for suppress mealy bug) three fourth 73.34 respondents found under most important of training need, 21.33 per cent and 05.33 per cent pomegranate growers were found in important and less important of training need, respectively. While for control of mealy bug (Release C. montrouzieri for suppress mealy bug) three fourth 73.34 respondents found under most important of training need, 21.33 per cent and 05.33 per cent pomegranate growers were found in important and less important of training need, respectively.

RESPONSE OF GROUNDNUT TO NITROGEN AND SULPHUR APPLICATION

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Field experiments were conducted at experimental farm, Annamalai University during Kharif season 2022 and 2023 to study the effect of nitrogen and sulphur on growth and yield of groundnut. The experiment consisted of sixteen treatments and were laid out in factorial randomized block design with three replications. The treatment consisted of Factor A (nitrogen levels): N_1- 0 Kg N/ha, N_2 - 17 Kg N/ha, N_3 - 25 Kg N/ha, N_4- 34 Kg N/ha and Factor B (sulphur levels): S_1- 0 Kg S/ha, S_2 - 20 Kg S/ha, S_3 - 40 Kg S/ha, S_4 - 60 Kg S/ha. Among the different nitrogen levels tried, application of 34 kg N/ha registered higher growth and yield attributes and yield of groundnut. Regarding sulphur levels, maximum growth, yield attributes and yield of groundnut was influenced by application of sulphur @ 60 kg/ha (S_4). With respect to various interaction effect, application of 34 kg N/ha along with 60 kg S/ha has a significant effect on growth and yield attributes which ultimately results in maximum yield of groundnut.

Keywords: groundnut, nitrogen, sulphur, growth, yield.

Effect of Blended games on Socio-Cognitive development of children (6-8 years)

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Games are essential for children's development, providing several cognitive and social benefits. Playing games helps children improve their problem-solving and creativity skills, as well as build critical thinking abilities that are necessary for academic achievement. Furthermore, games provide a platform for social engagement, assisting children in developing teamwork and communication skills, both of which are essential for their social development. While games benefit children's overall development, combining physical and modern educational games is essential for maximising their positive impacts on socio-cognitive development. The current study intended to look into the effect of Blended games on the socio-cognitive development of children aged 6 to 8 years. The study was carried out in Biswanath district of Assam. Initially, the socio-cognitive development of 590 children was evaluated. Subsequently, 60 children were chosen for both the experimental and control groups. The experimental group received a three-month intervention of blended games to measure its effectiveness on the children's socio-cognitive development. The findings revealed that children in the experimental group had better social development, including improved communication skills, self-help general abilities, self-direction skills, occupation skills, and locomotor skills. The results also showed that the experimental group's children had improved cognitive development in terms of information, comprehension, math, vocabulary, picture completion, block completion, object assembly, mazes, and coding.

Keywords: Early childhood; social development; cognitive development; blended games.

In vitro efficacy of different bioagents against Collar rot disease of Chickpea caused by Sclerotium rolfsii Sacc.

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Collar rot disease caused by Sclerotium rolfsii Sacc. considered as one of the most devastating soil-borne disease of Chickpea. Most of the first symptom associated with this disease are usually girdling or rotting at basal or collar region of the stem resulting yellowing and wilting of entire plant. The main aim of this study was to find out the potentiality of various fungal and bacterial bioagents viz., Trichoderma virens, T. harzianum, T. koningii, T. viride, P. fluorescens, B. subtilis and B. cereus against the S. rolfsii. The effect of different bioagents were evaluated by dual culture techniques. Among the bioagents tested, maximum growth inhibition of S. rolfsii was recorded with T. harzianum is 80.97 % which was found to be significantly superior than other bioagents. Similarly, P. fluorescens (74.04 %), B. subtilis (64.85 %), B. cereus (61.93 %), T. viride (60.19 %), T. koningii (52.89 %) and T. virens (45.53 %) also gave maximum mycelial growth inhibition of S. rolfsii under in vitro conditions.

Keywords: Sclerotium rolfsii, Trichoderma, Bioagents, Inhibition.

Comparative efficacy of quercetin and catechin in restoring plasma hepatic biomarkers, oxidative and histopathological alterations in hepatotoxicity induced by cisplatin in Wistar rats

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Thiols (-SH group) play an important role in maintaining homeostasis between cellular oxidants and antioxidants levels. Aim of present study was to determine the alterations in plasma hepatic biomarkers, oxidative and histopathological alterations in liver during acute exposure of cisplatin (cDDP) and ameliorative efficacy of quercetin and catechin. Twenty-four adult Wistar rats were randomly allocated in four groups with six animals in each. Group I served as control and group II animals were administered cDDP at the dose rate of 12 mg/kg b wt. intraperitoneal (IP). Group III and IV animals were administered cDDP along with quercetin and catechin at the rate of 100 mg/kg b. wt. IP. Following administration of cDDP, significantly ($p<0.05$) increase in activities of AST, ALT, LDH, GGT and reduced levels of blood glutathione (GSH) and protein profile (total proteins, albumin) indicated acute hepatic injury in Wistar rats. Additionally, reduced total antioxidant status (TAS), total thiols (TTH), GSH, glutathione reductase (GR), glutathione peroxidase (GPx), superoxide dismutase (SOD), catalase (CAT) activities and increased ($p<0.05$) levels of malondialdehyde (MDA), advanced oxidation protein product (AOPP) and 8-Hydroxydeoxyguanosine (8-OHdG) in hepatic tissue damage induced on cDDP exposure. These observations are further corroborated with the intensity of histopathological changes in hepatic tissue of exposed rats as compared to control. Increased levels of GSH, TTH and activities of GPx, GR and GST in hepatic tissue following treatment with quercetin and catechin indicated restoration of antioxidant biomarkers in cDDP induced hepatotoxicity. The concurrent exposure of quercetin and catechin along with cDDP significantly ($p<0.05$) reduced hepatic tissue damage as indicated by reduced lipid, proteins and DNA oxidation and restoration of plasma hepatic biomarkers along with histopathological alterations in rats. Data revealed that quercetin had better ameliorative efficacy than the catechin in cDDP induced hepatic damage in Wistar rats.

Keywords: Hepatotoxicity, Cisplatin, Quercetin, Catechin, Oxidative damage, Wistar rats

Economic of Kharif Soybean in Nagpur district of Maharashtra

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Soybean (Glycine max), family Leguminoceae, "miracle legume" of the 21st century contains high amount of quality protein (42 per cent) and oil (20 per cent). The middle and lower Yellow river valley in China has been reported to be the place of origin. The major soybean producing countries are Brazil, USA, Argentina, China, India, Paraguay, Canada, Ukraine and Russia. Soybean is an important vegetable oilseed crop. Soy-based nutritious food products such as tofu, soy milk, soy sauce, miso, etc. have been developed for human consumption while oil extracted soy meal is used as a nutritious animal feed. As a legume crop, soybean is capable of utilizing atmospheric nitrogen through biological nitrogen fixation and is therefore less dependent on synthetic nitrogen fertilizers.

The study was undertaken in two tahsils of Nagpur district viz. Umrer and Kuhi. From each tahsil two villages were selected. From each village 10 farmers were selected. In total 40 farmers were selected for the study. The main aim of the study was to find out the cost required for cultivation of soybean on per hectare basis. The standard cost concept i.e. cost A_1, cost A_2, cost B_1, cost B_2, cost C_1, cost C_2 and cost C_3 was used in present study.

The study revealed that for soybean crop at overall level the major inputs required were hired human labour (15.09 per cent), seed (11.41 per cent), bullock labour (10.53 per cent), fertilizers (6.88 per cent), machinery charges (3.44 per cent), plant protections (3.15 per cent) and manures (2.07 per cent) showing highest share in cost 'A_1' and cost 'A_2'. Per hectare cost of cultivation for overall farmers at cost 'A_1' and cost 'A_2' was ₹50092.73, cost 'B_1' ₹51518.37, cost 'B_2' ₹75379.41, cost 'C_1' ₹59201.75, cost 'C_2' ₹83062.80 and cost 'C_3' ₹91369.08. Gross value of produce was ₹144356.75 and per quintal cost of cultivation was ₹4109.41 Net returns for overall farmers at cost 'A_1' and cost 'A_2', cost 'B_1', cost 'B_2', cost 'C_1', cost 'C_2' and cost 'C_3' was ₹94264.02, ₹92838.38, ₹68977.34, ₹85155.00, ₹61293.95 and ₹52987.67, respectively. The benefit cost ratio at overall level at cost 'C_3' was found to be 1.58 this indicates that soybean crop is profitable.

Impact of storage temperatures on shelf life and biochemical composition of avocado fruit (Persea americana Mill.)

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Avocado (Persea americana Mill.) is a highly valued fruit known for its nutritional benefits and culinary versatility. However, its relatively shorter shelf life poses challenges for both consumers and distributors. The aim of present study was to investigate the impact of different storage temperatures on the shelf life and biochemical composition of avocado fruit. Fruits were harvested at optimum maturity stage and stored at various temperatures of 5 °C, 9 °C, 12 °C, and ambient temperature (26 – 32 °C). Results showed that lower storage temperatures significantly extend the shelf life of avocados by decelerating the ripening process. At 5°C, avocados experienced lower physiological loss in weight (PLW), slower loss of firmness, and reduced respiration and ethylene production compared to those fruits stored at higher temperatures. Despite this, prolonged exposure to 5°C resulted in some instances of chilling injury, characterized by darkened skin, and textural changes and these fruits were failed to ripe even after 21 days of storage. Biochemically, avocados stored at 9°C preserved higher levels of key nutrients, including carbohydrates, protein and fat throughout the storage period as compared to 12 °C stored fruits. In contrast, avocados held at room temperature exhibited accelerated ripening and a notable decline in biochemical compositions. These findings highlight the importance of optimal temperature management in shelf life extension and to preserve nutritional value of avocados. By maintaining appropriate storage conditions, producers and retailers can enhance fruit quality, reduce post-harvest losses, and improve marketability. This research provides crucial insights for the development of effective storage strategies that ensure avocados retain their desirable qualities and nutritional benefits throughout their commercial lifespan.

Keywords: Avocado, biochemical, storage temperatures, shelf life.

Role of exogenous phytase in fish feed to optimize nutrient utilization & growth performance.

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Feed is one of the most important external signals in fish that stimulates its feeding behavior & growth. The feed makes 50-60% of the operational cost of a fish farm and determines production efficiency. Its availability in quantity and quality is significant for the appropriate growth of fish. Nutritionists for many years have investigated the ways to utilize proteins of plants origin, because they are cheaper and easily accessible than animal protein sources. However, one of the major constraints that limit the use of plant proteins in animal feed is the presence of anti-nutritional factors, phytate being one of them. Phytate depresses protein and amino acid digestibility and utilisation efficiency in fish.

Phytate is a common constituent of plant-derived fish feed. It is a polyanionic molecule with six phosphate groups that can strongly chelate with cations such as calcium, magnesium, zinc, copper, iron and potassium to form insoluble salts. This adversely affects the absorption and digestion of these minerals in fish. Phytate-bound phosphorous is not available to gastric or agastric fish. Major concern about the presence of phytate in the aquafeed is its negative effect on growth performance, nutrient utilization & mineral uptake.

Therefore, the ideal approach to maximize the nutritive value of plant-based diet is through hydrolysis of undigestable phytate by use of exogenous phytase enzyme. The optimization of feed intake can lead to enhanced growth & body composition & reduced nutrient losses. For that purpose, increased need arises to improve the protein utilization of plant-sourced feed ingredients by enfeebling phytate with exogenous phytase to improve & optimize nutrient utilization & growth performance in fishes.

Keywords: Feed, Fish, Phytase, Nutrition

Physiological Responses of Plants to Drought Stress

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Drought stress is one of the most significant environmental factors limiting plant growth and agricultural productivity worldwide. As climate change exacerbates the frequency and severity of drought events, understanding the physiological responses of plants to water deficit is crucial for developing resilient crop varieties and sustainable agricultural practices. Plants respond to drought stress through a complex network of physiological, biochemical, and molecular mechanisms aimed at maintaining water balance, protecting cellular structures, and ensuring survival under adverse conditions. One of the primary physiological responses to drought is stomatal closure, which reduces transpiration and water loss but also limits carbon dioxide intake, leading to reduced photosynthetic activity. The decline in photosynthesis is often accompanied by alterations in chlorophyll content and changes in the activity of photosynthetic enzymes, which further impact plant growth and productivity. Additionally, drought stress triggers the accumulation of osmoprotectants such as proline, glycine betaine, and soluble sugars, which help maintain cell turgor and stabilize proteins and membranes.

Plants also activate antioxidant defense systems under drought conditions to mitigate the harmful effects of reactive oxygen species (ROS) generated by stress. Key antioxidant enzymes, including superoxide dismutase (SOD), catalase (CAT), and peroxidase (POD), play critical roles in scavenging ROS and protecting cellular components from oxidative damage. Moreover, drought stress induces hormonal changes, particularly the increase in abscisic acid (ABA) levels, which regulates stomatal closure and modulates gene expression related to stress tolerance. The root system undergoes significant adaptation during drought, often characterized by enhanced root growth and increased root-to-shoot ratio to improve water uptake from deeper soil layers. Drought also impacts nutrient uptake and assimilation, leading to imbalances that can affect overall plant health. Understanding these physiological responses provides insights into the mechanisms of drought tolerance and guides the development of crop varieties with improved water-use efficiency and stress resilience. Through advanced breeding techniques and biotechnological approaches, it is possible to enhance drought tolerance in plants, contributing to food security in the face of a changing climate.

Effect of different level of pruning's on growth and yield of high-density guava cv. Shweta.

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1

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Crop regulation is the most critical factor in guava (Psidium guajava L.) production. In the past, crop regulation has been accomplished through deblossoming, flower thinning, foliar NAA treatment, and irrigation withholding. Pruning has recently developed as a commercial and alternative way for managing the guava crop. Pruning on bearing trees includes forming new shoots, preventing branch overpopulation, removing crossing branches, unhealthy branches, water sprouts, and root suckers. This study was conducted for winter season crop at Advanced centre for horticulture research (ACHR), SKUAST-J, Udheywalla, Jammu during the year of 2022-2023. The pruning done at different levels i.e. 20 percent, 30 percent, 40 percent, 50 percent, 60 percent, 70 percent, 80 percent and control (no pruning) on 3 years-old plants spaced at 3 × 3 metres. The vegetative parameters and yield were analyzed to determine the effect of pruning intensity on fruit size and yield of guava. The result was revealed that the maximum fruit length (8.42 cm), fruit width (8.00 cm), fruit weight (201 gm) and fruit yield (27.40 kg) was recorded with 50% pruning and minimum in control. In general, the 50% pruning intensity level was found beneficial for enhancing fruit size and yield in guava crop.

Keywords: Guava, pruning intensity, yield.

Assessing the Impact of the Farmers-to-Farmers Extension Model on Rice Productivity in West Tripura District

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This study evaluates the efficacy of the Farmers-to-Farmers (F2F) extension model in enhancing rice farming practices in West Tripura District. The F2F model, which involves experienced lead farmers disseminating agricultural knowledge and innovations among their peers, offers a decentralized approach to agricultural extension. The research employs a mixed-methods approach, incorporating quantitative surveys, qualitative interviews, and field observations to assess the impact of the F2F model on knowledge transfer, the adoption of improved agronomic practices, and rice productivity. Results indicate that the F2F model significantly contributes to the diffusion of knowledge and adoption of new practices, leading to increased rice yields. However, the success of the model is influenced by several factors, including the selection criteria for lead farmers, the provision of continuous support, and the model's adaptability to local socio-economic and agro-ecological conditions. The study concludes that while the F2F model has the potential to be an effective extension strategy, its long-term success depends on tailored interventions and sustained institutional support.

Keywords: Farmers-to-Farmers Extension, Rice Farming, Agricultural Knowledge Transfer, Rural Extension Models, Lead Farmers, Grassroots Extension

Production potential of niger based intercropping system under rainfed condition

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An attempt has been made to study the production potential of niger based intercropping system under rainfed condition at Niger Research Station, Navsari Agricultural University, Vanarasi, Dist. Navsari. Treatment consisted of Niger sole (30 x 10 cm), Niger + Fingermillet (2:1), Niger + Direct Seeded Rice (2:1), Niger + Green gram (2:1) and Niger + Soybean (2:1). The experiment is laid out in randomized block design with four replications. Intercropping is the best cropping system to increase the per unit area returns to the farmers. It also safe sides the risk of dependence over a single crop particularly in rainfed situation. Niger is a minor oilseed crop mainly grown on rainfed situation and mainly grown in tribal areas. Results of the ongoing experiment revealed that niger + green gram (2:1) gave significantly higher crop equivalent yield of niger and remained at par with niger + soybean (2:1) intercropping treatment. The mean data of niger crop grown in intercropping showed an increase in number of branches and capitula per plant when sown along with greengram and soybean crop as compared to sole cropping.

Impact of Climate Change on Soil physiochemical properties

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Climate change is profoundly altering soil physiochemical properties, with significant implications for ecosystems and agriculture. Increased temperatures accelerate the decomposition of soil organic matter, potentially reducing carbon storage and altering nutrient dynamics. Changes in precipitation patterns contribute to variability in soil moisture, leading to either drought or waterlogging, which can impact soil structure and increase erosion rates. Elevated temperatures and shifting moisture levels influence soil pH, often causing increased acidity that affects nutrient availability and soil fertility. Extreme weather events, such as intensified storms, exacerbate soil erosion and disrupt soil structure, leading to topsoil loss and reduced fertility. Changes in temperature and moisture can also cause soil compaction, affecting aeration and root growth. Additionally, climate change impacts soil microbial communities, influencing nutrient cycling and soil health. Rising sea levels contribute to soil salinization in coastal areas, further challenging soil quality. Addressing these impacts requires adaptive soil management practices and ongoing research to develop strategies that enhance soil resilience and sustainability.

Keywords: Climate change, agriculture, soil fertility

Role of Medicinal Plant in Human Health Disease

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Medicinal plants have been integral to human health for millennia, providing therapeutic benefits for various diseases and health conditions. This abstract review the role of medicinal plants in human health, focusing on their potential to treat, manage, and prevent diseases. Medicinal plants contain bioactive compounds, including alkaloids, flavonoids, terpenoids, and glycosides, which interact with biological systems to exert therapeutic effects. These plants are used in traditional and modern medicine to address a range of health issues, such as cardiovascular diseases, digestive disorders, immune system deficiencies, mental health conditions, and skin problems. Scientific research has validated many traditional uses of medicinal plants, with studies demonstrating their efficacy and safety in treating specific conditions. For example, turmeric (Curcuma longa) is recognized for its anti-inflammatory properties, while garlic (Allium sativum) supports cardiovascular health. However, challenges such as variability in plant quality, potential drug interactions, and regulatory concerns must be addressed to optimize their use. Future research and integration of traditional knowledge with contemporary scientific methods are crucial for harnessing the full potential of medicinal plants in disease management and health promotion. This review underscores the importance of medicinal plants in health care and highlights the need for continued exploration to better understand their role and maximize their benefits.

Keywords: Medicinal plants, Human Health, Disease, Control

Enhancing Greengram Growth with Organic Phosphorus: Exploring the Potential of Inositol

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Modern agriculture faces a critical challenge in sustaining food production due to the heavy reliance on non-renewable rock phosphate (P). Phosphorus is essential for crop growth and global food security, but its reserves are limited, increasingly difficult to extract and largely unavailable to plants due to soil fixation. This scenario is particularly alarming for resource-poor farmers in tropical and subtropical regions, where declining P availability threatens crop yields. To address this challenge, it is crucial to enhance the acquisition of plant-available P from native or residual soil sources. Phytate, also known as inositol hexakisphosphate (IHP), a significant storage molecule for P found in cereals, grains, plant residues and animal manure, represents a substantial reservoir of P. Annually, the amount of phytate produced from crops globally corresponds to a considerable portion of the phosphate applied through mineral fertilizers. However, the mechanisms responsible for IHP accumulation in soils and its uptake by plant roots remain poorly understood. This study investigates the bioavailability of P to greengram (Vigna radiata) from IHP compared to inorganic P sources (KH_2PO_4) across different media—soil, sand, and goethite. Ten levels of P were added, ranging from 0 to 1000 mg kg^{-1} in soil and sand, and from 0 to 800 mg kg^{-1} in goethite. Phosphorus was evenly mixed throughout the media before seed sowing. The results showed that yields increased sharply with P addition but declined at higher concentrations, with variations depending on the medium and P source. In sand, greengram yields peaked at 200 mg P kg^{-1} with inorganic P, while higher levels led to detrimental effects due to excess P accumulation. In contrast, IHP-treated plants maintained high yields at the same level, approximately 98% of the maximum achieved with inorganic P, likely due to the hydrolysis of IHP by phytase enzymes, releasing P for plant uptake. However, yields in goethite were lower, likely due to the medium's unsuitability and absence of an available P source. Overall, the study demonstrates that P use efficiency in greengram is largely medium independent but consistent across different P sources.

Impact of drip fertigation and polyethylene mulch on yield attributing parameters in muskmelon (*Cucumis melo* L.)

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Muskmelon (*Cucumis melo* L.) is a significant crop among cucurbits grown globally. The quality and yield of its fruit can be influenced by agricultural practices, especially through effective irrigation and fertilizer management. The amount of irrigation water used significantly affects both the production and quality of muskmelon. Excessive irrigation negatively impacts marketable yield by increasing the number of rotten fruits and conversely, water deficit conditions have been associated with smaller fruits and reduced yields. In this experiment, irrigation was applied at three different levels—100% of crop evapotranspiration (ETc), 80% ETc, and 60% ETc. Mulch treatments included silver black plastic mulch and bare soil. These irrigation and mulch treatments were the main plot factors. Additionally, three fertilizer levels viz. 100% of the recommended fertilizer dose (RDF), 80% RDF, and 60% RDF were tested as subplot treatments and comparisons were made with traditional cultivation methods. Generally, RDF for muskmelon is 125: 62.5: 62.5 (NPK) kg per hectare. Drip irrigation at 100% of crop evapotranspiration (ETc) and 100% of the recommended fertilizer dose (RDF) with mulch enhanced vine length, the number of primary branches, average fruit weight, and total yield. These results were statistically comparable to those achieved with drip irrigation at 80% ETc and 80% RDF. Additionally, yields from various drip fertigation treatments ranged from 168.8 q/ha to 201.8 q/ha, representing a 16% increase compared to the conventional system. Therefore, fruit production in muskmelon and the efficiency of input usage can be enhanced by combining drip fertigation with mulch application.

Adolescent Pregnancy: Issues and Challenges

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Adolescent pregnancy is a worldwide occurrence with well-known causes and severe physical, social, and economic implications. Globally, the Adolescent Birth Rate (ABR) has declined, although the rate of change has varied by area. There are also significant differences in levels between and within countries. Adolescent pregnancy rates are greater among individuals with less education or a poor socioeconomic position. Furthermore, there has been less success in lowering adolescent first births among these and other disadvantaged populations, resulting in increased unfairness. Juvenile marriage and juvenile sexual abuse increase girls' chances of becoming pregnant, which is generally unwanted. Adolescents are often unable to avoid unwanted births due to hurdles to accessing and utilising contraception. There is a rising focus on expanding access to quality maternity care for pregnant and parenting adolescents. According to UNICEF since 2019, adolescents aged 15-19 years in low and middle-income countries had an estimated 21 million pregnancies per year, with nearly 50% being unplanned and resulting in an estimated 12 million births. Adolescent mothers (aged 10-19 years) are more likely to get eclampsia, puerperal endometritis, and systemic infections than women aged 20-24 years, and their kids are more likely to have low birth weight, pre-term delivery, and a poor neonatal condition. Preventing adolescent pregnancy, as well as pregnancy-related mortality and morbidity, it is critical to attaining optimal health outcomes throughout life and is required to meet the Sustainable Development Goals (SDGs) for maternal and newborn health.

Keywords: Adolescent pregnancy, ABR, mortality, morbidity, SDG

Transforming Agriculture: The Role of AI and ICT in Efficient Nutrient and Water Management

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A comprehensive review of current literature has been undertaken to evaluate the impact of artificial intelligence (AI) and information and communication technology (ICT) on improving nutrient and water management in agriculture. With the global population expected to hit 9.7 billion by 2050, the demands on agriculture and water supply systems are escalating. To address these challenges, enhancing resource resilience and sustainability is essential. Recent advancements in AI and ICT offer promising strategies. Technologies such as Conserwater, SupPlant, Plantix and cutting-edge smart irrigation systems are revolutionizing resource management by providing real-time monitoring and decision-making support. These tools employ AI methods, including machine learning and deep learning, and integrate with geographic information systems (GIS), smart meters, and mobile devices. This combination allows for predictive insights that greatly improve the management of nutrients and water. For instance, Conserwater and SupPlant enhance irrigation efficiency by tracking and adjusting water use in real time, while Plantix uses AI to identify plant health issues and recommend treatments. These technological advancements are crucial for advancing sustainable agricultural practices. By leveraging real-time data and predictive analytics, we can optimize resource management and address the needs of a growing population. These innovations not only enhance resource efficiency but also contribute to the broader sustainability of agricultural systems. Adopting these advanced technologies will help us manage resources more effectively and promote a more resilient and sustainable future for global agriculture.

Keywords: artificial intelligence; information and communication technology crop; irrigation; real-time monitoring; yield

Organic farming as a climate change adaptation and mitigation strategy

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Organic farming is increasingly recognized as a valuable strategy for both climate change adaptation and mitigation. By promoting sustainable agricultural practices that work in harmony with nature, organic farming addresses the twin challenges of reducing greenhouse gas emissions and enhancing the resilience of farming systems to climate impacts. One of the key ways organic farming contributes to climate change mitigation is through carbon sequestration. This process not only helps reduce the concentration of greenhouse gases but also improves soil fertility and structure, making farming systems more sustainable in the long term. It reduces reliance on fossil fuels by minimizing the use of synthetic fertilizers and pesticides, which are energy-intensive to produce. By avoiding these inputs, organic farming lowers greenhouse gas emissions associated with conventional agricultural practices. Additionally, organic farms often rely on renewable energy sources and more energy-efficient practices, further reducing their carbon footprint. In terms of adaptation, organic farming enhances the resilience of agricultural systems to climate variability and extreme weather events. Organic practices prioritize soil health, which improves water retention and reduces erosion. This is particularly important in the face of increasing droughts and floods associated with climate change. Healthy soils can better absorb and retain water, reducing the need for irrigation and helping crops survive during periods of water scarcity. Biodiversity is another crucial aspect of organic farming that supports climate adaptation. Biodiversity reduces the risk of crop failure due to pests, diseases, or extreme weather events, as diverse systems are better able to adapt to changes in the environment. Additionally, organic farming often involves the use of traditional and locally adapted crop varieties that are more resilient to specific climate conditions, further enhancing adaptation.

Keywords: Organic farming, Biodiversity, Sustainable Agriculture

Diversity analysis of morphological traits of bread wheat genotypes

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Awareness of genetic diversity in wheat is crucial for selecting parental genotypes that can yield heterotic combinations. Therefore, this study aimed to assess the genetic diversity of 100 bread wheat genotypes selected from diverse geographic regions. Field experiment was conducted during the Rabi season of 2022-23 at the Wheat and Barley Section, Department of Genetics and Plant Breeding, CCS HAU, Hisar, in Randomized Block Design with three replications in two sowing environments. The late sown environment was considered as the heat stress condition, while timely sown environment served as the control to compare the effects of heat stress. Data were recorded for 13 different morphological traits viz., days to heading, days to anthesis, days to maturity, plant height, number of effective tillers/meters, spike length, peduncle length, number of spikelets/spike, number of grains/spike, biological yield/plot, grain yield/plot, harvest index and thousand grain weight. Principal component analysis (PCA) revealed that first four principal components (PCs), with Eigen values >1, contributed to 74.40% of the variance among genotypes. Among these, PC1 contributed the greatest variation (28.52%), followed by PC2 (20.45%) and PC3 (15.91%). The maximum positive component loadings towards PC1 were contributed by BY/plot, GY/plot, GPS, DH, DA, DM, and NSS. For PC2, the highest positive loadings were observed for GY/plot, HI, NOT, TGW, NSS, and SL. Cluster analysis divided the experimental material into six major clusters: Cluster I had 15 genotypes, Cluster II had 43, Cluster III had 5, Cluster IV had 9, Cluster V had 22, and Cluster VI had 6 genotypes. The maximum intra-cluster distance was observed in Cluster II, while the maximum inter-cluster distance was noted between Cluster II and Cluster III. Based on this study, it can be suggested that important morphological traits could serve as effective phenotypic markers for selecting high-yielding wheat genotypes. Additionally, genotypes from Clusters II and III, representing the most diverse parents, could be utilized in hybridization programs to develop promising hybrids.

Keywords: Cluster, Heat, PCA and Wheat.

Evaluating the Applicability of Nano Scale Zero Valent Iron (nZVI) in Phytoremediation of Lead (Pb) contaminated soil by Ornamental Plants

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Lead (Pb) contamination in soil is a persistent global environmental challenge, posing significant risks to both the food chain and human health. The consumption of crops grown in Pb-contaminated soils highlights the urgent need for effective remediation strategies. Phytoremediation, enhanced by nanotechnology, particularly through the use of nanoparticles, offers a promising approach for Pb decontamination. This study explored the potential of nanoscale zero-valent iron (nZVI) at different concentrations (0, 100, 300, and 500 mg/kg) in combination with hyperaccumulator plants, Tagetes erecta L. and Calendula officinalis L., to enhance Pb removal from soil. The nZVI was synthesized via the borohydride reduction method and characterized using Field Emission Scanning Electron Microscopy (FE-SEM), UV-Visible Spectroscopy, Zeta Potential analysis, and X-ray diffraction. A pot experiment was conducted where these plants were grown through a full life cycle in soil contaminated with 250 and 500 mg/kg of Pb, amended with nZVI. The impact of Pb and nZVI on plant growth was evaluated by assessing morphological, physiological, and biochemical parameters. Statistical analysis, including one-way ANOVA and Tukey's multiple comparison tests, revealed that nZVI amendments significantly ($P < 0.05$) enhanced root length, chlorophyll content and total protein content in both plant species. Furthermore, the addition of nZVI reduced proline content, indicating decreased stress in the plants. Pb accumulation in roots increased by 18% in Tagetes erecta and 23% in Calendula officinalis in pots amended with 500 mg/kg nZVI compared to those without nZVI. The results demonstrate that nZVI application mitigates Pb-induced stress in plants and enhances Pb removal from soil. Thus, integrating nZVI with phytoremediation emerges as a promising strategy for remediating Pb-contaminated soils.

Fitness cost associated with imidacloprid resistance in brown planthopper, Nilaparvata lugens (Stål)

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A study was conducted to understand the effect of imidacloprid resistance on the fitness parameters of Nilaparvata lugens (Stål). The data on the bionomics and life table parameters of laboratory (LS) and resistant (RS) strains were analyzed using TWO-SEX-MS-Chart. The results revealed that the egg incubation period in RS strain (7.0 days) was significantly prolonged as compared to LS strain (6.54 days). Similarly, the third and fifth nymphal instar duration was significantly prolonged in RS strain by 0.38 and 0.36 days, respectively. The pre-adult period and TPOP were significantly prolonged in RS strain by 1.64 and 2.02 days, respectively. Whereas, total fecundity in RS strain (194.59 eggs) was significantly lower as compared to LS strain (224.05 eggs). The intrinsic rate of population increase(r) was significantly higher in LS (0.18) in comparison to RS strain (0.14). Consequently, the doubling time (DT) of RS strain was prolonged by 0.61 days. Other population parameters such as finite rate of increase (λ), net reproductive rate ($R_{0)}$, mean generation time (T) and gross reproductive rate were comparable in the two strains. However, the R_0 of the RS strain (66.16) was lower as compared to the LS strain (89.62). The relative fitness of RS was 0.74 which clearly indicated a trade-off between the imidacloprid resistance in N. lugens and its fitness.

Host response of diverse wheat genotypes against spot blotch of wheat incited by Bipolaris sorokiniana

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CITAAS/AB/2024/200

Wheat (Triticum aestivum L) is one of the most widely grown cereal crops around the world. It is a staple food for 1/3rd of the world's population, contributing about 20% of energy intake in human diet. In India, wheat is cultivated in an area of 31.23 million ha, with production and productivity of 112.92 million tonnes, 3615 Kg/ha respectively. In recent past decades research efforts have achieved higher production of wheat not only in India but on global level. However, wheat production is challenged by several threats via fast emerging pathogen variants, pests, and increased climate uncertainty, which constantly hampers crop productivity. Spot blotch disease is not an exception to the inventory of threats to wheat production. This disease can cause on an average 17% yield loss in wheat but severe infection during grain filling stage may cause up to 70% yield reduction, but under epidemic conditions yield losses may be as high as 100%. Keeping in view, the economic importance of disease and variation in symptomology and losses, an experiment was planned to screen diverse genotypic panel of wheat against spot blotch. About 403 genotypes were screened for two years with two replications during 2022-23 and 2023-24. Four parameters were observed for all genotypes viz., Disease severity, Area under disease progress curve (AUDPC), Incubation Period (IP), Lesion length and Lesion Breadth. Maximum DS was observed for Sonalika (99) followed by many other genotypes and minimum in case of HW2004 (12). Among all the genotypes minimum AUDPC was observed for HW2004 (90.1) followed by Chrirya-3(180.3), maximum AUDPC was observed for IC322001 (1313.38) followed by GW9715 (1249.5). Incubation period (days) values ranging from 3 to 7 were observed. In case of Lesion Length (cm) maximum values of 3.76 cm was observed for HINDI62 and minimum in case of Chirya-3 (0.23cm). In case of Lesion Breadth maximum values observed for BACANORA88 (0.57cm) and minimum in case of IC212153AMB (0.10cm).

Key words: Wheat, Spot Blotch, Bipolaris sorokiniana and AUDPC

DEVELOPING A MODEL FOR SOFT WHEAT'S FERMENTATION POTENTIAL USING RSM BASED ON ITS PHYSICO-CHEMICAL PROPERTIES

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The production of high-quality, sustainable distilled beverages demands meticulous consideration of raw material composition, process efficiency and its environmental impact. This research investigates the potential of soft wheat as a superior and sustainable substrate for this purpose. A comprehensive comparative analysis was conducted on soft, medium soft and hard wheat varieties developed in Punjab Agricultural University, encompassing physico-chemical characterization of key parameters, including protein (10.34%), moisture (13.04%), gluten (82.5%), total sugars (2.603%) and reducing sugar content (1.274%) was undertaken to assess the suitability of each variety. The soft wheat variety exhibited exceptional compositional attributes leading to enhanced fermentation efficiency. Employing response surface methodology, fermentation conditions were optimized 0viz., time (62.5 min), temperature (61.57℃) and enzyme dose (0.5% v/v) for enzyme α- amylase, resulting in significantly higher ethanol yields compared to commercial varieties in production of vodka. The difference between predicted R^2 and adjusted R^2 was less than 0.2 for the responses assessed (TS, RS, TSS) using RSM which indicated that the model was fitted well. This cultivar also demonstrated superior sustainability metrics i.e. higher grain-to-ethanol conversion efficiency. By unlocking the hidden potential of soft wheat, this study contributes to the advancement of beverage technology and the creation of novel, high-quality products.

Farmers' attitude towards adoption of organic vegetable production technologies in Longleng district of Nagaland

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This study was conducted at Krishi Vigyan Kendra, Longleng district of Nagaland with a sample size of 150 in the two blocks namely Longleng and Sakshi. The method of summated rating suggested by Likert (1932) was followed in the development of scale to measure the attitude of farmers towards the organic farming with 20 statements. A survey method through face-to-face interviews using a semi-structured questionnaire was used to collect data. Findings of the study showed that majority of the respondents (51.3%) were between the ages of 35 and 50 years i.e., most of the farmers were middle aged in their economically active stage. It was also observed that 55.3 per cent of the respondents were male whereas 44.7 per cent were female. In case of educational qualification, 48.7 per cent of the respondents studied up to secondary followed by higher secondary (20 %). 42 per cent of the respondents were categorized as small farmers followed by medium farmers (30%), marginal farmers (19.3%) and large farmers (8.7%). It was also found from the study that 46.7 per cent of the respondents had favourable attitude towards adoption of organic vegetable production technologies. However, the study also indicated that the most prominent attitudinal statement as ranked first with mean score 4.59 by the farmers was that organic farming will keep environment free from pollution followed by changing to organic system is an exciting new challenge (4.43) ranked 2nd.

Keyword: Attitude, adoption, organic farming, technology

INNOVATION IN PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR A SUSTAINABLE AGRICULTURAL SYSTEM

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Our population is expected to reach 9 or 10 billion people by 2050, meaning that at least 70% more food will need to be produced globally. This is a challenging endeavor because it further taxed the environment and already limits resources. On the other hand, biotic and abiotic factors are causing the nation's natural resources to diminish.According to the National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), India's degraded land area was estimated to be about 146.8 million hectares. The main threats to land degradation are runoff-induced soil erosion, intensive agricultural practices, and excessive groundwater use (via tube well drilling) as these factors lead to the degradation of soil and water resources. The results that were studied emphasize the revolutionary effect of combining creative technologies with conventional methods to transform farming practices. The integration of agroecology and organic farming with the advancement of contemporary technology promotes ecological balance. Precision farming combines IoTs, global positioning systems (GPS), GIS, sophisticated sensors, and data analytics in order to provide crop yields and cut waste to create a healthy environment. When it comes to conservation agriculture, the primary goals are to reduce soil erosion, minimize soil disturbance, rotate crops for diversity, and retain crop residue. Despite the difficulties, there is a rising consumer demand for organic foods that is bridging the knowledge gap between farmers and experts. Farmers can be empowered through the use of improved education and technical application-focused vocational training. Even though the government and non-governmental organizations were running numerous schemes, programs, and missions to address these issues, we still need to work toward a policy that would conserve natural resources through sustainable agricultural practices.

Keyword: Precision agriculture, conservation agriculture, GPS, soil erosion, sustainable, soil survey

Carbohydrate hydrolyzing enzymes inhibition studies of crude extract of Byadgi Red chilli Cultivars

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Diabetes mellitus (DM), a metabolic disorder characterized by hyperglycemia due to inability to secrete insulin hormone and or its responsiveness. DM is categorized as a life style disease and increasing worldwide tremendously with an estimate of approximately 783 million adults by 2024 as reported by World Health Organization. Early stages of DM could be treated by searching for nutraceuticals from plant sources that retard the absorption of glucose in gastrointestinal tract via inhibition of carbohydrate hydrolyzing enzymes, α-amylase and α-glucosidase. Red chilli (*Capsicum annuum* L.) is known for its pungency and greatly used in culinary for its attractant color. Red chilli is also a good source of bioactive constituents exhibiting health promoting properties. Byadgi Red Chilli of two kinds Kaddi and Dabbi are extensively used in food preparation as spice and as food colorant. Crude extracts of Byadgi Kaddi and Byadgi Dabbi varieties are evaluated for total phenol content and inhibition studies of carbohydrate hydrolyzing enzymes. Crude extract of Byadgi Kaddi Red chilli reported to inhibit α-amylase at IC_{50} values of 348.68 µg/ml and α-glucosidase at IC_{50} values of 83.35 µg/ml showing greater inhibition potential than Byadgi Dabbi Chilli. It is also observed for positive correlation with that of its total phenolic content (38.45 mg GAE/100g). Byadgi Kaddi chilli with high phenolic compounds significantly inhibited both carbohydrate hydrolyzing enzymes and consequently may determine a reduction in the rate of glucose absorption for promising post-prandial plasma glucose rise. The obtained data suggests that Byadgi Kaddi red chilli could be chosen for its application as nutraceutical ingredient in functional food preparations for management of Diabetes mellitus.

Keywords: Byadgi chilli, Total Phenol, α-amylase, α-glucosidase and Diabetes mellitus

A study on the antibacterial property of plant extracts against Aeromonas salmonicida subsp. salmonicida COFCAU_AS in vitro

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Bacterial diseases are major constraints to aquaculture production. Aeromonas salmonicida is a bacterium that primarily affects cold water fishes and is known for causing furunculosis, which can lead to severe losses in aquaculture systems. Plants and plant-derived products have been widely utilized to treat diseases. In the present study, ethanolic extracts of the dried leaves of four medicinal plants Cynodon dactylon (Bermuda grass), Azadirachta indica (Neem), Phyllanthus amarus (Gale of the wind) and Moringa oleifera (drumstick) were evaluated for antibacterial activity against Aeromonas salmonicida subsp. salmonicida COFCAU_AS. Agar well diffusion assay was performed to screen the antibacterial activity. MIC was determined by broth microdilution. Among the four tested ethanolic extracts, Cynodon dactylon exhibited higher antibacterial activity against Aeromonas salmonicida subsp. salmonicida COFCAU_AS, followed by Azadirachta indica. No antibacterial activity was exhibited by Moringa oleifera whereas a weaker activity was exhibited by Phyllanthus amarus. The study highlights the potential of plant extracts to combat bacteria and supports the use of plant-based products for managing bacterial diseases in aquaculture.

Keywords: Aquaculture, Bacterial disease, Plant extracts, Anti-microbial activity.

Precision Agriculture: A step towards future of farming

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Farming in which better decisions for crop production and other agricultural aspects are acknowledged by using new information technologies is called precision farming. Precision agriculture is mainly a management approach to the farm and helps in verifying critical factors in yield which can be controlled. Precision by its name itself means precise farm management; it is possible by use of modern technologies and knowledge about resources and inputs. It functions in a way for optimum profitability, sustainability and protection from land resource. The deviations persisting in crop or soil within a field are noted down, planned and management actions are initiated. By adopting site specific management technologies such as GPS, geographic information system (GIS), remote sensing helps in precise results. Economic and environment benefits can be visualized by reduced use of water, fertilizers, herbicide and pesticides in addition to farm equipment's. Precision farming has a pro that it adjusts management techniques with respect to variation specificity of field in comparison to conventional farming methods which manage entire field using theoretical based condition which may or may not exist. Precision farming gave convincing results for crops like sugarbeet, sugarcane, tea and coffee.

Keywords: Precision Farming, GPS, GIS, Remote Sensing, Sustainability, variation specificity.

IMMUNOMODULATORY AND QUALITY ATTRIBUTES OF COLOSTRUM WHEY POWDER (Freeze dried) SUPPLEMENTED FERMENTED DAIRY PRODUCT

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Colostrum is a complex fluid characterized by its high level of bioactive peptides e.g. immunoglobulins, growth factors and growth hormones as well as lactoferrin, lysozyme and lactoperoxidase. Colostrum plays a significant role in curing cancer, cardiovascular diseases, diabetes, autoimmune diseases, allergies, herpes, bacterial, viral and parasitic infections, gingivitis, cold as well as flu. Also, it has antioxidant, anti-inflammatory properties and is an enriched source of many vitamins, minerals, enzymes and amino acids. Knowledge concerning the influence of processing of colostrum and the isolation procedure of different fraction is limited. In the present study, freeze dried colostrum whey powder was incorporated in fermented milk @2% and 4%. As compared to control fermented dairy product, the level of inoculum as well as incubation time was found to be significantly higher. Growth pattern of starter culture in presence of colostrum whey powder was studied and it was found that significantly higher time was required for reaching desired acidity level. Colostrum whey powder supplemented fermented dairy product had increased increased viscosity as compared to control samples. The developed product was fed to immune-compromised swiss albino mice and it was found that groups that were fed with control product, it exhibited significantly lower phagocytic activity, significantly lower lymphocytic proliferation index as compared to the groups that were fed on colostrum whey powder supplemented product. There was no change in blood IgG and IgA content of mice which were fed with colostrum whey powder supplemented product whereas significant reduction was observed in blood IgG and IgA content of mice which were fed with control sample and basal diet.

Investigating the Impact of Classroom Interiors on Student Comfort in Special Schools

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The study investigates the correlation between classroom interiors and student comfort in special schools. A total of 120 students from four special schools in Hubli and Dharwad cities contributed to the study. The size of the classrooms of all the selected schools were lower than the Bureau of Indian Standards (BIS) recommendation (24'4"x23'x10'). Sill height in all the selected classrooms were as per BIS recommendation. The findings show that despite being smaller than the recommended BIS Standards, the majority of students perceived their classroom size as moderate. The level of illuminance was less (< 80 lux) than the BIS standard (150-200 lux). Opinion of students and the collected data regarding space availability in the classroom was similar. The study also reveals that the light intensity in the classrooms was below BIS standards, yet students considered it sufficient. Furthermore, the study highlights a strong link between classroom interiors, encompassing physical conditions, space availability, and illumination levels, and student comfort. These results underscore the importance of adhering to standards in classroom design to ensure student comfort and adaptability, ultimately enhancing their overall learning experience. Policymakers and educators can benefit from these findings, as they emphasize the significance of considering classroom interiors in special schools to establish an optimal learning environment.

In-Situ Vermiculture: A Sustainable Approach to Reducing Whiteflies and Mealybugs in Pomegranate Ecosystems

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This study investigated the use of vermiculture as a sustainable method for pest control in pomegranate farming. Field experiments were conducted in farmers' fields at Managuli, Vijayapura, College of Agriculture, Vijayapura, Karnataka, during 2020-2022. The in-situ vermiculture technique, involving the application of earthworms at 200 per plant (148,000 per hectare), farmyard manure (FYM) at 30 kg per plant, and crop residue mulching, resulted in the lowest number of sucking pests (1.05 whiteflies and 0.99 mealybugs per shoot). In contrast, the plot treated only with FYM showed the highest pest population. Additionally, the plot with earthworms recorded a significantly higher number of clitellate earthworms (41.82) compared to other treatments. The presence of beneficial microorganisms in the vermicompost likely contributed to the reduction of pests, minimizing the need for chemical pesticides. The findings highlight the dual benefits of in-situ vermiculture in enhancing soil quality and controlling pests, leading to higher yields and improved fruit quality. Overall, this sustainable practice provides a viable solution for improving both agricultural productivity and environmental health in pomegranate cultivation.

Key words: Pomegranate, Whiteflies, Mealybugs, Earthworms, Soil health

Effect of different treatments on the functional properties of milk protein hydrogel

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The objective of this research was to develop and characterise sodium caseinate (SCA) hydrogels subjected to various treatments, such as ionic, enzymatic, and non-thermal, and their combinations. The SCA hydrogels were developed by adjusting the pH at 2.5 using 1M HCl and subsequently treated with NaCl or KCl, microbial transglutaminase (MTGase), and ultrasonication and their combination. The results demonstrated that ionic treatments alone exhibited lower gel strength compared to the native hydrogel (untreated-pH 2.5). However, when combined with ultrasonication, the ionic treatments significantly enhanced the gel strength and WHC, indicating a synergistic effect between the treatments. The enzymatic treatment employing MTGase also improved the properties of the hydrogel when combined with ultrasonication, leading to the creation of hydrogels with improved gel strength and WHC. Additionally, no new peaks were generated after providing different treatments to the native SCA hydrogels, ensuring that no new additional functional groups were developed after providing these treatments. The spray drying of treated hydrogels into a powdered form revealed a reduction in gel strength upon rehydration, suggesting that high temperatures during drying might have weakened the gel network. Swelling ratio analysis demonstrated that treated hydrogels exhibited a higher swelling ability than the native SCA hydrogel, with the MTGase-ultrasonication combination exhibiting the highest swelling ratio. Furthermore, the thermal stability also increased significantly after different treatments to native sodium caseinate hydrogel. The study also found that the least gel concentration remained consistent across all treatments, indicating that the treatments did not affect the fundamental gelation ability of the hydrogels. These treatments offer the potential for the development of hydrogels with tailored characteristics, particularly in improving gel strength, water retention, and transparency, thereby expanding their utility in commercial applications.

Development and Production of Ginger Beer Culture and Ale

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Ginger is a best plant in the perspective of medicine and spice. In the Asian continent there is humongous trend to use ginger as the medicinal and spice product to get better result in taste in food products. In medicinal terms ginger use as the main ingredient to counter the cough, cold, fever, runny nose, and many more. In the Southern Asia countries including India, Pakistan, Bangladesh, China, Bhutan, Nepal and many more Asian country's make production and use in every possible sides where the ginger will be used. Due the heavy medicinal property and spicy nature of it use in daily basis. The presence of Gingerol compound in the ginger it helps to make reduction in inflammatory property. It has also help in weight loss and use to boost the immune system. It make more helps to body to maintaining metabolic rate and boost it. Ginger is also make more effect when we use as probiotic food. The probiotic supplement which are produce through the fermentation process. Fermentation of ginger make more palatable and use as the probiotic food. By using the natural culture for the making of ginger beer at the lab scale by the help of raw ginger, by using the sugar as nutrient base. During the process of racking there is a formation of CO_2 (Carbon Dioxide) which make more palatable for the consumer. It known as carbonation. During drinking of Ginger Beer the sparkling effect can experience by the consumer which make more satisfactory and refreshing moment to the consumer.

Keywords: Beer, Humongous, Probiotic food, Perspective, Palatable, Sparkling etc.

Exploring Gender-Wise Locale Differences in Locus of Control: A Comparative Study of Uttarakhand and Punjab

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This study investigates the gender-wise locale differences in locus of control among 360 individuals (180 males and 180 females) from Uttarakhand and Punjab. Locus of control, a psychological construct that determines individuals' belief systems regarding the outcomes of their actions, was measured using Levenson's scale by Vohra (1999). The scale assesses three dimensions: Powerful Others, Chance Control, and Individual Control. Results revealed that females from Punjab exhibited higher individual control, indicating a stronger belief in the impact of personal abilities and hard work on their life outcomes, compared to females from Uttarakhand. Conversely, males from Uttarakhand scored higher on Powerful Others and Chance Control, suggesting a belief that their actions are more influenced by external forces like powerful individuals and chance, than males from Punjab, who demonstrated higher individual control. The study highlights significant gender and locale-based differences in locus of control, providing insights into how cultural and regional factors shape individuals' perceptions of control over their lives. These findings align with previous research, such as Stocks et al. (2012) and Spector et al. (2002), which indicated cultural variations in locus of control across different regions. This research contributes to the understanding of how gender and cultural context influence psychological constructs, with implications for mental health interventions and educational strategies tailored to different populations.

Keywords: Locus of Control, Powerful Others, Chance Control, Individual Control, Gender, Culture

Integrated Disease Management of Sesasum

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Sesamum is popularly known as “Queen of oilseeds” because of its resistance to oxidation and rancidity properties which are suitable for cultivation in a wide range of climatic conditions extending from the tropics to the temperate regions. India is one of the largest exporters of sesame in the world with an area of 1.72 M ha, production of 0.81 M t and productivity of 474 kg/ha. Although the crop is widely used for various purposes, it has low productivity due to non-availability of high yielding varieties and more prone to biotic & abiotic stresses. Among biotic stresses, insect pests like capsule & leaf borers and diseases like stem and root rot, powdery mildew, Alternaria leaf spots and phyllody are most significant and also responsible for yield losses. Of all the diseases, phyllody is one of the major constraints causing economical yield losses and initially it was considered to be caused by a virus but later resulted it was associated with phytoplasma presence. The pooled data (rabi, 2021-22, 2022-23 and 2023-24) results in the current study on the integrated disease management of sesame revealed that seed treatment with carbendazim+mancozeb @ 2.0 g/kg seed and Trichoderma@ 8-10 g/kg, soil application of FYM enriched Trichoderma @ 2 kg/acre and spraying of propiconazole @ 1 ml/l + imidacloprid @ 0.4 ml/l at 30 & 40 DAS proved significantly effective by recording minimum per cent disease incidence of phyllody (13.96%) and powdery mildew (19.44%) with highest seed yield of 861 kg/ha and cost benefit ratio of 1 : 4.22.

Keywords: Sesame, phyllody, entries, check, disease incidence

HISTOCHEMICAL STUDIES ON THE RECTUM OF GOAT (Capra hircus)

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The present investigation was carried out on 10 rectums from recently slaughter adult goat. Rectum of goat was composed of four layers viz. tunica mucosa, tunica submucosa, tunica muscularis and tunica serosa or adventitia.The lining epithelium and lamina propria of rectum showed positive reaction for carbohydrates. Tunica muscularis showed positive reaction for mucopolysaccharide and negative reaction for glycogen. The lining epithelium showed positive reaction for sulphated mucosubatances at pH 1.0. Lamina propria showed moderate positive at PAS Alcian Blue reaction at pH 0.4, pH 1.0 and pH 2.5 and lamina muscularis showed week positive reaction for pH 0.4 and moderate positive reaction for pH 2.5. Tunica submucosa showed moderate positive reaction for neutral mucosubstances for PAS Alcian Blue at pH 1.0 and pH 2.5 whereas it showed moderate positive reaction for sulphated mucosubstances at pH 2.5 and for acidic sulphated mucosubstances at pH 0.4. Tunica muscularis showed strong positive reaction for sulphated mucosubatances for PAS Alcian Blue reaction at pH 1.0 and pH 0.4 but showed mild to moderate positive reaction at pH 2.5. The tunica serosa layer showed moderate positive reaction for sulphated mucosubatances for PAS Alcian Blue at pH 1.0 and pH 2.5 whereas showed strong positive reaction for acidic sulphated mucosubstances at pH 0.4. All layers of rectum showed negative reaction for dane's method for prekeratin, keratin and mucin.

Keywords: Histochemical, Goat, Rectum.

Macrocybe sp.: An ideal tropical mushroom suited to Kerala

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Macrocybe sp. is widely cultivated edible species in tropical/ subtropical regions of the world. The mushroom possesses nutritive as well as numerous therapeutic values. It is a source of proteins, polysaccharides, fat, amino acids, and many mineral elements. Nutritionally, Macrocybe sp. contains 24.1 % protein, 10.2 % carbohydrate, and high levels of mineral elements such as Ca, Mg, and Zn. Their therapeutic value is attributed to its antioxidant, anti tumour, and antibacterial activities. A study was conducted to evaluate the suitability of Macrocybe sp. for cultivation in Kerala. The strains tested were MG-23-01 to MG-23-06. The cultures were obtained from ICAR-DMR, Solan. These cultures were used for the preparation of mother spawn and bed spawn. The spawn was used for bed preparation by poly bag method using paddy straw as substrate. The prepared bed was kept in a dark room for 21days, followed by application of casing material. After casing the beds were shifted to cropping room for fruiting. The different strains of Macrocybe took 21-24 days for spawn run and 26- 29 days for pin head initiation. The days taken for first harvest ranged from 29- 33 days. Among the different stains tested MG-23-05 took minimum days for first harvest. The yield obtained from different strains ranged from 39.65 to 62.77 kg/ 100kg dry substrate. The strain MG-23-03 was the potent yielder with 62.77 kg followed by MG-23-05 with 55.22 kg which was on par with MG-23-04 (52.28 kg). The strain MG-23-06 gave minimum yield. The number of sporocarps were higher in MG-23-03. The sporocarps of MG-23-03 and MG-23-05 were buff coloured. The average weight of the sporocarps ranged from 14-51g. The maximum weight of sporocarp was observed in MG-23-04 and MG-23-05. The pileus diameter ranged from 3.39 – 6.27 cm, while stipe length varied between 5.40-16.18 cm. The stipe was comparatively bigger in MG-23-04and 05. All the isolates had good organoleptic characters. The trial identified MG-23-05 as a strain suited to Kerala conditions.

Drone-Based Pesticide Application: Implications for Beneficial Insects Population in Rice Cultivation

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Agriculture plays a pivotal role in feeding the world's growing population, and pesticide applications have become an integral part of modern agricultural practices to ensure crop protection and productivity. However, indiscriminate pesticide use can have unintended ecological consequences, affecting non-target organisms, including beneficial insects that serve as natural biocontrol agents in agroecosystems. The present study investigated the ecological effects of drone-based pesticide spraying on beneficial insects, specifically coccinellids (lady bird beetles) and spiders, in rice ecosystems. In the kharif 2022, physically compatible combination of insecticides (chlorantraniliprole 18.5% SC and tetraniliprole 200 SC) with fungicides (picoxystrobin 7.5% + tricyclazole 22.5% SC and tebuconazole 50% + trifloxystrobin 25% WG) were administered via drones. The incidence of these beneficial fauna was monitored at multiple time points before and after pesticide application. The results indicated no significant differences in coccinellid populations after both the first and second spray applications. The mean number of coccinellids per 10 hills ranged from 3.67 to 8.83 across all treatments and time intervals whereas, significant variations in spider populations were observed among the treatments after both the first and second spray applications. Treatments T1 (chlorantraniliprole) and T2 (tetraniliprole) exhibited relatively higher spider populations, while T3 (picoxystrobin + tricyclazole) and T4 (tebuconazole + trifloxystrobin) showed lower spider populations.

Intelligent Aeration and Feeding System: An AI-Driven Approach to Aquaculture Productivity

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Aquaculture practices traditionally rely on inefficient and labour-intensive methods like paddle wheel aerators and manual feeding. This study presents a novel AI-powered system that integrates aeration and feeding processes for enhanced aquaculture productivity. The system employs a one-horsepower motor and optimized pipe configuration to deliver superior oxygenation compared to conventional aerators. Coupled with an AI-controlled automatic feeding mechanism, this approach significantly reduces operational costs, improves water quality, and optimizes nutrient distribution. By demonstrating the technical specifications and benefits of this integrated system, we highlight its potential to revolutionize aquaculture towards a more sustainable and profitable industry.

Keywords: Aquaculture, Artificial Intelligence, Aeration, Automatic Feeding, Water Quality, Cost-Efficiency

Development and sensory evaluation of proso millet value based added products

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Proso millet *(Panicummiliaceum)* is commonly known as white millet which is widely cultivated and consumed in India. It is gluten-free, an excellent source of fiber and contains high amounts of carbohydrates, protein, niacin (vitamin B3) and fatty acids. In addition to these nutrients, it is high in minerals such as phosphorus and magnesium compared to other millets. Many traditional Indian recipes have been prepared from proso millet or blended with other cereal and legumes to enhance the nutritional value and palatability. Besides, Proso millet is least consumed/ preferred by people due to lack of awareness of its nutrients, health benefits and consumption pattern. In order to upgrade the knowledge level about nutritional value of proso millet and also to enhance the consumption level of proso millet in diet, demonstration of proso millet value added fresh products like idli, dosa and payasam and subjected to organoleptic evaluation. A total number of 40 rural women participated in the demonstration. Results indicated that all proso millet based recipes significantly improved organoleptic evaluation. Hence, rural women accepted the recipes and enhanced their knowledge level which helps in popularizing proso millet based recipes and entrepreneurship.

Key words: Proso millet, Organoleptic evaluation and Enterpreneurship.

Water Productivity of Spring Sugarcane and Summer Moong Intercropping Under Sub-Surface Drip Irrigation with Mulching Techniques

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The study titled, "Water Productivity of Spring Sugarcane and Summer Moong Intercropping Under Sub-Surface Drip Irrigation with Mulching Techniques" was carried out at the Punjab Agricultural University, Regional Research Station, Faridkot, during the 2022-2023 growing season. The experimental field had sandy loam soil with a slightly alkaline pH. The experiment, using a randomized complete block design with sixteen treatments and three replications, tested three levels of sub-surface drip irrigation (60%, 80%, and 100% CPE) combined with two intercropping levels (2 and 3 rows of summer moong) and two mulch levels, resulting in twelve treatment combinations. Sub-surface drip irrigation at 100% CPE produced a summer moong seed yield of 5.23 q/ha, cane yield of 834.2 q/ha, and cane equivalent yield of 953.1 q/ha, which were comparable to 80% CPE and higher than 60% CPE. Intercropping with 3 rows of summer moong outperformed 2 rows in yields. Mulching at 6 t/ha resulted in a 10.3% higher cane yield and 8.7% higher cane equivalent yield. Combinations of sub-surface drip irrigation at 80% or 100% CPE, with or without mulching, and 2 or 3 rows of summer moong produced significantly higher cane and cane equivalent yields than the check basin irrigation method. Various growth and yield-related factors were significantly improved by different irrigation levels and mulching. The primary reason for higher yields under sub-surface drip irrigation was enhancement of yield attributes. Sub-surface drip irrigation at 100% and 80% CPE saved 25% and 37.5% more water than the check basin method while net returns from 60%, 80% and 100% CPE with 2 or 3 rows of summer moong and mulching exceeded those from check basin irrigation.

Keywords: Sugarcane, intercropping, summer moong, sub surface drip irrigation, cane yield, cane equivalent yield, water productivity.

Solar drying techniques for preservation of fish and fishery product: An overview

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Solar drying is the ancient, cheapest and most basic way of drying known to mankind. Most agricultural goods, including grains, spices, fruits, and vegetables, fishery products are still sun-dried today. However, drying these items in the open sun has various drawbacks, including dirt, rain, wind, insect infestation, human and animal intervention, contamination and weather dependent. Solving such issues is easy with solar dryers. This paper describes the current condition of several types of solar dryers that are extensively used today, as well as the drying processes that have been performed during the drying of various fish items. The potential of indirect, direct, mixed mode, and hybrid dryers for drying agricultural /fish products in tropical and subtropical regions is explored. Solar dryers are specialized equipment that use sunlight to dry fruits, vegetables, meat, and fish. The development of solar technology has made it feasible to create affordable, environmentally friendly solar dryers for agricultural products. It is crucial to support the construction of these facilities, even at the village level, in order to reduce post-harvest losses and extend the shelf life of food items without compromising quality. This paper addresses the various solar dryers and drying procedures used mainly on agricultural and fishery items.

Keywords: Solar dryer, direct solar dryer, indirect solar dryer, mixed mode, hybrid mode

Morphometric and reproductive characterization of Zokel indigenous goat: An unexplored germplasm of Mizoram, North Eastern Region of India

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The current study aims to assess the management techniques, phenotypic variability, morphometric characteristics and performance traits of the Zokel indigenous goat of Mizoram. This documentation is crucial for breed registration and the conservation of the breed via suitable breeding programmes. Methods: An extensive study was conducted, with a sample size of 300 indigenous goats gathered from 22 communities. The data was collected according to the prescribed format recommended by ICAR National Bureau of Animal Genetics Resources, Karnal, for breed characterization and was analyzed using the SPSS statistical software.Result: Studies revealed that these goats are medium to short in stature with a colour combination of black, brown and white. Zokel goats were found to have a small to medium body size (90-95%) and a short stature with a cylindrical body shape. The body colour of Zokel varied in different colors, which included white (40-50%), black (20-30%), brown (8-10%), white with black patches (5-7%) and a combination of brown and black (3-5%). Foreheads were narrower, straight, and somewhat depressed in the middle (92-96%), whereas just 2-5 percent were flattened and straight. Both sexes have small horns with black and brown (90-93%), grey (2-6%), and mixed color (1-5%), and a little curve and slight bend at the ends upwards and backwards. Ears were small to moderate in size and oriented horizontally or drooping in a few cases. The average body length, chest girth, height at wither, horn length, ear length and tail length were 53.34±0.75 cm, 71.12±0.32 cm, 50.80±0.51 cm, 8.89±1.03 cm, 13.97±0.21 cm, and 17.78 ± 0.11 cm, respectively. The measurements of all morphometric traits were higher than the Assam Hill goats. The reproductive data indicates early age at first mating, viz., 225.25±8.04 days and higher kidding intervals, i.e. 232.5±8.09 days. The results indicated that the Zokel goats showed comparable physical and morphometric traits but significant variations in proportions of these attributes compared to the other goat breeds.

Key words: Zokel goat, Morphometric traits, Physical traits, Performance, Mizoram

Genetic Divergence Study in King Chilli (Capsicum chinense Jacq.) Under Protected Cultivation

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For any crop improvement programme knowledge of genetic divergence in population is utmost importance because utilization of parents which are genetically diverse within same species results in wider variability. A study on genetic diversity in King Chilli (Capsicum chinense Jacq.) was conducted at ICAR Research Complex for NEH Region, Umiam, Meghalaya under protected structure. Results revealed that the 30 accessions of King Chilli under study were grouped into total 10 clusters. Amongst all the cluster group, cluster 6th comprising of 9 accessions was the largest followed by cluster 1st (6 accessions); cluster 5th (4 accessions); cluster 2nd (3 accessions); cluster 8th and 10th (2 accessions each). It was observed that cluster 3rd, 4th, 7th and 9th are monogenotypic and comprises of brown colour, elongated, companulate shape and smooth surfaced accession, respectively. Based on the Mahalnobis Euclidean Distance the largest inter cluster distance (77.28) was recorded between cluster 8th and 6th, while the largest intra cluster distance (18.45) was found between cluster 6th and 5th. The percentage contribution of each traits towards the total genetic divergence of King chilli accessions was also studied for ranking the traits based on their contribution towards divergence observed. As depicted by the result amongst all the 18 traits studied plant height (18%), no. of main branch (17%), plant spread E to W (cm) (16%) and no. of primary branch (13%) contribute maximum to the total genetic divergence amongst the accessions of King Chilli.

Keywords: Capsicum chinense Jacq., Protected Cultivation, Genetic Diversity, Cluster Analysis

Microencapsulation of probiotic strain Lactobacillus rhamnosus NCDC 347 using different encapsulation matrices and its characterization

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In this study, probiotic cells Lactiplantibacillus plantarum NCDC 347 were encapsulated using spray drying technology to produce a probiotic powder with 20% whey protein, 20% carrageenan, and a 20% whey protein+carrageenan mixture (10% each). The resulting spray-dried powder was evaluated for probiotic enumeration, encapsulation efficiency, tolerance to simulated gastric and intestinal conditions, water activity, moisture content, hygroscopicity, color measurement, SEM analysis, bulk and tapped densities, and XRD analysis. The results showed that the double-layer matrix (whey protein+carrageenan) maintained a viability of 8 log CFU/mL, encapsulation efficiency of 56.0 g (28%), and particle sizes ranging from 1 to 12 μm. Under simulated gastric conditions, viability was maintained at 5.31 log CFU/mL at pH 2.0 for 3 hours, and under simulated intestinal conditions, it was 5.76 log CFU/mL. The water activity was 0.35, moisture content 3.51%, and hygroscopicity 11.37%. There were no significant differences in color measurement and bulk and tapped density. In X-ray diffraction, a broad peak appeared at $2\theta = 31.1°$. In conclusion, the combination of whey protein and carrageenan could be a promising encapsulation material for the probiotic bacteria Lactiplantibacillus plantarum NCDC 347.

Keywords: Probiotic, Lactiplantibacillus plantarum, Encapsulation, Viability,

Vegetable Production Boost through Artificial Intelligence

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According to UN Food and Agriculture Organization, the population will increase by 2 billion by 2050. However, only 4% additional land will come under cultivation. Use of latest technological solutions to make vegetable production more efficient, remains one of the greatest imperatives. While Artificial Intelligence (AI) sees a lot of direct application across sectors, it can also bring a paradigm shift in how we see vegetable cultivation today. AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for vegetable crops. With the help of AI, the agricultural data is processed in the cloud, and the risk of disease is predicted. For example, grey mold, a fungal disease, spreads at 90 percent humidity and an ambient temperature of 22 degrees Celsius. Those two readings are easily taken, but plantect factors some parameters into the equation in order to predict the risk of infection with far greater accuracy. These parameters, some of them based on sensor data, include the total time in which optimum conditions have prevailed, plant age, disease history, and weather forecasts. The most popular applications of AI in vegetable production appear to fall into three major categories: Harvesting Robots – Companies are developing and programming autonomous robots to handle essential tasks such as harvesting crops at a higher volume and faster pace than human laborers. Crop and soil monitoring - Companies are leveraging computer vision and deep-learning algorithms to process data captured by drones and/or software-based technology to monitor crop and soil health. Predictive Analytics - Machine learning models are being developed to track and predict various environmental impacts on crop yield such as weather changes.

Keywords: Artificial intelligence, weather forecast and vegetable production,

Exploring the genetic variability, correlated response and diversity in fieldpea (Pisum sativum L.) genotypes for various agro-morphological traits

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Fieldpea (*Pisum sativum* L.) is a nutrient-rich Rabi season pulse crop, thereby significantly contributing to nutritional security for underprivileged populations in developing regions. The present investigation was conducted at Pulses Research Area, Department of Genetics and Plant Breeding, CCS HAU, Hisar during Rabi 2023-24 in order to calculate the genetic variability, correlation and genetic diversity among 150 fieldpea genotypes. Based on their mean performance, the genotypes HFP 2008, KMPR 851, HFP 1426 and HFP 1428 showed higher seed yield highlighting their potential use in advanced breeding programs. As per DUS guidelines of fieldpea, amble amount of variability was observed among fieldpea genotypes for all examined traits. PCV was slightly higher than the GCV for all examined traits, indicating minor influence of environment and further suggested that the observed variation is largely due to genetic factor, making it a reliable basis for selection. Most the traits showed high heritability with high genetic advance suggest indicating additive gene effects, so selection would be effective for these traits. Number of seeds per pod, hundred seed weight and biological yield per plant. Based on UPGMA method of clustering, all 150 field pea genotypes were grouped into eight clusters based on their genetic divergence. Cluster IV had the highest number of genotypes followed by Cluster. Furthermore, maximum inter-cluster distance was observed between Cluster V and VIII, followed by Cluster VI and VIII, whereas Cluster VII had the highest mean values for most yield-related traits suggesting genotypes from these clusters may be used as parents for hybridization programs to develop desirable types, as crosses between genetically divergent lines will generate heterotic segregants.

Keywords: Cluster, Correlation, Fieldpea, Genetic advance, GCV, Heritability, PCV

Effect of Bio inoculants on Vegetative characters of Asiatic Lily under different growing conditions

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The experiment was conducted at Agri-tourism Centre, CCS HAU, Hisar (Haryana) during the year 2020-2021 to study the effect of bio inoculants on length and diameter of the flowering bud of Asiatic lily cv Fangio under different growing conditions. The experiment was laid out in Randomized Block Design for bud parameters with three replications. The experiments consisted of three growing conditions (polyhouse, shadenet and open conditions) and eight different treatments of bio inoculants (T_1: Recommended dose of fertilizers (RDF), T_2: RDF + Azotobacter, T_3: RDF + PSB, T_4: RDF + Mycorrhiza, T_5: RDF + Azotobacter + PSB, T_6: RDF + PSB + Mycorrhiza, T_7: RDF + Azotobacter + Mycorrhiza, and T_8: RDF + Azotobacter + PSB + Mycorrhiza). Among the different growing conditions, the maximum plant height and no. of leaves were observed under poly house conditions whereas the maximum leaf length and maximum width were observed under shadenet conditions. Among the various treatments, vegetative characters were recorded best in T_8 (RDF + Azotobacter + PSB + Mycorrhiza).

Keyword: Bioinoculants, Polyhouse, Shade-net, Plant height

Evolution of Front-Line Demonstration on Integrated Pest Management Module in Ground nut (Arachis hypogaea L) at farmers' fields in Warangal District

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A study on evaluation of Integrated Pest Management module in groundnut crop was carried out by Krishi Vigyan Kendra Mamnoor as part of Front-Line Demonstration at ten different locations in Warangal district for two consecutive years during Rabi, 2022-2023 to 2023-24. The treatments in IPM module included i.e. Summer deep ploughing, planting of traps crops like soybean for leaf minor, castor for Spodoptera, cowpea for red hairy caterpillar, collection and destruction of egg masses of red hairy and tobacco caterpillar, installation of pheromone traps @ 4-5/acre for Spodoptera sp. and ground nut leaf minor, installation of bird perches @ 8-10/acre, seed treatment with tebuconazole@ 1ml/kg seed, spraying with azadirachtin 1500 ppm @ 5 ml/l, spraying of insecticides like chlorantraniliprole @0.3ml and emamectin benzoate 0.5g/l water against Spodoptera sp. and other defoliators, poison bait: 5kg rice bran + 0.5 kg jaggery +500g thiodicarb against late stages of Spodoptera sp., application of thiamethoxam 0.5g and fipronil 2ml/l water for managing sucking pests like aphids, thrips and hoppers management. The farmer practice was non adoption of Integrated Pest Management practices and indiscriminate use of insecticides and fungicides profinophos 2ml/l and copper oxychloride 3 g//l. The pest population was significantly reduced in IPM module as compared to the farmers practice plot. Yield of groundnut pods obtained from farmers practice and IPM module plots was 2651 kg pods/ha and 3200 kg pods/ha, respectively. The avoidable yield losses observed due to pest were 549 kg pods/ha. The per cent increased yield in IPM module over the farmer practice was computed as 20.70 per cent. The cost-benefit ratio recorded from farmers practice and IPM module plots were 1:2.18 and 1:2.89, respectively.

An Analysis of managerial skills required by the Teaching professionals

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Learning skills for teachers are an ongoing process that encourages them to master newer information and build new abilities, all of which contribute to enhance student learning. As teacher learning skills have an impact on student learning outcomes, teachers must practice or upgrade the skills in order to attain learning goals in the form of altered practice-related beliefs. A teacher may keep up with the younger students by continually honing their micro teaching techniques and are crucial in ensuring that their students remain attentive, responsive, and engaging. Managerial skills are crucial for teaching professionals as they ensure efficient classroom management, foster a positive learning environment, and enhance student engagement. These skills enable teachers to plan effectively, handle diverse student needs, and manage time and resources efficiently. The present study mainly aimed to assess the managerial skills required by teaching professionals. For this study, a sample of 30 teaching professionals from the University of Agricultural Sciences, Dharwad, were randomly chosen and self-structured questionnaire with 25 competencies including technical, conceptual, and human abilities was used. The responses were scored on a three-point scale, with 3 being always important, 2 representing sometimes important and 1 representing not important. The study concludes that teaching skills, classroom management, time management, being subject expertise, communication skills, guiding skills, leadership skills, adaptability/flexibility, patience, mentoring skills, active learning skills, decision making abilities, and delegating work/responsibilities are the most important skills required by an teaching professional.

Keywords – Technical skills, Human skills, Conceptual skills, Managerial skills of Teaching Professionals.

Exploring the Intersection of Panchayat Development Societies and Human Rights in Rural Governance: Operational Challenges, Effectiveness, and Recommendations

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Panchayat Development Societies (PDSs)play a crucial role in rural governance and development, particularly in how they navigate issues such as caste dynamics and gender disparities. affecting human rights. This study explores the multifaceted issues and challenges surrounding PDSs and human rights within the context of rural governance. After examining the operational challenges faced by PDSs, such as financial transparency and resource allocation, the study then assesses how these challenges impact the human rights situation in rural areas, including access to healthcare education, clean water, and livelihood opportunities, and analyses the role of PDSs in safeguarding and promoting these rights. It identifies the challenges that arise when PDSs aim to balance developmental goals with human rights concerns, such as resource constraints, bureaucratic hurdles, and societal attitudes. The study explores community participation in decision-making processes and its impact on local development. Based on the findings, the study offers practical recommendations to address the identified challenges. These recommendations may include policy changes, capacity-building initiatives, and community engagement strategies. The abstract concludes by emphasizing the need for a holistic approach to rural development that integrates PDSs and human rights considerations. It underlines the interdependence of these aspects and the potential for synergy in achieving sustainable development and human rights protection in rural areas.

Keywords: - Panchayat Development Societies, Rural governance, Caste dynamics, Gender disparities, Human rights, Healthcare, Education

Evaluation of Wheat Genotypes at Different Sowing Dates and Higher Fertility doses with growth retardants

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A field experiment was conducted at Research Farm of CCS Haryana Agricultural University, Hisar, India (29º10'N latitude, 75º46'E longitude and 215.2 M altitude) during Rabi season of 2022-23. The experiment was laid out in split-split plot design with three sowing dates i.e. 27th October, 11th November and 27th November and two level of nutrients management i.e. Recommended Dose of Fertiliser (RDF)- 150 N :60 P_2O_5 :60 K_2O (NM_1) and 150% RDF+ FYM@15 t/ha+ Growth Regulators (Two sprays as tank mix-Chlormequat chloride (Lihocin) @ 0.2%+ tebuconazole (Folicur 430 SC) @ 0.1% of commercial product dose at First Node and Flag leaf (Tank mix application) (NM_2)) in main plot and nine genotypes (WH 1270, DBW 187, DBW 303, DBW 222, WH 1252, P13031, P13653, P 13679, P 13983) were in sub plots, replicated thrice. Fertilizer was applied as per treatments. Other management practices were adopted as per recommendations of the wheat crop under irrigated condition. The significantly higher grain yield (69.20 q/ha) was recorded in early sown condition (27th October) as compared to timely sown crop (11th November) and late sown crop (27th November). The early sowing led to higher productivity of all genotypes and the average yield decline by 6.2 and 15.43 per cent as compared to 11th November and 27th November sowing, respectively. In nutrient management treatments, significantly higher grain yield (65.83 q/ha) was recorded with 150 % RDF + 15 FYM t/ha + two sprays as tank mix - Chlormequat chloride (Lihocin) @ 0.2% + tebuconazole (Folicur 430 SC) @ 0.1% of commercial product dose at first node and flag leaf (tank mix application) stage as compared to recommended doses of fertilizers (RDF). Among the genotype, P 13983 produced significantly higher grain yield (67.64 q/ha) as compared to other genotypes except WH 1270 and DBW 303 which were statistically at par with P 13983. It is concluded that the highest grain yield was recorded with high fertility treatment i.e. 150% RFD+ 15 FYM t/ha + applications of growth retardants under early sown conditions. Among the genotype, P 13983 produced maximum grain yield.

Maize Crop Diversification: A Crop of Opportunities, Options for Income and Nutritional Security to Grow

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India is a country of about one billion people. More than 70 percent of India's population lives in rural areas where the main occupation is agriculture. Indian agriculture is characterized by small farm holdings. Presently, with the rapid growth of population, the pressure on land has increased and the size of holdings has considerably decreased while the food demand is rising. Hence, crop diversification through technologically feasible and economically viable enterprise seems to be the only option to achieve the income and nutritional security. Crop diversification needed for the employment generation, sustainable income, ecological balance and to reduce the risk due to crop failure. Horizontal and vertical crop diversifications are the two approaches of diversification. Introduction of new crops is a most important diversification option.

Maize is the second most important cereal crop in the world in terms of acreage and is called the 'Queen of Cereals'. Global maize production touched approx. 1040 million MT in 2016-17, wherein, US has been the leading producer, followed by China, accounting for about 38% and 23% respectively. Importantly, maize contributes more than 2 per cent to the total value of output from all agricultural crops. Raw material of maize used for hundreds of industrial products that includes starch, oil, protein, alcoholic beverages, food sweeteners, pharmaceutical, cosmetics etc. Due to regular use of chemicals to control diseases, fungicide-resistant phyto-pathogenic strains may develop and adverse effect of chemicals on soil, plant health and crop products have compelled plant pathologist to look for eco-friendly strategies for plant disease management. Various disease management methods have been implemented to combat and eradicate pathogen. These include cultural, regulatory, physical, chemical and biological methods. All the methods are effective only when employed in advance as precautionary measures.

Keyword: Crop Diversification, Maize, Nutrition, Production etc.

Effect of spermidine on the nutritional indices of silkworms

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Spermidine, a polyamine known for its various biological functions, has been investigated for its potential to enhance nutritional uptake in silkworms (Bombyx mori). This study explores the impact of spermidine supplementation on the growth, development, and nutritional indices of silkworms (Bombyx mori). Experimental groups were fed a diet supplemented with varying concentrations i.e., 50 and 75 of spermidine, while control groups received a standard diet. Silkworms were administered varying concentrations of spermidine through their diet, and the effects on growth performance and food consumption were evaluated. Results indicated that spermidine supplementation led to a significant improvement in growth rates and efficiency of food consumption compared to the control group. The nutritional indices i.e., ingesta, digesta, excreta, approximate digestability and consumption index were recorded and spermidine recorded significant increase as compared to the control. The highest concentration of spermidine also resulted in improved silk gland development and elevated cocoon yield. These findings provide insight into the potential applications of spermidine in sericulture, offering a promising avenue for improving silkworm productivity and efficiency in silk production.

Keywords: silkworm; spermidine; nutritional;

Study of Nitrogen Use Efficiency in Potato (*Solanum tuberosum* L.)

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Study was conducted under All India Coordinated Research project on potato at Research cum Instructional form, Department of Genetics and Plant Breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.) during Rabi season 2021-22, in split plot design with three replications, for this research the experimental material consisting of twenty potato genotypes including two check variety Kufri Khyati and Kufri Chipsona-1.With three Nitrogen levels (0, 180 and 250 kg N/ ha), to find out the N requirement and Nitrogen use efficiency of Potato genotypes. Results of present experiment reveal that, all the genotypes are showing genotypic variability for NUE, there is sufficient variation for NUE. The genotypes used in the experiment are showing response to nitrogen and performing different the same genotype in three different nitrogen level, among the twenty genotypes P-73 recorded maximum Nitrogen Use efficiency at all the levels of nitrogen followed by Kufri Mohan and Kufri Lalima. Genotype P-73 proved to possess high tolerance to N stress and was the most nitrogen efficient variety followed by Kufri Mohan and Kufri Neelkanth. This experiment can be concluded as, the variety responding same at 180 and 250 Kg Nitrogen can be recommended to apply only 180 kg Nitrogen, the knowledge of NUE can save the money and land of farmer by minimal use of Nitrogen.

Keyword: Nitrogen use efficiency, nitrogen, potato, yield, varieties.

OCCUPATIONAL HEALTH HAZARDS AND DRUDGERY PERCEIVED BY FARM WOMEN

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Women are involved in both agriculture and household chores in rural India. Most of the tasks carried out by women are tedious as well as time consuming. An occupational hazard is something that causes harm to the farm women while performing the agricultural activities. In agriculture, they get exposed to hazards such as physical, chemical, biological, ergonomic, and psychosocial. Besides this they face additional risks, particularly reproductive health issues. Drudgery is commonly understood as the physical and mental exertion, suffering, exhaustion, repetitiveness, and challenges faced by individuals. Rural women are essential contributors to agriculture and various agro-based processing activities. There is significant concern regarding environmental and occupational health issues faced by agricultural workers, particularly related to working in high temperatures, injuries, exposure to pesticides, postural discomfort etc. The use of women friendly equipment and tools can enhance work efficiency and mitigate health risks associated with farm activities. Although women form the backbone of the agricultural labour force, their extensive contributions often go unpaid on a global scale. They undertake the most laborious and physically demanding tasks in agriculture, animal husbandry, and domestic responsibilities. The involvement of farmwomen is critical in numerous operations, including sowing and transplanting, weeding, grain storage, land preparation, seed cleaning, gap filling, manure and fertilizer application, harvesting, as well as threshing and winnowing. These activities significantly increase physiological demands and physical burdens, leading to an imbalance in the body due to heavy workloads. Various researches in this area revealed that musculoskeletal disorders, particularly affecting the lower and upper back, are prevalent among farm workers, primarily due to the bending and squatting postures required during manual rice transplanting and uprooting tasks.

Keywords- Rural women, Occupational hazard, Drudgery, Farmwomen

Bio-inspired silver nanofungicide for the effective control of anthracnose

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This study reports the green synthesis of silver nanoparticles (AgNPs) using indigenous leaf extract of *Pongamia pinnata*, exhibiting complete inhibition of the phytopathogenic fungus *Colletotrichum gloeosporioides*. *Colletotrichum* species rank among the top ten widespread phytopathogens, responsible for anthracnose and rotting diseases in over a hundred economically important crops, including okra, cereals, legumes, eggplant, tomato, banana, mango, apple, peach, grapes, citrus, and avocado. The eco-friendly and cost-effective AgNPs exhibit distinctive physicochemical properties, with their formation confirmed by a color change from brown to black. Comprehensive characterization of the synthesized AgNPs was investigated using various analytical techniques such as UV-Vis spectroscopy, Fourier-transform infrared spectroscopy (FTIR), field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDX), transmission electron microscopy (TEM), and X-ray diffraction (XRD). The antifungal activity was assessed in vitro using the poison food technique, with inhibition zones recorded across a concentration range of 10 to 2000 ppm. Mycelial growth inhibition was measured at 3, 5, and 7 day intervals, showing a concentration dependent increase in efficacy, with complete inhibition at 2000 ppm. These results highlight the potential of green synthesized AgNPs to serve as an effective and sustainable nanofungicide, offering an environmentally sustainable alternative to chemical fungicides for managing anthracnose and enhancing crop protection.

Keywords: *Colletotrichum gloeosporioides*, *Pongamia pinnata*, silver nanoparticles, silver nanofungicide, anthracnose.

Morphological characterization in recombinant inbred lines of bread wheat

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Wheat (*Triticum aestivum* L.) is a major cereal crop, integral for sustaining global food security. However, biotic stress such as yellow rust poses a significant threat to its stable production. Breeding wheat varieties resistant to yellow rust represents a cost-effective and sustainable strategy for addressing the challenges posed by the disease. The current experiment was conducted using 136 recombinant inbred lines (RILs) developed by crossing two parents viz. WH711 (susceptible) and PBW698 (resistant) for yellow rust resistance during Rabi 2022-23. Data was recorded for yield and yield contributing traits. Correlation analysis revealed a highly significant and positive correlation for grain yield with flag leaf length, peduncle length, number of productive tillers per meter, spike length, number of spikelets per spike, number of grains per spike, thousand grain weight, harvest index and biological yield per plot. Moreover, cluster analysis categorized the RILs into six discrete clusters with parent PBW698 lying in cluster II and parent WH711 lying in cluster V, representing the presence of sufficient genetic diversity among the lines as well as parents. The highest inter-cluster distance was found between cluster I and cluster IV indicating maximum divergence among these two clusters, while highest intra-cluster distance was observed in cluster I. Disease scoring done on the basis of Modified Cobb's scale, categorized the population into 5 classes i.e. highly resistant (56), resistant (23), moderately resistant (25), moderately susceptible (8) and susceptible (26) to yellow rust. The selected lines could be further used for the hybridization programme for breeding high yielding and yellow rust resistant genotypes in wheat.

Keywords: Correlation, Cluster, RILs, Wheat and Yellow rust.

Deep Learning-Based Accurate Detection of Insects and Damage in Cruciferous Crops Using YOLOv5

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Insects are an integral part of an agroecosystem. Some of them are pestiferous, while some are beneficial like, - natural enemies and pollinators. Therefore, it is very important to identify and manage them timely. With the rapid development of convolutional neural networks, automatic detection techniques for identifying insects using digital images have shown impressive performances in agriculture. In this study, we propose a deep learning approach using YOLOv5-based single-stage object detection model for the identification of agriculturally important insects of crucifers and some of their damage symptoms. A total of 2,730 images were captured from different fields and polyhouses using different smartphones and an SLR camera. The specimens were taxonomically identified by experts and the images were curated, annotated, resized, augmented, split, and trained, validated and tested through five variants of YOLOv5 viz. nano (n), small (s), medium (m), large (l), and extra-large (x). After all the experiments, YOLOv5l was found to be the best-performing model, acquiring an average accuracy, precision, recall, and F1-Score of 99.5%, 92.0%, 83.0%, and 0.873, respectively in the test images. The inference time and computational complexity of YOLOv5l were also significantly lower than those of YOLOv5x. Therefore, to strike a balance between complexity and performance, YOLOv5l had emerged as the most viable option to integrate with AI-based insect identification applications. Our findings revealed that deep learning is reliable for quick detection of insects under complex backgrounds. Further, we demonstrated that the use of damage symptoms produced by insects will also be explored for pest detection. Integration of present model with mobile application will help the farmers and other stake holders in detection of insects and suggesting effective management.

Keywords- agriculture, crucifers, deep learning, detection, YOLOv5

Revolutionizing Microbial Nutrition: The Development and Impact of NanoBioNourish for Enhanced Bacterial and Fungal Growth

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Microbial nutrition plays a crucial role in the sustainable growth and activity of bacteria and fungi, which are essential for various industrial, agricultural, and environmental applications.. By leveraging nanotechnology, NanoBioNourish ensures precise delivery of essential nutrients at the cellular level, resulting in superior growth rates, increased metabolic activity, and improved overall microbial health. NanoBioNourish was developed through a comprehensive research process that involved optimizing the size, composition, and functionalization of nutrient nanoparticles. These nanoparticles are engineered to facilitate better uptake by microbial cells, significantly improving nutrient availability and utilization. This innovation addresses the challenges posed by conventional microbial nutrients, such as poor solubility, limited bioavailability, and nutrient wastage.

The paper presents extensive experimental results demonstrating the efficacy of NanoBioNourish across various microbial species, including both bacteria and fungi. Comparative studies reveal that NanoBioNourish outperforms traditional nutrient formulations in promoting microbial growth under different environmental conditions. The use of NanoBioNourish also contributes to reduced nutrient input requirements, lowering costs and minimizing environmental impact. The development of NanoBioNourish marks a significant advancement in microbial nutrition technology. Its application potential extends to diverse fields, including agriculture, biotechnology, pharmaceuticals, and environmental management. The paper discusses the potential implications of NanoBioNourish in enhancing microbial-based processes, such as bioremediation, biofertilization, and industrial fermentation. In conclusion, NanoBioNourish represents a revolutionary approach to microbial nutrition, with far reaching impacts on various sectors reliant on microbial activity. This innovation not only improves microbial growth and productivity but also supports sustainable practices by optimizing nutrient use and reducing environmental footprints.

RESIDENTIAL INTERIORS FOR ELDERLY IN KITTUR TALUK

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With changing times, the joint families are replaced by nuclear families and the current generation of old, people do not want to be dependent on their family members. Staying in their own houses makes then lonely by themselves which results in depression. Retirement housing gives them the sense of ownership of their own house but at the same time caters to their various need. Retirement housing community is a type of housing which houses the senior citizen after retirement or after a given age to aid their living with special design elements in the coming years. The study was conducted in Kittur taluk of Belgavi district with sample size of 60 men and women above the age 60 years. The purposive random sampling technique was adopted to select the sample for the study. The study concluded that, related to physical health problems of elderly, poor vision was found to be a major health problem among both men and women folloed by leg pain. Majority of the respondents faced problem with slippery tiles in house and size of the basin in bathroom and difficulty to use Indian toilets. Elderly men and women come across with insufficient lighting and ventilation problems in bathroom and water closet.

Keywords: Elderly, Housing, Health, Bathroom

Role of family environment on Socio-emotional problems of school discontinued rural youth

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A study on "Role of family environment on Socio-emotional problems of school discontinued rural youth" was carried out in UAS, Dharwad with objectives to assess level of socio-emotional problems and family environment of school discontinued rural youth and impact of family environment on socio-emotional problems. The results revealed that, more number of school discontinued rural youth were found to have severe level of socio-emotional problems followed by moderate and mild respectively. With respect to relationship dimension of family environment, majority of the respondents belonged to average category with respect to acceptance and caring (62%) and conflict (58%). However, more percentage of youth belonged to low category of cohesion and expressiveness (72 and 60% respectively). This indicates that most of the youth were accepted and cared by their parents in the family. With regard to personal growth dimension, majority of the respondents were found to be fall under the average category of active recreational orientation (70%) and low category in independence (56%). In case of system maintenance dimension, 62 per cent of the respondents belonged to average category in both sub dimensions namely organization and control. Further results of influence of family environment on socio-emotional problems of school discontinued rural youth showed that among family environment dimensions, particularly cohesion component of relationship dimension and control of system maintenance dimension had positive and significant influence on socio emotional problems of youth. While the independence of personal growth dimension had negative had significant influence on socio emotional problems. So, it is necessary to provide intervention programs to educate rural youth and their parents about quality of family environment to minimize youth's socio-emotional problems.

Keywords: Family environment, Socio-emotional problems, Discontinued, Youth

MANAGEMENT OF SUCKING INSECT PESTS ON COTTON BY USING DRONE TECHNOLOGY

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A field experiment was carried out at RARS, Nandyal during the kharif season of 2023 to evaluate the efficacy of sequential spraying of selective insecticides i.e., flonicamid 50 WG @ 0.3 g l^{-1} and fipronil 5 SC @ 2 ml l^{-1} at 30 days after sowing (DAS), imidacloprid 17.8 SL @ 0.4 ml l^{-1} and thiamethoxam 25 WG @ 0.2 g l^{-1} at 60 DAS, diafenthiuron 50 WP @ 1.25 g l^{-1} and profenophos 50 EC @ 2 ml l^{-1} at 90 DAS for the management of sucking insect pests (leafhopper, thrips, aphids and whitefly) on cotton by using drone spraying in comparison with knapsack sprayer. Totally three sprays were taken at different intervals i.e., 30, 60 and 90 DAS. The data on sucking pest population was recorded at five intervals i.e., day before spray, three, seven, fourteen and twenty days after every spray in both drone spraying and knapsack spraying plots. The results of the present study indicates that less number of sucking population was recorded in drone spraying compared to knapsack spraying. The insecticide flonicamid 50 WG @ 0.3 g l^{-1} with drone spray recorded less number of leafhopper population (0.30 per three leaves) with highest per cent reduction (98.65%) and thiamethoxam 25 WG @ 0.2 g l^{-1} with drone spray recorded the less number of thrips, aphids and whitefly population (0.16, 0.08 and 0.12 per three leaves) with highest reduction per cent of 99.10%, 99.63% and 98.96%, respectively.

KEYWORDS: Cotton, Insecticides, Sucking pests, Amrasca biguttula biguttula, Aphis gossypii, Bemesia tabaci, Thrips tabaci.

Babesiosis: A prevalent parasite of Banaskantha district of North Gujarat

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Bovine babesiosis is a tick-borne disease caused by the hemo-protozoan parasites of the genus Babesia. It has 4 main species viz., Babesia bigemina, Babesia bovis, Babesia major and Babesia divergens that can cause bovine babesiosis. Ticks mostly present in the area are Rhiphicephalus (Boophilus) spp, Hyalomma spp, etc. A study was conducted with 206 bovines (160 cattle and 46 buffaloes) to estimate the prevalence of babesiosis in Banaskatha district of Gujarat. Blood was collected based on the history of high fever, coffee-coloured urine and tick infestation from different farms of Banaskatha districts. Traditional microscopic examination revealed the presence of pear shaped paired Babesia spp. was 22.5% and 13.04% in cattle and buffaloes, respectively whereas PCR based assay with an amplicons size of 278 bp specific for Babesia bigemina revealed in 53 cattle and 13 buffaloes indicating that bovine babesiosis is prevalent in the district. No blood samples were found to be positive for other Babesia spp. in microscopic as well as in PCR based assay. Thus it can be concluded the molecular PCR based assay has higher potency for detection of the parasite as compared to the efficacy of microscopic blood smear examination and can be regarded as a suitable diagnostic tool for detection of the parasites.

Studies on seed quality parameters in cold plasma treated paddy grown during Rabi season for cold stress tolerance

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Rice (Oryza sativa L.) is the world's second-most-important staple food crop nearly half of the world's population depends on it. Rice is sensitive to various abiotic stresses among which cold stress is important one which impacts the germination rate, vegetative and reproductive phases. Low temperatures impede photosynthesis resulting in the formation of free radical species. Development of climate resilient varieties is critical as cold stress is a polygenic trait, identifying the germplasm for this trait is highly challenging. Cold plasma treatment to rice seeds act as a "mild stressor" that could induce signalling pathways and strengthen the rice plants to combat cold stress, thus eliciting a response from the plant immune system to protect itself from stress. Both normal seed and sprouted seed of three varieties of rice viz., RNR15048, JGL24423 and Tellahamsa were treated with 20 kV cold plasma for 15 minutes. The nursery was raised during Rabi 2023-24 when the temperatures dropped below 15^0C. The crop was harvested in the month of April, 2024. The harvested seed quality parameters were recorded by taking seed germination rate (%), radicle emergence (%), seedling dry weight (g), seedling vigour index- II, speed of germination, seed moisture content (%) and electrical conductivity of seed leachate (µS/cm/g). The results revealed that, cold plasma treatment showed non-significant difference for germination rate for varieties; types of seeds and their interaction effects. In radicle emergence test after 96 hrs RNR 15048 showed 8.4% increase over Tellahamsa, among types of seed sprouted seed had showed 6% increase over untreated control and in interaction effects RNR15048 plasma treated normal seed revealed 14.6% increase over Tellahamsa control seed. For seedling dry weight (g) Tellahamsa had showed 58% increase over RNR15048, while types of seeds were on par each other and interactions effects revealed that Tellahamsa control had recorded 62% increase over RNR15048 plasma treated normal seed. Tellahamsa recorded 56% higher seedling vigour index-II compared to RNR15048 while interaction effects showed Tellahamsa control recorded 61% higher seedling vigour index- II compared to Tellahamsa normal seed treated with plasma. JGL24423 had showed 5.8% increase over RNR15048 for germination index while interaction effects showed that JGL24423 normal seed treated with plasma recorded 14.23% increase over Tellahamsa control. Less moisture content was recorded in JGL24423 sprouted seed and highest in JGL24423 control seed. Lowest electrical conductivity of seed leachate has recorded in Tellahamsa sprouted seed while highest was recorded in JGL24423 control. Thus, cold plasma treatments can be used to improve seed quality parameters and protect paddy seeds from cold stress.

Exploring the biocontrol potential of native rhizospheric bacteria against Sclerotium rolfsii in elephant foot yam

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Elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.)), popularly known as "King of tuber crops" is valued for its therapeutic and nutritional qualities and often regarded as one of the most significant crops among the tropical tuber crops grown in India and abroad. Collar rot disease caused by Sclerotium rolfsii, is a major threat to its cultivation leading to a potential yield loss of up to 100%. Chemical methods were mostly adopted for the management of the disease. However, biological control methods are considered as a safe and sustainable choice over the popular chemical management strategy. Hence, the present study was carried out to evaluate the effectiveness of native rhizospheric bacterial isolates against S. rolfsii. A total of 82 bacterial isolates were isolated from healthy plants' rhizospheric soil and evaluated for their antagonistic activity against the pathogen by dual culture assay. Based on the initial trials, 15 bacterial isolates were identified as potential biocontrol candidates and further subjected to cultural and morphological studies. Among these isolates, the best bacterial antagonists were identified to be B 57 and B 43 based on their percentage of mycelial inhibition (60.74 % and 58.51 %) compared to control. Molecular characterization identified and confirmed the isolates as Bacillus amyloliquefaciens (B57) and B. velezensis (B43). These native rhizospheric bacterial isolates were considered as environmentally friendly and further field research may be carried out to include these in the integrated approach to plant disease management, and improving crop yield.

SUSTAINABLE LANDSCAPE DESIGNING

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The best landscape designs are the ones that have been carefully thought out with attention paid to the details. Before planning a landscape it is important to decide what style would best fit your home and lifestyle. Landscape design is both an art and a purposeful process. It is the conscious arrangement of outdoor space to maximize human enjoyment while minimizing the costs and negative environmental impacts. A well-designed home landscape is aesthetically pleasing and functional, creating comfortable outdoor spaces as well as reducing the energy costs of heating and cooling the home. It offers pleasure to the family, enhances the neighborhood, and adds to the property's value. With a little forethought and planning, the designer can maximize the property's use and people's enjoyment of it; establish a visual relationship between the house, its site, and the neighborhood; and contribute to a healthy local ecosystem. Garden historians now recognize the important influences that physical geographic factors have on design outcomes. Traditional garden history, however, has concentrated on investigations of visual form, the arrangement of landscape designs and the cultural or social influences behind design ideas. Similarly, conventional histories, written by experienced locals, focused on northern hemisphere, temperate climate gardens where regional differences were usually explained by cultural forces without adequately exploring the impact of the natural environment.

Recent research has shown that migrant gardeners' experiences of learning about their new land and climate, typically involves a three-step process of acclimatization: firstly, observation and experimentation; secondly, adaptation and refinement; and thirdly, innovation and consolidation. Documenting and promoting this acquired gardening knowledge for warmer climates slowly developed during recent centuries. Information technologies especially GIS can help to improve the landscape planning process and to capture the results in existing information systems for future use or as part of environmental information or decision support systems. If landscape architects take seriously their role as community builders, then they must embrace GIS as an exploratory design tool and elevate its application.

Ultrasound powered Accelerated Aging of Paddy: Process Optimization and Techno-functional characteristics

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The present research study was undertaken to explore the possibilities of accelerating the aging of paddy through ultrasound processing and assess its effects on techno-functional properties of milled rice. The central composite rotatable design of response surface methodology was adopted for experimentation with time of ultrasound processing and thermosonication temperature as process variables and milling and cooking characteristics as response variables. The paddy grains, free from dust and foreign materials, were subjected to controlled ultrasound processing at constant frequency (20 kHz) and power (250 W) for various time durations (30, 60 and 90 minutes) and at different ultrasound temperatures (30, 40 and 50℃). The results indicated that ultrasonication improved the milling efficiency and certain cooking quality characteristics of milled rice. The cooking time of rice decreased while water uptake ratio, volume expansion ratio and solid loss of rice increased. The ultrasonication process contributed in improvement of bioactive components of rice which was resulted from increased phenolic content and antioxidant activity. Moreover, texture profile of rice was modified after ultrasound treatment which was evidenced from the increase in cohesiveness and springiness of rice which are responsible for mouthfeel texture of rice. The numerical optimization suggested that the optimum ultrasound treatment conditions were finalized up to 60 minutes time and 50℃ temperature at which desirable changes at par to naturally aged rice were found. Furthermore, the structure profile of rice performed through the X-ray diffraction, Fourier Transform Infra-Red spectroscopy analysis and Scanning electron microscopy have revealed that the rice from ultrasound treated paddy had higher crystallinity, undergo protein dissociation and had more porous structure.

Evaluation of total phenol and Vitamin C contents in Byadgi Red Chillies (Kaddi and Dabbi) grown in different locations of Haveri District, Karnataka.

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Red Chilli (*Capsicum annuum* L.) is widely cultivated spice belongs to the genus Capsicum and is extensively used in food preparation for its pungency, flavor and as natural food colorant. The phytochemicals in Red Chilli found to exhibit vital pharmaceutical properties. Byadgi Chilli variety grown expansively in town of Byadgi of Haveri District of Karnataka has granted Geographical Indication tag (No. 129) and includes two main kinds namely, Byadgi Kaddi, long- wrinkled chilli and Byadgi Dabbi, short-rounded chilli that varies in their phenotypic appearance. The present study investigated total phenol and Vitamin C (Ascorbic acid) contents in ten samples each of Byadgi Kaddi and Dabbi chilli varieties grown in different locations of Haveri District. The total phenol content was in the range of 26.60 - 42.60 mg GAE/100g DW and 22.80 - 38.50 mg GAE/100g DW for Byadgi Kaddi and Dabbi varieties, respectively. The Ascorbic acid content of Byadgi Kaddi was found to be in the range of 178.84-193.45 mg/100 g DW and 206.35 – 221.46 mg/100 g DW in Byadgi Dabbi varieties. It was documented that Byadgi Dabbi chilli showed higher Ascorbic acid and upright total phenol contents. Red chilli that are rich in ascorbic acid and phenolic compounds are potent antioxidants for human nutrition and helps in proper functioning of metabolism. Hence, Byadgi Dabbi chilli rich in these phytochemicals may be recommended for culinary dishes for pharmaceutical benefits and for its bright color in food preparations.

Keywords: Red Chilli, Byadgi Kaddi, Dabbi, Total Phenol and Vitamin C

Vetiver (*Chrysopogon zizanioides* (L.) Roberty) – an aromatic root crop for soil and water conservation

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Khus grass or vetiver (*Chrysopogon zizanioides* (L.) Roberty) is a hardy perennial aromatic grass with long enormous tufted fibrous root system. Commercially, dry roots are used for extraction of essential oil that acts as a fixative in perfumery industry worldwide. Besides, vetiver roots are used in medicinal and pharmaceutical industries to treat rheumatism, arthritis, gouty joints, paralysis and indigestion. Roots and root oil have strong anti-oxidant, stimulant, carminative and cooling properties and used in Ayurvedic medicines. Traditionally, vetiver plants are being used to cultivate across hill slopes, waterways and wastelands to reduce runoff and soil conservation. During 1990's World bank was promoting use of vetiver grass as contour vegetative barrier in upland farming systems of Asian and African countries. Further, recent studies report the use of vetiver in phytoremediation, reclamation of mined lands and soil and water detoxification in addition to carbon sequestration. Due to introduction of modern cultivation practices, traditional soil conservation practices are being vanished gradually over a period of time. In this regard, an attempt has been made to review the scientific evidence for use of vetiver grass as a soil and water conservation measure along with phytoremediation. Contour hedgerows of vetiver, planted at 1m vertical intervals under 5% slope, have reduced surface runoff an average of 30% and 47% compared to conventional practices of graded banks and across slope cultivation. It was reported that 94-97% reduced soil loss along with 95% low soil detachment rate and the runoff rate was reduced by 21 % in vetiver planted location.

Comparative Analysis of Integrated Farming Systems for Employment and Income Generation in Central India: A Case Study of Chhattisgarh and Madhya Pradesh

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This study explores the efficiency of Integrated Farming Systems (IFS) in boosting employment and income in selected districts of Chhattisgarh and Madhya Pradesh, two states in Central India. The research was conducted in Rajnandgaon and Kawardha in Chhattisgarh, and Balaghat and Mandla in Madhya Pradesh, involving 320 respondents from these regions. IFS, which integrates activities such as crop production, cattle rearing, vegetable cultivation, and poultry, offers a sustainable agricultural approach by optimizing resource use and enhancing economic stability for smallholder farmers.

The study reveals notable disparities in employment and income generation between the two states. In Chhattisgarh, employment primarily stemmed from crop production, cattle rearing, and vegetable cultivation. In contrast, Madhya Pradesh saw greater employment generation from crop production, cattle rearing, and poultry farming. On average, Madhya Pradesh achieved 92.77 man-days of employment per year, surpassing Chhattisgarh's 82.73 man-days. This indicates a higher efficiency of IFS in generating employment in Madhya Pradesh.

When examining income, crop production emerged as the most lucrative IFS component in both states. The study highlights the significant role of IFS in improving the livelihoods of farmers by offering a diversified and sustainable approach to agriculture. The data suggests that specific IFS practices in Madhya Pradesh contribute more effectively to both employment and income generation. These findings are vital for policymakers and agricultural planners seeking to advance sustainable agricultural practices and improve economic conditions in Central India. The insights from this research can guide future strategies to optimize IFS and support the development of agricultural sectors in these regions.

Keywords: Integrated Farming System, Employment Generation, Income Generation, Chhattisgarh, Madhya Pradesh

Understanding the antifungal properties of endophytes through metabolomics study

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Endophytic fungi are known to be the natural storehouse for several active metabolites which has a varied biological and cellular function that affects both primary and secondary metabolism. The study of these metabolites forms the core of metabolomics. Being downstream to transcriptome and proteome, metabolomics gives a key to understanding the relationship between pathogen and endophyte interaction, the effect of endophyte on the metabolome of the pathogen, and the effect of metabolites produced on the environment. The present research focussed to study the antagonistic effects of Schizophyllum commune and Nigrospora oryzae when confronted against phytopathogens showed significant inhibition on the growth of the pathogens. Schizophyllum commune (E1) showed a maximum inhibitory zone against Botrytis sp. with PI% of 77.77% followed by Fusarium sp. with PI of 75.18%, whereas Nigrospora oryzae (E2) showed maximum inhibition against Colletotrichum sp. (70%). A further insight into the evaluation of defense-related enzyme of the endophyte-primed seeds revealed the production of different phenolic compounds in varying concentrations. HPLC analysis of the same plants identified approximately 90 metabolites from which 4 important metabolites namely, salicylic acid, coumaric acid, quercetin, and rutin were shared by both the endophytes. The spectra showed 7 different antifungal compounds namely, aspartate, fumaric acid, salicylic acid, adenine, glutamylphenylalanine, 2-oxo isocaproate, and quinolinic acid which were produced by endophytes primed seeds. These metabolites have important role in the activation of defense signaling pathways. An attempt was made to bioformulate the effective endophyte using solid carrier (talcum powder) and its efficacy was checked on solanaceous crops. The overall germination percentage and seedling vigor were found to be increased with lesser disease incidence on the treated plants.

Keywords: Schizophyllum commune, Nigrospora oryzae, HPLC, NMR, metabolites, bioformulation

Comparative study of different farming practices on soil physical, chemical and biological properties under rabi sorghum ecosystem

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An experiment was conducted at Institute of Organic Farming, University of Agricultural Sciences, Dharwad on a fixed site during rabi season for two years (2020-21 & 2021-22) to assess the effect of natural farming, organic farming, integrated nutrient management practice (INM) and recommended package of practices (RPP) on physical, chemical and biological properties of soil in rabi sorghum (Variety: SPV 2217) under rainfed condition. The mean of two years study revealed that, among soil physical properties, organic farming recorded significantly higher soil aggregate stability and maximum water holding capacity (MWHC) but bulk density (BD) remain unaffected. Among soil chemical properties, that soil reaction (pH) did not differ significantly while electrical conductivity was significantly higher in RPP and higher organic carbon content in soil was recorded in organic farming practice compared to natural farming, INM practice and RPP. With respect to macronutrients, RPP recorded significantly higher available N and P_2O_5 but available K_2O and S were significantly high in organic farming while micronutrients; Fe, Zn, Mn and Cu content were significantly higher in organic farming. For biological properties, dehydrogenase activity (DHA) was considered which was significantly higher in organic farming compared to RPP. However, DHA of natural farming and INM practices were on par with organic farming.

Challenges and opportunity in Organic farming

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Organic farming is also known as ecological farming or, biological farming is an agricultural system that uses fertilizers of organic origin such as compost, manure, green-manure, and bone meal and places emphasis on techniques such as crop rotation and companion planting. Organic farming in India is attaining popularity day by day. The rising population of India has started creating demographic pressure on the agriculture sector to maintain food security. To generate good health and environment, a need arise a shift to organic agriculture. India is home to 30% of total organic producer in the world. But organic farming may faces the different challenges like lower yield as compared to conventional method of farming. This is due to factors like pest & diseases pressure, nutrient limitation & reliance on less potent weed control methods. Organic farming typically faces with more labour cost, and have limited infrastructure for processing, storing and distributing organic produce often less developed than from conventional product. This can lead to challenges in getting organic food from farm to table. The demand for organic food is growing, but still it represents a niche market in many regions. This can make it difficult for organic farmers to find reliable buyers and secure fair prices for their produce. The growing health consciousness among the consumer and increasing awareness about organic food has led to numerous opportunities for organic producers like advancement in areas like use of biopesticide, precision agriculture and soil health managements making organic farming more efficient and productive. Government also recognizing the value of organic agriculture and implementing policies that encourage its adoption and the consumer become more aware of the benefits of organic food, so this create opportunities for farmers to expands their market and connect directly with consumers. Organic farming offers a range of environment benefits like improving soil health, reduced pollution and increased biodiversity.

Key words-Bio-diversity, Bio-pesticide, soil health, crop residue, sustainable etc.

Innovative approach for enhancing the farmer's income

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Doubling agricultural income in India is a very big task and there is a need of the hour in present day. The pasts strategies for development of agriculture sector in India have focused primarily on raising agricultural output and improving food security. The net result has made India not only food self-sufficient, but also a net food exporting country. There are three primary ways in which income of farmer's may be enhanced as for example, increasing the gross income, reducing the costs and stabilizing the income. Some of the innovative approaches for doubling farmer's income are enhancing production through improved seeds, planting material and organic farming, adopting biotechnological approaches, genome editing an alternative to transgenic technology, leveraging water resources and initiating integrated water use policy, strengthening warehousing and cold chain facilities to curb post-harvest losses, value addition through food processing, establishing special Agriculture zones(SAZ) by selecting export oriented and industrial use crops, precision agriculture, agriculture diversification including secondary and specialty agriculture and leveraging the flagship programmes of the government. By adopting the above said approaches in an integrated manner, the objective of doubling farmer's income can be achieved. About 85% farmers of India are small and marginal. Hence, there is need for establishing package of practices in an integrated manner to enhance on-farm resource recycling, employment, income and sustain soil health. In India, the agriculture sector is constantly improving its mechanism to maximize output and ensure food security. However, a large population is leaving farming practices because of the low- income generation. As a result, in 2016, the government of India formed an interministerial committee for the evaluation of existing problems and then recommends feasible strategies to accomplish the mission of "Doubling farmer's income by 2022''.

Keywords: Food security, Biotechnological approach, value-addition, Agricultural-diversification etc.

Effect of ramie fodder on in vitro rumen fermentation and methane production

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Reducing methane emissions from ruminants is crucial for sustainable livestock production and mitigating global warming. This study evaluates the effectiveness of incorporating ramie (Boehmeria nivea L. Gaud) into a total mixed ration (TMR) with a 60% roughage and 40% concentrate formulation as the control. In this in vitro trial, berseem in the TMR was replaced with ramie fodder at levels of 10%, 20%, 30%, 40%, and 50%, referred to as R10, R20, R30, R40, and R50, respectively. The findings indicated that as the proportion of ramie increased, there was a gradual decline in total gas production, methane production, in vitro dry matter digestibility (IVDMD), and in vitro organic matter digestibility (IVOMD) compared to the control group. Notably, methane emissions were reduced by 12.7% and 14.95% at the 40% and 50% ramie replacement levels, respectively. The study revealed strong negative correlations between the inclusion of ramie in the TMR and both IVDMD ($r = -0.88$) and IVOMD ($r = -0.89$). Additionally, there was a negative correlation between ramie levels and total gas production ($r = -0.68$) and methane production ($r = -0.90$). A positive correlation was observed between methane production and both IVDMD ($r = 0.80$) and IVOMD ($r = 0.74$). The inclusion of ramie did not significantly ($P<0.05$) affect ammonia nitrogen concentration (mg/dL), pH, total volatile fatty acids (TVFA, Mm/L), or butyrate (Mm/L) production in rumen liquor. However, a significant ($P<0.05$) reduction of 11.10% in acetate (Mm/L) production was observed in the R50 group compared to the control, with no differences among the R10-R40 treatments. Propionate production increased significantly ($P<0.05$) by 12.26%, 14.81%, 23.81%, and 30.05% in the R20, R30, R40, and R50 groups, respectively. In conclusion, replacing berseem with 50% ramie fodder in the TMR offers an effective strategy for reducing enteric methane emissions by 14.95% under in vitro conditions.

Keywords: Ramie; Methane mitigation; Livestock; In vitro; Degradability

AI-Driven Speed Breeding: Transformative Approaches for Advancing Modern Crop Improvement

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Breeding crops in a conventional way demands considerable time, space, inputs for selection, and subsequent crossing of desirable plants in addition to the rate of yield increment in most crop breeding programmes is insufficient to cope up with the increased food demand caused by the burgeoning global population, coupled with the challenges posed by climate change and food security. In this context, speed breeding (SB), relying mainly on photoperiod extension, temperature control, and early seed harvest, has the potential to accelerate the rate of plant improvement. The integration of AI with genomic selection has ushered in a new era in speed breeding, providing unprecedented precision, efficiency, and adaptability. The combination of genomic information and advanced AI algorithms holds immense promise for rapidly developing crop varieties with improved traits, addressing the challenges posed by a growing global population and changing environmental conditions. Advancements in computer vision technologies, particularly convolutional neural networks (CNNs), have reshaped the landscape of plant phenotyping. In conclusion, the integration of AI into crop simulation for speed breeding represents a paradigm shift in modern agriculture. The ability to forecast crop performance accurately and rapidly under varying conditions empowers breeders with the knowledge needed to make informed decisions, ultimately expediting the development of resilient and high-yielding crop varieties. As technology continues to evolve, the synergy between AI and accelerated crop simulation holds great promise for meeting the challenges of global food security in the 21st century.

Keywords: Artificial Intelligence, Speed Breeding, Decision Support System, Crop Simulation, Neural Networks.

Role of Government policies in promoting sustainable millet cultivation and climate resilience in India

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Government policies are crucial for initiatives in various sectors viz., public welfare, community development and agriculture. In agriculture, they contribute to success by providing financial support, enhancing infrastructure, promoting sustainable practices and addressing challenges faced by farmers, which is essential for achieving food security and ensuring long-term sustainability. Through impactful policies the government promotes sustainable agricultural practices, invests in agricultural research, provides financial assistance and insurance, and improves infrastructure to enhance resilience to climate change in the agricultural sector. Integrating climate change considerations into agricultural policies ensures sustainability goals are met, enhancing the effectiveness of initiatives. Globally, climate change significantly impacts agriculture, affecting productivity, food security, and farmers' livelihoods. Altered weather patterns, soil degradation, pest proliferation, threats to livestock and food security are key concerns. In India, average temperatures have risen by 0.7°C since 1901, leading to warmer growing seasons that adversely affect crop yields. Summer monsoon rainfall has declined by about 6% since the 1950s, with a more significant decline of 10% in central India. Without adaptation measures, projections indicate that rainfed rice and wheat yields could decrease by 20% and 19.3% by 2050, respectively under changing climatic conditions. The frequency of extreme weather events, such as heatwaves and floods, has increased, significantly impacting commercial crops like wheat, maize, and soybeans. Millets, also known as "Shree Anna," are gaining attention in India due to their nutritional benefits and climate resilience. The government is promoting millets as a sustainable agricultural practice to improve food security and combat climate change. Millets are rich in protein, fiber and minerals, making them a superfood that can combat malnutrition. They are drought-resistant, require less water, and thrive in poor soil conditions, making them ideal for arid regions and providing farmers with an environmentally friendly alternative to water-intensive crops. The government aims to revitalize millet cultivation and consumption in India through targeted policies and initiatives such as the National Millets Mission (NMM), incentives under the National Food Security Mission, and the Mission on Sustainable Dry Land Agriculture (MSDA). Various state initiatives and the encouragement of Farmer Producer Organizations (FPOs) also play a crucial role. Additionally, strengthening research and development, linking farmers to value chains (e-NAM), and promoting millet exports through APEDA are major government initiatives that have led to better prices in the market and incentivized farmers to produce more climate-smart crops viz., millets.

Keywords: APEDA, millets, superfood, FPO, policies.

Evaluation of yield attribute, soil nutrient status and cost analysis in Aman rice under integrated nutrient management in old alluvial soil of West Bengal

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A field experiment was conducted at eleven farmers' fields of Dakshin dinajpur district during kharif season for three years under alluvial soil of West Bengal to assess the integrated plant nutrient supply system (IPNS) in Aman rice involving different organic as well as inorganic nutrients sources on growth attribute and yield, related to cost analysis. The treatments were kept minimal to avoid multicollinearity effect which would also evoke better understanding of the study. The experiment employed a randomized block design having similar soil properties and also receiving similar pattern of fertiliser application for long period of time. The experiment was laid out in consisting three treatments i.e., T_1-application of NPK @ 55:32:27 kg ha^{-1} as farmers' common practice, T_2- application of soil test based 75% recommended dose of N through chemical fertilizer + 25% N through azolla in rice fields, and T_3- application of plant nutrient through soil test based 75% recommended doses of chemical N + 20% recommended doses of N from vermicompost + 5% recommended doses of N through Azolla in rice fields. T_3 significantly improve plant height, number of effective tiller m^{-2}, number of $panicle^{-2}$, gain $panicle^{-1}$, LAI, 1000 grain weight that directly increase grain yield compared to T_2 and T_1 treatments. Highest B:C ratio was estimated in T_3 (1.29) because of lower cost of production and significant higher yield than T_2>T_1. This experiment results combine and balance nutrient source (T_3) could improve crop growth and sustain rice productivity.

Keywords: Rice, integrated plant nutrient supply, vermicompost, azolla

Advanced Seed Classification Using a Deep Neural Network Framework with NIR Spectroscopic Technology

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Assessing seed health is crucial for agriculture, environmental preservation, and ecological studies. Traditional methods for testing life potential of seed are resource-intensive, inefficient, and non-invasive, making them less suitable for evaluating limited or valuable seed resources. In fields such as farming, biodiversity protection, and environmental research, accurately determining seed quality is essential. Near-Infrared (NIR) spectroscopy offers a non-invasive approach but poses challenges in pre-processing spectral data, such as baseline shifts and noise interference. To address these challenges, a Convolutional Neural Network (CNN) model, rather than conventional linear machine learning algorithms, can be employed to analyze NIR spectral data and enhance the accuracy of seed viability assessments. This study introduces a non-invasive technique that integrates NIR spectroscopy with a CNN algorithm to improve the precision of seed viability evaluations. NIR spectral measurements were captured from various seed species within a diverse dataset. The spectral data were processed using Convolutional Neural Networks to classify seeds based on their germination status, distinguishing between healthy and dead seeds. The model's performance was assessed using metrics such as accuracy, precision, recall, and F1 score. Experimental results demonstrated that the combination of NIR spectroscopy and CNN effectively classified healthy and dead seeds according to their germinating ability. The CNN model, in particular, excelled at identifying subtle patterns in the spectral data, achieving a significant accuracy (approximately 96%.) of identifying seed samples of the major class that were normal seeds as compared with other traditional machine learning algorithms. The automatic object identification method not only preserves precious seed resources but also offers a scalable solution ideal for extensive agricultural and conservation efforts.

Keywords: Classification, Machine Learning, Convolutional Neural Networks (CNN), Near-Infrared (NIR) Spectroscopy, Healthy seed identification.

Empirical Constraints Perceived by Shrimp Farmers in North Konkan, Maharashtra, in Compliance to CAA Act, Rules and Guidelines

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The Coastal Aquaculture Authority (CAA) Act, along with its rules and guidelines, encourages sustainable aquaculture practices in coastal areas to protect the livelihoods of coastal communities. The CAA's act, rules, and guidelines were used as the framework to identify the constraints faced by shrimp farmers in compliance to CAA regulations. Data were randomly collected from 108 shrimp farmers using a well-structured interview schedule and analysed using descriptive statistics to identify the constraints faced by shrimp farmers. Results indicated that the major constraint faced by cent percent shrimp farmers in compliance to CAA guidelines include use of aerator only during emergency and last two month of culture, less knowledge regarding required HP aerator per hectare and application of excess cow dung leads to more algal bloom. The study sheds light on the current state of brackishwater shrimp farming in the North Konkan region of Maharashtra. It is necessary to implement prompt and effective measures to secure the long-term sustainability of shrimp farming in North Konkan region of Maharashtra.

Keywords: Constraint, shrimp farmers, compliance, CAA guidelines, Maharashtra

Advanced Modeling of Agricultural Commodity Prices: A Bivariate ARIMA-GARCH Copula Analysis

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Price fluctuations in agricultural commodities are often marked by inherent noise and volatility, driven by market forces. This study presents an in-depth analysis of price volatility for select oilseed crops (Safflower, Mustard, Groundnut) and pulses (Lentil, Chickpea, Green gram) in two key Indian markets for each commodity. The study seeks to enhance price forecasting accuracy by employing a Bivariate AutoRegressive Integrated Moving Average (ARIMA)-Generalized AutoRegressive Conditional Heteroskedasticity (GARCH) Copula model. Monthly price data from January 2010 to December 2022 for these commodities were utilized to assess the predictive capability of this model. The performance of the proposed model was compared against traditional statistical time series models, including the Multivariate GARCH (MGARCH)-Dynamic Conditional Correlation (DCC) model and the Univariate ARIMA-GARCH model. Results reveal that the Bivariate ARIMA-GARCH Copula model consistently outperformed the conventional models, as evidenced by metrics such as Root Mean Square Error (RMSE), Mean Absolute Error (MAE), and Mean Absolute Percentage Error (MAPE). Additionally, the Diebold–Mariano test confirmed the superior predictive accuracy of the Bivariate ARIMA-GARCH Copula model over traditional approaches for this dataset. The integration of Copulas with the ARIMA-GARCH framework demonstrates significant potential for improving price forecasting accuracy, offering critical insights for researchers and policymakers navigating the dynamic agricultural markets in India.

Keywords: Agricultural commodities price series; ARIMA; Copula; GARCH; Volatility.

Different Methods of Extracting Betalain from Red Beetroot (*Beta vulgaris* L.) for Solid Food Coloring and Beetroot Leather Preparation

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An experiment was carried out to find the best way to extract concentrated Betalain from beetroot at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, Uttar Pradesh. The freezing – ground and squeezing method produced the highest betalain extract (530g/kg fresh beetroot) with a pH of 5.08. Eleven different methods were tested for making betalain powder and beetroot leather. The combination of Freezed-Betalain and 3g corn starch (T9) was the most effective for betalain powder preparation, based on its properties and taste. For beetroot leather, the combination of 860g beetroot pulp, 1g salt, 1g citric acid, 200g sugar, and 4g maltodextrin powder was found to be the best. Samples were stored at room temperature and refrigerated conditions for 60 days. The beetroot leather performed better under refrigerated conditions, while the betalain powder performed better at room temperature. The highest Benefit cost ratio (2.46) was found in T9 (Freezed Betalain + 3g corn starch).

Agroforestry as a strategic approach to combat climate change and nurturing sustainable farming system

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For millennia, agriculture has been a vital source of sustenance, economic growth, and nourishment. However, in the present, the two most significant obstacles climate change and global warming have emerged as critical global challenges threatening food security, environmental sustainability, biodiversity, and economic stability. Therefore, we urgently need management strategies that guarantee food security, maintain soil health, and mitigate the effects of climate change. Agroforestry, a sustainable land-use system that combines trees, crops, and livestock, offers a potent solution by mitigating climate change effects while enhancing agricultural productivity. This integrated approach provides a dual benefit by acting as a significant carbon sink and promoting climate resilience by giving at least one output in case of any severe climatic events like sudden rainfall, heatwaves, or pest attacks because in this system we intercropped two or more than two crops on the same piece of land. In addition to its environmental benefits, it enhances livelihood by diversifying income streams, boosting agricultural productivity, and offering financial incentives through carbon trading and government subsidies. The economic resilience provided by agroforestry systems, especially in the face of climate variability, makes agroforestry a climate-smart practice. Moreover, integrating agroforestry into national and international climate policies can drive sustainable development by aligning environmental goals with agricultural practices. Studying the contribution of agroforestry in the context of SDGs (Sustainable Development Goals) and NDGs (Nationally Determined Goals) is crucial; it can help to achieve at least nine of the 17 SDG while creating an additional carbon reservoir of 2.5 to 3.0 billion metric tons of CO_2 equivalent by 2030 through expanding forest and tree cover. It is a complex system and needs higher labor inputs, but its potential is not hidden from anyone. So, there is a need to take actions for better extension programs, research, and development, as well as adoption of the lab-to-land approach more efficiently. Through strategic planning, supportive policies, and robust management frameworks all constraints can be balanced out. In conclusion, agroforestry stands as a pivotal tool in the fight against climate change and its integration into climate action strategies can foster a balanced approach to sustainable land management and a resilient agricultural future while contributing to global environmental goals.

Keywords: agroforestry, climate change, carbon, sustainability

Physicochemical characterization, mineral content analysis and in vitro propagation of Camarosa variety of strawberry (Fragaria × anannasa duch.)

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Camarosa variety of strawberry is a shortday plant (June bearing) with greater production, larger fruit, firmer fruit and is a more vigorous plant. Variety bear fruit over an extended period when treated appropriately in arid, subtropical climates. Thus to meet out the demand of true to type quality planting material of this variety, experiments were conducted to develop a micropropagation method for camarosa strawberry and phytochemical profiling of this variety. Different physicochemical characters such as fruit size length (34.93), width (30.72), weight (17.74), firmness (5.88), pH (11.14), total soluble solids content (16.83), titratable acidity (5.14) and phytochemicals viz., anthocyanin (36.31), antioxidant capacity (49.08) was determined. The mineral profile was also determined dominated by five major elements—Potassium (23.90), Calcium (16.91), Iron (8.67), Zinc (3.73), Magnesium (1.09) and Copper (1.98) with potassium showing the highest concentrations. Fragaria× anannasa duch. was propagate in vitro using various explants such runners and leaves. The present study demonstrated the combined effects of various growth regulators viz., BAP, IBA, IAA, NAA, Kn, TDZ and GA3 at varied concentration with MS medium on shoot proliferation, multiplication and rooting media. The runner tips were sterilized using 3% percent bavistin for 2 minutes + 0.1 per cent $HgCl_2$ for 120 second, which was been establish on MS medium consisting of 1.5 mg/l BAP+ 0.5 mg/l IBA. The leaves were sterilize using 0.2% mercuric chloride for 30 seconds and established on MS media consisting of 1.0mg/l TDZ and 0.5mg /l IBA. The highest multiplication of the established explants was obtained when MS medium supplemented with1.0 mg/l BAP + 0.5 mg/l Kn used. The maximum rooting of the shoots were obtained on half strength MS medium supplemented with 0.5 mg/l IBA. In vitro plantlets were further hardened using soil:sand:cocopeat. In vitro propagation is suitable for the efficient propagation of true-to-type plants of strawberry cultivars and continuous production of fruits with stable quality.

IMPACT OF DIFFERENT ROW SPACING AND NUTRIENT MANAGEMENT PRACTICES ON RABI NIGER

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An attempt was made to study the effect of different row spacing and nutrient management practices on rabi niger during rabi season of the year 2021-22 at Niger Research Station, Navsari Agricultural University, Vanarasi, Dist. Navsari. The factorial RBD experiment consisted of three level of row spacing (20, 30 and 45 cm) and four levels of nutrient management practices [RDF (20-20-00NPK kg/ha), Vermicompost @ 1.5 t/ha, RDF + Vermicompost @ 1.5 t/ha, RDF + Vermicompost @ 1.5 t/ha + Biofertilizers (Azotobacter + PSB + KSB)]. Significantly higher number of capitula per plant, number of seeds per capitula and seed yield was recorded with 45 cm row spacing. Among the nutrient management practices, significantly higher number of capitula per plant, number of seeds per capitula and seed yield were recorded with application of RDF + vermicompost @ 1.5 t/ha + biofertilizers (Azotobacter +PSB +KSB) and remained at par with vermicompost @ 1.5 t/ha and RDF + vermicompost @ 1.5 t/ha treatments for number of capitula per plant and number of seeds per capitula. While in case of seed yield, RDF + vermicompost @ 1.5 t/ha + biofertilizers (Azotobacter +PSB +KSB) treatment remained at par with RDF + vermicompost @ 1.5 t/ha treatment. Therefore on the basis of results, it can be concluded that niger crop (GNNIG-3) should be sown at 45 cm row spacing and nutrient management should be integrated in the manner of RDF (20-20-00 N-P_2O_5-K_2O kg/ha) along with 1.5 t/ha vermicompost (basal application) with or without biofertilizers seed (Azotobacter + PSB + KSB) treatment for securing higher seed yield.

Investigating the changes in biochemical, microbial, and sensory characteristics of Hypnea pannosa seaweed-infused face creams and soaps during the storage period

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The study aimed to investigate the changes in the biochemical, microbial, and sensory characteristics of face creams and soaps incorporated with Hypnea pannosa during a storage period of 720 days. The study formulated different creams and soaps: control cream (CC), seaweed extract cream (EEC), control soap (CS), and seaweed soap (SS), using H. pannosa ethanol extract for the cream and H. pannosa powder for the soap with the optimized composition. Face creams (CC and EEC) and soaps (CS and SS) were packed in a polyacrylic container and kraft paper box container, respectively, stored at room temperature, and analyzed for biochemical (peroxide value, free fatty acid, and thiobarbituric acid), microbial (Total plate count and total fungal count), and sensory changes (overall acceptability) every 60 days. During the storage period, the face creams (CC and EEC) and soaps (CS and SS) revealed that biochemical parameters like PV (0.36±0.10- 5.25±0.06 for CC, 0.24±0.03-4.20±0.02 for EEC, 0.48±0.06 - 4.48±0.03 for CS and 0.36±0.04 - 4.0±0.13 meq of O_2/kg of sample for SS), FFA (0.59±0.02-3.94±0.09 for CC, 0.45±0.05-3.45±0.06 for EEC, 0.15±0.05 - 2.82±0.06 for CS and 0.09±0.04 - 3.09±0.04% for SS) and TBARS (3.05±0.05-34.09±0.12 for CC, 2.23±0.11-29.08±0.02 for EEC, 1.34±0.06 - 42.89±0.07 for CS and 1.45±0.07- 41.68±0.07 µg of MA/kg of sample for SS) showed an increasing trend with storage time. Microbial quality including TPC ($0.15x10^1$- 7.49 $x10^1$ for CC, $0.13x10^1$- 4.25 $x10^1$ for EEC, $0.45x10^1$ - 5.01 $x10^1$ for CS and $0.39x10^1$ - $4.95x10^1$cfu/g for SS) and TFC (Est<1-2.97 $x10^1$ for CC, Est<1 -$2.45x10^1$for EEC, Est<1 - 3.0 $x10^1$ for CS and Est<1 - $2.85x10^1$cfu/g for SS) increases over storage time. The shelf life of the soap (9.00±0.00-5.00±0.00 for CS and 9.00±0.00-5.60±0.26 for SS), face cream (9.00±0.00-4.80±0.10 for CC and 9.00±0.00 - 5.60±0.60 for EEC), was determined based on the OAA score, and the seaweed-incorporated soap and cream remained lather and texture consistent than control soap and cream up to 720 days. Additionally, the OAA decreased with prolonged storage. The present study reveals that adding seaweed boosts cosmetic products' shelf life and quality more than control, offering a natural way to enhance preservation.

Optimization of nano-DAP fertilization for improvement in growth and yield of finger millet (Eleusine coracana (L.) Gaertn.)

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To maximize the production of finger millet, nutrition control is critical. Volatilization, denitrification, and leaching losses brought on by excessive fertilizer use have reduced fertilizer efficiency. Phosphorus fixing at soil collisions results in decreased phosphorus accessibility. One of the quickest ways to improve crop growth is to treat seeds with foliar spray of nano-DAP in order to prevent or minimize such losses and fixation. This investigation was conducted in kharif 2021-22, with variety VL-352 at Research and Extension Centre, Gaja, College of Forestry, Ranichauri (Tehri Garhwal), Uttarakhand. This experiment comprised of ten treatments viz., T1- NK 100% (Control), T2- NPK 100%, T3- 75%P + 100%N + 100%K, T4- 50%P + 100%N + 100%K, T5- 75%P + 100%N + 100%K + ST + FS(2ml), T6- 75%P + 100%N + 100%K + ST + FS(4ml), T7- 50%P + 100%N + 100%K + ST + FS(2ml), T8- 50%P + 100%N + 100%K + ST + FS (4ml), T9- 50%P + 100%N + 100%K + ST + FS(2ml) + FS(2ml), T10- 50%P + 100%N + 100%K + ST + FS (4ml) + FS(4ml) and was laid out in Randomized Block Design (RBD) with three replications. The plant growth parameters and yield attributing parameters were recorded significantly higher in the treatment T10- 50%P +100%N + 100%K + ST + FS (4ml) + FS(4ml) while significantly lower yield was recorded in T1- NK 100% (Control). The findings of this study showed that finger millet yield and plant growth were significantly increased by applying 50% P through DAP and 100% NK, treating the seed with nano-DAP at a rate of 5 ml/kg seed, and performing two foliar sprays of nano-DAP at a rate of 4 ml/l of water, one at 30-35 days after seed germination and the other at 45 days.

Keywords: Volatilization, Denitrification, Leaching losses, Soil collisions, Randomized Block Design, Foliar sprays, Finger millet, nano-DAP

Physiological Temperature Regulation in Insects: A New Frontier for Pest Management in Warm Climates

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Insects being poikilotherms are vulnerable to global warming but few agriculturally important insect pests possess significant threats to the cultivated crops even during the hottest seasons. Their physiological adaptations like joint action of phenotypic plasticity and genetic adaptation enable them to withstand extended period of extreme temperatures. Heat shock proteins (HSPs) play a crucial role in the genetic adaptation of insects to increased temperature. These proteins include both small ATP-independent variants and larger ATP-dependent forms such as Hsp70, Hsp90, and Hsp60. Their primary functions encompass protein folding, its localization, and degradation, often with the aid of cochaperones and accessory proteins. In genetic pest control, advanced methods such as CRISPR/Cas9 and RNA interference (RNAi) are employed to target heat shock proteins (HSPs) in both insects and plants. For instance, depleting Hsp70 through RNAi has been shown to increase mortality in whiteflies feeding on wild tomato plants, Solanum habrochaites. 21 Hsp genes from four major families were studied in various developmental stages of fall armyworm, Spodoptera frugiperda, revealing that promoter from SfHsp70D and SfHsp20.71 genes exhibited strong heat-induced activity. It makes them promising for applications in transgenesis and genome editing of lepidopteran insects. Another report in Drosophila melanogaster, five independent transgenic lines were developed using piggyBac construct with an EGFP fluorescent marker, Cas9 gene and Hsp70 promoter. Heat-shocked embryos demonstrated high inducibility of Cas9 expression, leading to enhanced somatic and germline mutagenesis rates, with a 92% mutation inheritance rate in progeny. Thus, leveraging HSPs for genetic manipulation and pest control holds a significant potential for advancing insect pest management strategies.

Keywords: Heat Stress, Pest management, HSP (Heat shock proteins), High Temperature, genetic adaptation.

VALORIZATION OF BREWER'S SPENT YEAST FOR EXTRACTION OF β–GLUCAN

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The brewing industry generates significant amount of by-products, among which one of the most notable is spent yeast. BSY is a waste for the brewer and is discarded into sewage systems or sold as a low cost animal feed supplement. Improper disposal of BSY can lead to environmental issues. However, BSY is a potential source of valuable compounds such as β-Glucan having several biological and techno-functional properties to be used as functional ingredient in food products. These beneficial properties make it valuable in the food industry, where it is used as stabilizer, thickener and emulsifier in the production of soups, beverages and other food products. Therefore, the study aimed to produce pure β-Glucan from BSY. The process involved cell wall disruption and extraction of β- Glucan using Acid- Base Extraction and Water Extraction. Along with this proximal analysis of BSY was carried out viz, total sugar content (8%), protein content (10%) and structure was evaluated using FTIR (Fourier-transform infrared spectroscopy) .The present study indicated BSY to be a potential source of β-Glucan for its potential applications and functionality.

A COMPARATIVE ANALYSIS OF KENGURI SHEEP FARMERS MARKET ORIENTATION UNDER INTENSIVE AND EXTENSIVE REARING SYSTEMS IN YADGIR DISTRICT OF KARNATAKA

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Forty Kenguri sheep farms, having flock size range of 25 to 1480 and 35 to 300, were selected from intensive and extensive sheep farming systems, respectively, in Yadgir district of Karnataka, India and the sheep market orientation criteria were analyzed by structured questionnaire. The current study was conducted in a designated study location i.e., Yadgir between January and February months of 2022. The most farmers were dependent on body conformation (45.00%) followed by body weight (40.00%) and age (15.00%) in intensive rearing system for price fixation. In extensive system, price fixing was equally dependent on age as well as body conformation (40.00%) followed by body weight (20.00%). Market availability (90.00 and 75.00%), market plan information (80.00 and 50.00%), market price information (60.00 and 45.00%), and satisfaction about market (65.00 and 40.00%) were having major and minor roles in intensive and extensive systems, respectively. The average market age and body weight at sale of sheep (7.43 ± 0.26 months and 33.93 ± 1.13 Kg) in intensive system were more as compared to extensive system (4.60 ± 0.19 months and 20.00 ± 1.69 Kg). The average selling price per culled adult in intensive system was more compared to extensive system (₹ 9059 ± 41.75 vs. 7998 ± 49.98), however, the average selling price per excess stock was more in intensive system (₹ 11247 ± 30.32) paralleled to extensive (₹ 11099 ± 31.15) system. The average selling price per marketable stock in intensive system was less compared to extensive system (₹ 313 ± 9.86 vs. 427 ± 12.89). Overall, the market orientation patterns of Kenguri sheep farmers under intensive rearing system were better when compared with extensive rearing system.

Keywords: Kenguri sheep, Distribution of sheep, Market information, Market orientation, Price fixing criteria

Farmers' Perceptions of Online Training Effectiveness During the COVID-19 Pandemic: A Comprehensive Analysis

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The agriculture sector adapted to challenges brought by the COVID-19 pandemic. The pandemic not only disrupted traditional farming practices but also accelerated the shift towards digital platforms for knowledge dissemination and skill development among farmers. As face-to-face training became difficult, the importance of online training programs grew, offering a lifeline to the agricultural community by providing continuous access to critical information and skills. Farmers' perception of online training effectiveness during this period reveals a generally positive response, with many recognizing the benefits of these programs in maintaining and even enhancing their farming practices. The effectiveness of these programs was influenced by several key factors, including the quality of training content, the environment in which the training was conducted, the availability and adequacy of facilities and materials, the presentation style of trainers, and the overall scheduling of the training sessions. Overall, the study concludes that online training, despite the challenges posed by the pandemic, was largely successful in meeting the needs of farmers. The findings highlight the importance of continued adaptation and improvement of online training programs to ensure they remain effective and accessible, especially in the face of ongoing global challenges. This shift towards online platforms marks a significant transformation in agricultural education and extension services, demonstrating the sector's resilience and capacity to innovate during crises. Moving forward, the insights from this study can guide policymakers and agricultural educators in designing more effective and inclusive digital training programs, ensuring that farmers continue to receive the support they need in an increasingly digital world.

Keywords: Farmers' Perceptions, Online Training, COVID-19 Pandemic, Agricultural Education, Farmer Empowerment, Training Effectiveness

Identification of key virulence features and evolutionary history of Albugo candida infecting Brassica juncea in India through genome sequencing

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Albugo candida belonging to oomycetes causes white rust disease in Indian mustard (*Brassica juncea*) and in several other hosts of Brassicaceae family. Albugo candida is an obligate biotrophic pathogen and causes significant yield losses in Indian mustard in the country. Considerable progress has been made in the country in understanding genetic basis of white rust resistance in Indian mustard. However, understanding of key virulence features as well as evolution of Albugo candida infecting mustard in India is relatively lacking. This is largely due to absence of genomic resources of Albugo candida in the country. Well characterized genomic resources could lead to better understanding of virulence determinants and evolutionary potential of a particular species. Therefore, in this study draft genomic resource of Albugo candida isolate AC-BPM infecting Indian mustard is reported. The draft genome was sequenced on Illumina Novaseq 6000 sequencer. The draft genome is of 36.57 Mb size, with GC content of 42.21% and BUSCO completeness of 99%. Repetitive sequences represented 14.12% of the genome. The genome consists of 8181 predicted gene models out of which 8130 are coding sequences (CDS). Out of the predicted gene models, 6687 gene models were annotated. Secretome analysis identified 543 secreted proteins. The secretome was found to be enriched in important protein families such as elicitins, glycosyl hydrolases, phosphatases, transglutaminase elicitors etc. Effector analysis identified 278 candidate effectors out of which 244 (44.94%) were predicted cytoplasmic effectors and 34 (6.26%) were predicted apoplastic effectors. A. candida secretome lacks RxLR and CRN class of effectors, but it was found to be enriched in CCG class of effectors. Comparative genomic analysis revealed shared as well as unique gene clusters in A. candida isolate with other straminopiles species. The information generated in this genomic resource could be used further for deciphering virulence, ecology, evolutionary features of A. candida as well as prevention and control of A. candida infecting B. juncea in India.

Estimation of heavy metals and analysis of proximate composition in mackerel fish

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Fish is a valuable and versatile food source with significant nutritional, cultural, and economic importance worldwide. Mackerel, a diverse family of pelagic fish found in both temperate and tropical waters, holds a prominent place worldwide, renowned for its rich flavor, versatile culinary applications and nutritional value cherished by coastal communities and gastronomes alike. Heavy metals such as mercury, lead, cadmium present in natural environment can build up due to pollution, industry and other anthropogenic factors. When these metals are found in aquatic environments, they can bio accumulate in fish tissues and endanger human health if ingested. The heavy metals was analyzed using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and proximate composition of fish from Mirkarwada and Rajiwada landing centre was compared. The study revealed that mercury, lead, cadmium found in mackerel from Mirkarwada jetty were within the safety limits indicating safe for human consumption whereas proximate composition of mackerel from Mirkarwada had higher protein and lipid content compared to Rajiwada landing centre respectively. The study conclude that mackerel fish from Mirkarwada jetty not only meet safety nutritional quality but also recommend further research into seasonal & regional variations in heavy metal & nutrient content. Further study suggest, research from seasonal & regional variations of heavy metal contamination and its nutritional content.

Study the distribution pattern of mollusks on the sandy seashore

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Molluscs are filter feeder and diverse marine invertebrates found in the aquatic water body worldwide. They play an important role in coastal ecosystem such as nutrient cycling, preserving water quality, sediment stabilization, balancing primary productivity, food web formation, etc. They are also used as a prey for variety of predators including fish, birds, and other invertebrates. Their presence is commonly used as indicators of habitat quality and environmental changes. Molluscs are sensitive to environmental changes including fluctuations in water quality, temperature and food availability. Coastal beach like Bhatye and White sea are subject to various natural, human-induced changes, natural events such as storms, erosion, as well as human activities like construction, pollution and tourism which can significantly impact these environments. For each beach (Bhatye and White Sea) species richness (total number of species), abundance (total number of individuals), Spatial distribution patterns of molluscan species were assessed using appropriate statistical methods, such as species diversity indices (e.g., Shannon diversity index, Simpson Diversity Index, pielou's evenness and was compared for significant differences in species composition and abundance. Therefore, studying their distribution pattern can gain insights about how such factors affect coastal ecosystem as well as provides early warnings of disturbances such as pollution, habitat degradation and impacts of climate change. It can also raises awareness about the need for preserving the environments and encourages informed stewardship of natural resources. By understanding the intricate relationships between mollusks and their habitat, we can better appreciate the complexity of coastal ecosystems and the importance of their conservation.

Physical properties of Jasmine flower (*Jasminum Multiforum*.L)

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Basic information on physical properties of flowers are of great importance and helpful to engineers towards efficient process and machine development. Some of the physical properties of Jasmine flower (*Jasminum Multiforum*.L) variety has been studied in order to provide data needed in designing jasmine processing machinery. These Properties include Length of Corolla (mm), Diameter of Corolla (mm), Wight of 1000 flowers (g), Flower Projected area (cm^2), Stalk thickness (mm), Strength of stalk (kgf), Bulk Density (g/cm^3), Moisture Content (%), Colour values such as L*, a*and b*. The average range of these properties for Jasmine flower is in the range of 32.16 to 36.11mm for Length of Corolla, 6.05 to 6.49mm for Diameter of Corolla, 134.19 to 177.11 g for wight of 1000 flowers, 6.8 to 8.5 cm^2 for Flower Projected area and 1.30 to 1.54 for Bulk Density (g/cm^3).Strength of the stalk falls in the range of 1.38 to 1.98 kgf. Moisture content is in the range of 72 to 74.3 and colour values fall in the range of 67.62 to 73.69 for L*, -0.95 to -2.11 for a* and 11.90 to 16.15 for b*.

Keywords: Physical properties, Jasmine flower

Effect of Pre-treatment and Extraction method on anti-oxidant and chemical properties of oil extracted from Black Cumin (*Nigella Sativa*) Seeds

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In the present study the effect of pre-treatments on oil extraction yield and active components of Nigella sativa has been studied. Nigella sativa seeds are pre-treated with microwave heating and steam conditioning at different time period and then oil is extracted from the seeds by using two methods i.e., hydro-distillation and supercritical fluid extraction. The effect of pre-treatments on the oil extraction yield, the samples with higher yield of oil from both methods Hydro-distillation and supercritical fluid extraction are further analyzed by Gas chromatography mass spectroscopic (GCMS) to see the effect of pre-treatments on active components of oil. In case of hydrodistillation method, the samples pretreated with microwaves at 3 min i.e., HM_3 has shown highest yield (0.892%) when compared to H_0 (0.436%) In supercritical fluid extraction, the samples pretreated with microwaves at 3 min, HS_3 has shown highest yield (9.44%) when compared to S_0 (4.10%). Even though steam pretreatment has shown increase in the yield of oil, % increase in yield is less when compared to microwave pretreated sample. H_0 oil sample has shown Thymoquinone content of about 19.40% and pretreated sample HM_3 has shown 26.73%. The sample S_0 has shown Thymoquinone content of about 8.35% and pretreated sample SM_3 has shown 11.53%. Although there is increase in yield in supercritical fluid extraction Thymoquinone content is less compared to that of hydro distillated sample. This may be due to low operating pressure (70 atm) used in supercritical fluid extraction. Further by improving the process conditions like pressure it is possible to obtain more yield of oil and significant rise in thymoquinone content. Thus the pretreatments proved to be useful for increasing the yield of oil without any detrimental effects on antioxidant activity and quality of oil.

Keywords: Black cumin, Hydrodistillation, Thymoquinone

Optimization of Post-harvest chemical treatments in extending shelf-life of Jasmine flower (*Jasminum multiforum* L.)

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Jasmine flower occupies very special and selective place among the ornamental and medicinal plants. It is also gaining priority in the loose flower trade. Post-harvest management in Jasmine flower can fetch can enhance prices up to 5-10 times of the produce. Therefore, there is a necessity and scope for extending flower shelf life for long time. Flowers are treated with different chemical treatment combinations and kept at ambient condition for 5 days for observation. The flowers treated with T4 (Sucrose 20 % + GA_3 (100 ppm) + Boric acid-2 %) packed in polypropylene bags (PP) of 200 gauge without ventilation shows effective in extending shelf life up-to 96 hours (4 days) with minimum physiological loss in weight (PLW) of 31.3%, lower flower opening index of 58.9 , higher freshness index of 59.5, lower respiration rate of 5.49 ml-Co2/kg-h and lower total phenol content of 6.78 mg/g at the end of 5 days.

Keywords: Jasminum multiforum L, Shelf-life extension, Pre-treatment

Formulation and Quality evaluation of Extrudate Snack (Sev) Using Different Proportions of Composite Flour

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In today's era, there is an immense craze and demand of extruded snack food products worldwide for all age groups of people. This is because of people's acceptability, palatability, and affordability towards the trend of extruded snack products. This study was carried out to formulate and prepare a new innovative extrudate snack (sev) product using different proportions of composite flour based on traditional method. The composite flour consists of Little millet (LM), Proso millet (PM), Brown top millet (BTM) and Tapioca (TF). The product samples were prepared using four treatments (T_0), (T_1), (T_2), (T_3) where T_0 determines control sample (chickpea flour also called Besan). To enhance the quality of the product, sensory evaluation was assessed using 9-point hedonic scale. These sensory attributes include colour, taste, flavor, texture, appearance and overall acceptability. Among all the four treatments, treatment (T_2) with proportion LM (30%), PM (20%), BTM (5%), and TF (45%) was the most preferred formulation achieving high scores in all sensory attributes with overall acceptability of 8.8. These scores or results emphasized the importance of optimizing the flour proportions in developing nutritious and healthy extrudate snacks.

Keywords: Extrudate snack, Sev, Nutritional analysis, Millet, Composite flour, Sensory properties, Quality evaluation.

SUSTAINABLE MANAGEMENT OF RAINFED RICE-FALLOW WITH WINTER PULSES IN ODISHA A STEP FOROWARD TO FOOD AND NUTRITIONAL SECURITY

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Nutritional security is still a challenge for developing countries like India though food security has almost been attained. Due to predominance of rice in major growing season (kharif) in eastern states like Assam, Bihar, Chhatishgarh, Jharkhand and Odisha, area expansion is difficult for traditional pulses and oilseeds. About 12 million hectares of land remain fallow in Odisha, with sufficient residual moisture left in soil at the time of rice harvest which can be efficiently utilized for low water demanding nutritious crops like pulses and oilseeds through proper analysis of rice-fallows according to their suitability and potentiality. Unfortunately, enough, several biotic, abiotic and socio-economic constraints and challenges impedes the utilisation of these lands for crop production in the subsequent rabi season. Some of the enlisted reasons are delay in sowing of rabi crops due to late harvesting of long duration rice varieties, moisture stress at sowing in rabi season due to early withdrawal of monsoon, water logging and excessive moisture in November/December, lack of appropriate varieties of winter pulses for late planting which can tolerate terminal drought and heat stress. Moreover, threats from stray cattle also discourage the farmers to go for sowing in lately available rice fallows. However, some strategies for promotion of oilseed and pulses in rice fallows are pertinently suggested by experts, scientists and policy makers along with farmers. Some of them are discussed in details here.

Adoption of early and mid-early short and medium duration rice varieties/hybrids in kharif will provide a larger window for cultivation of low temperature tolerant pulses in rabi season. Fast depleting soil moisture in rice fallows can be rendered by cultivation of pulses in zero tillage or leaving high amount of previous crop stubbles in conventional system of sowing. Efficient and quicker crop establishment of pulses in utera sowing can be ensured through practices like seed priming (Soaking seed overnight with water or nutrient solution), increasing seed rate by 20-25%, seed treatment with fungicide, rhizobium culture and phosphorous solubilizing bacteria.

Some specific intercultural operations like application of appropriate herbicide to check the regrowth of stubbles to avoid rapid loss of soil moisture, INM, IPM, safeguarding the crop from stray cattle through suitable policy are to be followed judiciously to motivate the farmers to go for a profitable rice fallow cultivation.

Apart from this, ensuring rural credit facilities, subsidies for farm inputs, crop insurance scheme for under privileged subsistent farmers, organised market facility are also crucial to encourage pulses in rice fallows.

Keywords: Rice-fallow, Winter pulse, Nutritional security

Effect of Soaking and Cooking on Nutritional and Quality Properties of Kidney Bean (*Phaseolus vulgaris*)

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Kidney bean (*Phaseolus vulgaris*) seeds were soaked in tap water and different saline solutions (0.5, 1% baking powder and 0.5, 1% sodium bicarbonate) to accelerate the cooking process and improve their nutritional and quality properties. Soaking and cooking parameters of raw and treated cooked kidney beans were investigated. The samples were evaluated for their nutritional, physical and sensory characteristics and in-vitro protein digestibility (IVPD). The data showed that, water absorption values increased as the soaking time increased (14.39 - 21.99 after 1hr and 76.96 - 88.17% after 12 hrs). Cooking time decreased as a result of soaking process. It was higher (260 min) for raw bean and lower (40 min) for 1% baking powder. The IVPD improved after soaking and cooking. It was 70.35 for raw bean, 83.47 for control and 87.29% for 1% sodium bicarbonate. Total carbohydrates and phenolic compounds decreased for all cooked samples as compared to the raw one. As a conclusion, soaking for 12hrs with 1% baking powder, discarding soaking solution and using fresh water for cooking is the best treatment to reduce cooking time and improve the nutritional and quality properties of cooked kidney beans.

Keywords: Kidney bean, Soaking, Cooking, IVPD, Nutritional and quality properties

Effect of different concentrations of plant growth regulators on the vegetative and qualitative attributes of capsicum hybrid Orobelle

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Capsicum being non pungent bell-shaped fruit from solanaceous family commonly known as Shimla mirch. Due to erratic weather conditions the production is hampered which ultimately effect the productivity of the crop. Therefore, to solve the problems in cultivation of capsicum under polyhouse. It is being preferred to minimise the loss and maximise the profit by the use of plant growth regulators (PGRs). The experiment entitled "Effect of different concentrations of Plant growth regulators on the growth and quality of Capsicum Hybrid Orobelle" was conducted at Experimental Research Farm Chhapang during the year 2023, Dr. Khem Singh Gill Akal College o.f Agriculture, Eternal University, Baru Sahib, Sirmour, Himachal Pradesh. The experiment was laid out by RBD with three PGRs and four different levels of concentrations each having twelve treatment combinations (NAA @ 0, 75, 150 and 225ppm), (GA_3 @ 0, 15, 45 and 60ppm), (CCC @ 0, 200, 400 and 600ppm) with three replications. Among all the treatment combinations NAA@225ppm recorded the best results in vegetative parameters like days to 1st flowering (48.53 days), days to 1st picking (74.53 days). Best qualitative parameters like carotenoid (5.57 mg/100g), ascorbic acid (140.93 mg/100g), pericarp thickness (7.94 mm) and shelf life (8.10 days) were also recorded by the same combination. Therefore, from the experiment it was clear that application of PGR NAA@225ppm gave the best quality and vegetative attribute when grown under polyhouse conditions which was required by the farmer to fetch the better price for their produce. So, it must be recommended to the farmers in order to gain maximum vegetative and qualitative parameter than other combinations in order to improve their livelihood.

Keywords: Plant growth regulators, NAA, Vegetative and Qualitative

Agriculture A Major Occupation of Punjab: A Historical Analysis

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Punjab state is an agricultural state. Agriculture has a pivotal part in the economy of Punjab. In the history of the agriculture world, Punjab state is unrivalled developments. Since Ancient times, agriculture has been the cornerstone of our rural economy. Indus valley people were the preliminary to produce cotton. In the time of Mahajanapadas there were major changes in agriculture they used ploughshares. Medieval period also had eminent advancement in agriculture. During the reign of the great Akbar, the area of wahi land was 61,55,643 bigha. By the end of the Mughals period the area under cultivation had increased to 2,43,19,900 bigha. The Mughals adopted some methods to improve agriculture in Punjab. At the time of Maharaja Ranjit Singh 66% of the population of Punjab was occupied with agriculture in all parts of villages. The foremost tribes were Jat, Kamboj, Rajput etc. But the Jat were the agriculturalist and were premeditated as the back bone of the peasantry of Punjab. In the time of the British Era under John Lawrence paid special attention to the growth of agriculture cotton seed 4F was introduced in Punjab 1914-15. Efforts were made to popularize flax growing. In order to get more production of wheat he introduced wheat named Punjab 11 and Punjab 8. The first major irrigation and power project in India was designed after 1947 to increase Punjab agriculture production. The state has grasped enormous growth in the agriculture production during the green revolution period, on the whole by cause of strong match of institutional and technological factors. Punjab operates numerous latest cultivation including hellacious agriculture progressive and drip irrigation. Punjab is not only selfsustained in manufacturing food grains but also supplies around 60% food grains to the central pool. Punjabi's grew various crops wheat, maize, Sugarcane, rice, mustard, cotton etc. Due to its production Punjab was called 'Granary of India or Food Basket of India. Punjab holds place of pride among the Indian state for its outstanding achievements in agricultural development.

Optimizing Multi-Pass Harvesting of Cauliflower: Image Processing for Infield Maturity Detection

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Cauliflower harvesting using traditional manual methods is prevalent globally and accounts for around 50.0% of production costs due to its labor-intensive nature. Moreover, due to the fact that cauliflower fruits do not reach maturity at the same time, it is necessary to do multiple harvests from a single field, which poses a difficulty for traditional cauliflower harvesting machines. Therefore, it is necessary to develop a specialized cauliflower harvesting machine that can selectively harvest based on the maturity of the cauliflower. Therefore, in the current investigation, a system was designed to determine the maturity of cauliflower curd specifically for use with a selective cauliflower harvester. The present study used the curd's diameter to measure cauliflower maturity. The developed detecting method consists of an RGB camera to record the images and further process to calculate the diameter of cauliflower. Three distinct methods, including the color difference method, color component ratio method, and chromatic aberration method, were devised to achieve precise segmentation of cauliflower. To get the best possible segmentation performance, the threshold values were optimized using the response surface approach technique. The chromatic aberration approach at 42000 lux with a CA value of 232 had the maximum segmentation performance, with a recall of 70.83%, precision of 99.37%, and accuracy of 99.08%. A camera height adjustment unit, utilizing an ultrasonic sensor, was incorporated into the system to enhance measurement precision by removing discrepancies in camera height during field operations.. Therefore, this developed device can be successfully integrated with harvesters for selective cauliflower harvesting based on maturity levels.

Keywords: Multi-Pass Cauliflower Harvesting, Cauliflower Maturity, Image Processing, Response Surface Method

Comprehensive Analysis of the Nutritional Profile of Underutilized Crop Harad (Terminalia chebula)

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The underutilized crop Harad (Terminalia chebula Retz), known for its significant role in traditional medicine, is gaining attention for its nutritional profile and potential health benefits. It belongs to the family Combretaceae and is found throughout India and other subtropical and tropical regions of the world. It can exhibit various kinds of pharmacological activities due to presence of various kinds of phytoconstituents such as gallic acid, methyl gallate, ethyl gallate, ellagic acid, chebulagic acid, chebulinic acid, penta-O-galloyl-β-D-glucose and many others. Owing to significant health benefits exerted by T. chebula, it is known as 'King of Medicines' in Tibet and is used as conventional medicine for household remedy against many ailments. Harad fruits are rich in dietary fiber, essential for digestive health, and contain a notable concentration of carbohydrates and proteins. They are a valuable source of various micronutrients, including potassium, magnesium, and calcium, which are crucial for maintaining electrolyte balance, bone health, and overall physiological function. Additionally, Harad fruits are high in antioxidants such as tannins, flavonoids, and phenolic compounds, which contribute to their anti-inflammatory and anti-aging properties. The study also explores the presence of vitamins such as Vitamin C and Vitamin E, which play significant roles in immune function and cellular protection. The comprehensive nutritional profile of Harad fruits positions them as a promising addition to health-promoting foods and supplements.

Keywords: Gallic acid, Harad, micronutrients, phenolic compounds, antioxidants.

Combining ability studies through Line × Tester design in strawberry (Fragaria × ananassa)

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A line × tester mating design was used, consisting of five lines (Douglas, Brighton, Royal round, CH-40 and VL-13) and two testers (Chandler and Sweet Charlie) to explore the gene action and combining ability estimates for various physico-chemical traits in strawberry. For most traits like fruit length, fruit breadth, number of sepals, number of achenes per fruit, number of fruits per plant, titratable acidity, reducing sugars and ascorbic acid dominance variances were higher than additive variances, which indicates that these traits are heavily influenced by non-additive gene action. According to the present study, Douglas has been identified as an excellent general combiner when it comes to fruit breadth, number of sepals, number of fruits per plant, average berry weight, total yield, titratable acidity and ascorbic acid while Royal round was also recognized as the good general combiner for fruit length, fruit breadth, number of achenes per fruit and total sugars based on significant GCA effects. The hybrid Douglas × Chandler was identified as a good specific combiner for number of sepals, number of fruits per plant, total sugars and ascorbic acid.

Role of nano selenium in promoting the growth and drought tolerance in apple

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The current study was conducted at the Experimental Farm, Department of Fruit Science, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experimental goals were to investigate the effects of nano selenium on the growth and physiology of apple rootstocks, as well as drought tolerance. The MM 106 rootstocks were grown in pots under regulated climatic conditions. The experiment was set up in a Completely Randomized Design (CRD), with three replications comprising of six treatment combinations involving nano selenium concentrations (0, 10 and 20 ppm) and field capacity levels (100 and 60%). The results revealed that as the drought stress level increased, the vegetative parameters of the rootstocks such as fresh and dry weight of roots, fresh and dry weight of shoots, total root length, number of primary roots per plant diameter of primary roots, total biomass, percent survival, number of leaves per plant and leaf area were significantly decreased, while the application of different doses of nano selenium (10 and 20 ppm) significantly improved vegetative traits. Leaf nutrients were also enhanced with 20 ppm foliar spray in 60% field capacity, compared to 100% field capacity without foliar applications. Different moisture regimes and nano selenium treatment dosages had no significant effect on soil physico chemical characteristics.

Antioxidant enzymes activity in ear head of wheat under terminal high temperature and soil moisture stress

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Climate change is associated with rising temperatures and increased climatic variability, leading to more extreme weather conditions. Increasing temperature and unpredictable precipitation patterns have increased global apprehensions about wheat production and productivity. Wheat ear head has some distinct features, and its photosynthetic contribution to grain yield is significant especially under abiotic stress conditions. This investigation aims to examine the activity of antioxidant enzymes in the ear head of wheat genotypes under terminal heat stress and terminal drought stress conditions. Two wheat genotypes, WH 1021 (heat and drought tolerant) and WH 1105 (heat and drought sensitive), were cultivated in pots. Plants are subjected to terminal heat stress by late sowing i.e., first fortnight of December. Terminal drought stress was induced by reducing irrigation level to 50 % of field capacity starting from the booting stage. Activity of antioxidant enzymes in wheat ear head such as superoxide dismutase (SOD), catalase, peroxidase, glutathione reductase (GR) and ascorbate peroxidase (APX) was estimated at anthesis, 10 days after anthesis (DAA), and 20 DAA stages. Activity of these enzymes were highest in WH 1021 (heat and drought tolerant genotype) compared to WH 1105 (heat and drought sensitive genotype) under both terminal heat stress and terminal drought stress. Activity of these antioxidant enzymes increased from the anthesis stage to 10 DAA stage but subsequently decreased in both genotypes under both stresses. Activity of SOD and GR enzymes were positively associated with thousand grain weight under stress conditions. Catalase and APX activity were positively related with grain yield per plant under stress conditions. This investigation highlighted the significance of antioxidant enzymes in the ear head of wheat under terminal heat and drought stress conditions. Increased activity of antioxidant enzymes helps in scavenging excess reactive oxygen species under stress conditions, thereby helping the plants to tolerate adverse effects caused by terminal heat and drought stress.

Keywords: Wheat, Ear head, Drought, Heat stress, Antioxidants, SOD, Catalase

A field study on of supplementation of Area specific mineral mixture (ASMM) on milk yield and composition of dairy animals

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A study was conducted in selected villages of Warangal district aimed to evaluate the impact of area-specific mineral mixture supplementation on dairy animal production. The study was carried out for three continuous years. Thirty dairy animals were randomly chosen from five adopted villages (Malkapally, Battupally, Gavicherla, Mamnoor, and Singaram), evenly divided into two groups of fifteen. During a 90-day lactation period, the treatment group was supplied with a daily supplement of 50 g of area-specific mineral mixture, while the control group animals were not fed any area specific mineral mixture. Data analysis revealed that the mineral supplementation increased milk yield by 1.05 liters per day (16.65%) compared to the control group. Economic indicators such as gross returns, net returns, and the Benefit-Cost (B:C) ratio were notably higher in the treatment group. These findings suggest that continuous feeding of area-specific mineral mixture has enhanced the production performance of dairy animals, thereby recommending its ongoing use.

Keywords: Area specific mineral mixture; milk yield; production; B:C ratio

Ozone and its application of in seafood industry

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Currently, food industries are in need of different innovative technologies to meet the consumer demand. Now days, there are some of the technologies like High Pressure Processing, pulsed electric field, high intensity pulsed light etc. Ozone technology is one, such technique that has become a focal point as an effective sanitizer that may fulfill the prospects of food industries, regulating authorities, and consumers. Ozone, have sporicidal activity, is an efficient sanitizer and disinfectant which can be effective against harmful pathogens including their spores and can act as an excellent antimicrobial agent. Ozone treatment has been found effective in most food products during processing as well as storage and to maintain the quality, safety, shelf-life and contamination-free food supply chain of these products. Besides the inactivation of microbes and it's also reduces the level of pesticides in fresh produce. Ozone treatment is very effective in decreasing the biological and chemical oxygen demand of water used in processing and washing in the food/fish industries. It will also acts as a promising eco-friendly sanitizer. This review is to provide limelight on the ozonation as an advanced green technology along with its promising and multi-dimensional applicability in the fish processing industries.

Keywords: Ozonation, eco-friendly sanitizer, fish processing industries, inactivation of microbes

Application of SWAT model and SWAT-CUP software in Hydrological Simulation of Ken Basin

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Soil and Water Assessment Tool (SWAT), is a physically based semi-distributed hydrological model that requires a large number of input parameters, which includes model parameterization and calibration. SWAT-CUP (SWAT- Calibration and Uncertainty Programs) is one of the recent developments of the watershed model for calibration/sensitivity analysis, which includes a semi-automated SUFI-2 (Sequential Uncertainty Fitting) approach for both manual and automatic calibration as well as global sensitivity analysis. The aim of this study was to calibrate and validate using the SWAT model for Ken Basin. The entire catchment was divided into 4 sub-basins comprising 698 hydrological response units using the SWAT model based on unique slope, soil and land cover classes. A Sensitivity analysis was performed to examine the critical input variables and to evaluate goodness-of-fit of the study area. For the Ken Basin, CN2, ALPHA_BF, GW_DELAY, GWQMN were found to be the most sensitive parameters. Calibration (1985–1995) and validation (1996–2009) were carried out using observed discharge data from the Banda site in the Ken Basin. During model calibration, the coefficient of variation (R^2) and Nash-Sutcliffe efficiency (NSE) were used to measure the statistical performance of the model. R^2 was 0.92, and NSE was 0.85. The validation also showed satisfactory results with R^2 of 0.84 and NSE of 0.83 respectively. The study found a high correlation between observed and simulated discharge on monthly time steps. The results and conclusion would be extremely beneficial to the hydrologist and water resources management.

Keywords: SWAT model, Ken Basin, Calibration, Validation, SWAT-CUP, sensitivity analysis

Population dynamics of Galleria mellonela on Apis mellifera in Punjab

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The detailed study focuses on the population dynamics of Galleria mellonella (greater wax moth) in Apis mellifera (European honey bee) colonies at Pathankot, Amritsar and Talwandi sabo in Punjab. By continuous monitoring from June 2021 to May 2023, the research showed fluctuations in larval pupal and adult populations of Galleria mellonella. The greatest mean larval, pupal and adult population @ 13.4, 10.6, 8.0 respectively was observed in July, followed by a gradual decline through March and the population reached 3.1, 2.7, 2.5 larval, pupal and adult in respective month. Correlation analysis revealed that both larval and pupal populations had a significantly positive relationship with minimum and maximum temperatures. Non-significant positive correlations were observed between larval and pupal populations with evening relative humidity and rainfall. Conversely, a non-significant negative correlation existed between these populations and morning relative humidity. These findings suggest that temperature plays a significant role in the population fluctuation of Galleria mellonella. By using these patterns, we can aid in developing timely and effective control measures for managing wax moth infestations in honey bee colonies. This research scrutinized the importance of targeted pest management strategies to safeguard honey production and the broader agricultural ecosystem reliant on pollination by Apis mellifera.

Keywords: Seasonal incidence, Greater wax moth, European honey bee, larva, pupa.

The impact of Medical4.0 on agriculture: Addressing the use of AI-based treatment

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Agriculture 4.0, which involves the incorporation of Industry 4.0 ideas into the agricultural sector, is similar to the progress shown in healthcare with Medical 4.0. This paper investigates the integration of Medical 4.0 concepts, including AI, IoT, big data analytics, and precision technologies, into agriculture to improve productivity, sustainability, and food safety, while simultaneously reducing the need for pharmaceutical interventions and mitigating environmental impact. This paper examines the potential of AI and IoT to enhance agricultural practices, including the precise application of inputs based on real-time data and predictive analytics for disease and pest management, by drawing parallels between personalized medicine and precision agriculture. Genomic techniques are recognized for their pivotal role in the development of robust crops and the reduction of chemical usage, similar to individualized therapies in medicine. In addition, the study explores the advantages of remote monitoring and automation in agriculture, which enable the early identification and specific addressing of crop health problems without the need for widespread use of chemical treatments. Conclusively, the acceptance of Medical 4.0 ideas in agriculture promises a sustainable and effective method of food production, thereby reducing negative environmental and health consequences related with conventional agricultural techniques.

Role of producer organizations in horticultural development

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Horticulture is an important branch of agriculture and had a significant role in healthy diet with minerals, vitamins, antioxidants and photochemical which have medicinal values. It covers high valuable crops like vegetables, fruits, spices, aromatics, medicinal, flower and ornamental crops with wide opportunities for value addition and employment all-round the year. It provides raw materials for many industries such as food processing, pharmaceuticals and aromatics across the country. Fruits and vegetables are delicious and essential for malnutrition, particularly in children. The individual volume of production of the small farmers is low which averts them from reaping benefit of economics of scale. Small farmers can benefit from the economics of scale only through aggregation. Producer organizations are useful for mobilizing individual farmers' effort into collective action which will be helpful in improving the socio-economic condition of all the members of the group. Organizing farmers will aid in access to resources, information, specialization in commodities, processing and value addition, large-scale operations, market orientation and better bargaining power. FPO is a group of rural producers built on the principle of membership, to work towards the common interests of their members and develop technical and economic activities that benefit their members. The principle of the clustering approach is used in the functioning of the FPOs. FPO shifts the focus on the resources and capabilities of the farmers to providing agri-input services and technical services, creating market access, and generating employment. FPOs have contributed to the diversification of high-value crops, benefitted the poorest most, improved access to credit and information services, promoted collective action and public-private partnership, access to the international market, enable better prices and quicker payments for the produce and organization of the supply chain.

Keywords: Farmer, horticulture, producer organization, resources, value addition

Valorization of Jackfruit (Artocarpus heterophyllus) Waste for its Potential Application in Bioethanol

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Food processing waste refers to the residual materials generated by different food processing companies that are not suitable for further use in the manufacturing of the particular product. If suitable processes are available to exploit these wastes, they may be regarded as valuable by-products that can be used to create a value new product. Around 65% of the weight of the original jackfruit (Artocarpus heterophyllus) fruit is discarded as waste during processing, including the peeled skin, rags, and core. These waste materials are not being used and so contribute to disposal and pollution problems. The waste generated by jackfruit is considered lignocellulosic waste, including significant amounts of cellulose and hemicellulose. These components can be efficiently converted into bioenergy sources, such as bioethanol, by biological processes. Bioethanol derived from lignocellulosic biomass is acquired via three primary stages: pre treatment to diminish lignin levels and reveal cellulose and hemicellulose for hydrolysis; hydrolysis and sugar fermentation. Following the process of sugar fermentation, the resulting ethanol includes a certain amount of water that has to be extracted. The distillation process involves the boiling of a mixture of water and ethanol to separate the water from the ethanol. The manufacture of bioethanol from jackfruit waste not only helps to manage jackfruit waste, but it also generates biofuel, which contributes to the creation of an eco-friendly environment. Therefore, the use of jackfruit waste may contribute to sustainable solutions for waste management and novel biorefineries provide an opportunity for achieving zero waste.

Keywords: bioethanol, fermentation, lignocellulosic biomass, hydrolysis.

Farmers' Knowledge, Attitudes, and Practices Regarding Climate Change, Low Carbon Farming, and Carbon Credits in Bishnupur District of Manipur: A Comparative Study

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This comparative study examines the knowledge, attitudes, and practices of farmers regarding climate change, low-carbon farming, and carbon credits in the Bishnupur district of Manipur, India. A survey of 200 farmers from the blocks of Thinungei, Kwaksiphai, Sendra, and Kumbi in Bishnupur district of Manipur was conducted using a questionnaire. The questionnaire prepared for the interview is composed of four parts: socio-demographic information, behavioural information, sustainable farming practices, and agronomic information. Farmers were divided into adopters and non-adopters of low carbon farming practices. The study reveals significant differences in their understanding of climate change, perceptions of low carbon farming, and engagement with carbon credit initiatives. Adopters demonstrate higher knowledge and more positive attitudes towards climate-resilient agriculture, while non-adopters face barriers such as limited access to information and resources. The study highlights the need for targeted interventions to enhance farmers' knowledge, attitudes, and practices regarding climate change mitigation and adaptation strategies, ultimately supporting the resilience of agricultural systems and the well-being of farming communities in Manipur.

Keywords: climate change, low carbon farming, carbon credits, farmers' knowledge, attitudes, practices.

Understanding the Influence of Parental Engagement and Play on Children's Development: A Review of Literature

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Play and parental engagement are critical components in shaping a child's development, influencing a wide range of growth areas including cognitive, social, emotional, and physical domains. This review paper delves into exploring how play fosters essential skills and how active parental involvement supports and enhances developmental outcomes. Play is fundamental in fostering cognitive skills through problem-solving and creativity, enhancing language acquisition, and supporting motor development. Socially, it teaches essential skills such as cooperation and empathy, while emotionally, it aids in regulation and confidence building. At the same time, parental engagement is critical in providing emotional support, modelling behavior, and fostering educational and health-related practices. This paper synthesizes recent research on the synergy between play and parental involvement, highlighting how interactive and guided play can optimize developmental outcomes. Play and parental engagement are crucial components of child development. By integrating findings from various studies, this review underscores the importance of a balanced approach that combines both free and structured play with active parental participation to support holistic child development. The paper concludes with recommendations for integrating these insights into practical strategies for parents, educators, and policymakers to enhance developmental support for children.

Soil nutrient management for sustainability of Indian agriculture: Evidence from a Meta-analysis

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The intensive use of chemical fertilizer has degraded soil health and agro-biodiversity, increased GHG emissions, and intensified global warming worldwide, particularly in developing countries. Besides, agrochemicals have resulted in a deterioration in the quality of food and feed, adversely affecting human and animal health. In contrast, organic fertilizer increases carbon sequestration, soil fertility, and microbial activities and enhances nutrient quality and agro-biodiversity and reduced water use and GHG emissions. However, the contribution of non-marketed ecosystem services is undervalued or not estimated in terms of monetary terms. Estimating the monetary value of these ecosystem services (ES) is crucial to incentivizing and motivating farmers to adopt sustainable agricultural practices (SAPs). Therefore, this study quantified and valued key ecosystem services from organic farming compared to inorganic farming using a meta-analysis approach. The farm-level analysis results show that the sole application of farm yard manure (FYM) provided significant environmental benefits such as improved carbon sequestration (2.86 t/ha), increased nutrient availability (20 kg NPK/ha), and water-saving (-380 m3/ha). However, applying only FYM resulted in declining crop yield compared to inorganic fertilizer application. Whereas the application of integrated nutrient management (INM), the use of FYM in combination with inorganic fertilizer, provided significantly higher C-sequestration, soil fertility, water saving, and crop yield compared to chemical fertilizer and organic farming. Despite the huge environmental benefits of soil application of organic fertilizer, the net economic value of ecosystem services using sole FYM is negative mainly due to yield penalty. However, the net economic value of ecosystem services of INM is substantial (₹24,054/ha), and the total economic value of non-marketed services is significantly greater than that of inorganic fertilizers, accounting for 30% of the overall economic value of the ecosystem services under INM. Thus, these findings highlight the cost-effectiveness and efficacy of INM in achieving food security while minimizing adverse environmental effects. The study provides a means of sustainable agriculture production through applying FYM and INM. The study will sensitize the stakeholders and policymakers about ES provided by SAPs and develop the mechanism for incentivizing farmers and promoting the adoption of SAPs.

Keywords: FYM, INM, ecosystem services, Sustainable agriculture, economic value, Meta-analysis

Endosymbiont-based strategies for sustainable pest management

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Hexapod invertebrates, the most diverse and unique with more than a million reported organisms have been roaming this Earth since 300 million years ago, this evolutionary success can be attributed to its resident microbes. As reported endosymbionts reside within specialized cells or tissues of host organisms, providing essential functions that contribute to the host's survival, reproduction, and fitness. For sustainable pest management, strategies based on endosymbionts are rapidly emerging as a cutting-edge that offers different innovative approaches while minimizing environmental impact. Manipulating these endosymbionts within pest populations by artificial methods affects the reproductive success, lifespan, or fitness of pests. When Wolbachia bacteria was introduced into mosquito populations the spread of vector-borne diseases like dengue, Zika and chikungunya. Furthermore, when Rickettsia was manipulated in whiteflies, a decrease in insecticide resistance was observed as the symbiotic relationship between the insect and its endosymbiont was disturbed. This disruption weakens the pest, eventually leading to its death. This can be achieved through targeted antimicrobial treatments or genetic engineering techniques that interfere with symbiont-host interactions. Additionally, Bacillus thuringiensis is a well-known biopesticide that targets specific pests, Lactobacillus protects against fungal pathogens and Helicoverpazea also limits the pest population. Endosymbionts may be engineered to produce toxins or other compounds that increase the lethality of these agents against pest insects. The endosymbionts can also be used to enhance the effectiveness of biological control agents such as parasitoids or predators. These interactions between insects and their endosymbionts are often complex and context-dependent. More research is needed to fully understand these dynamics and predict the outcomes of manipulating them. However, Introducing or modifying endosymbionts in pest populations carries the risk of unintended ecological consequences, such as the disruption of non-target species or the evolution of resistance. Implementing endosymbiont-based strategies on a large scale requires careful consideration of how these methods can be integrated with existing pest management practices, including chemical, biological, and cultural controls.

Keywords: endosymbiont, sustainable pest management, symbiotic-association

Sustainable Development through Agroforestry: A Multi-Goal Approach

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Agroforestry, as a versatile land-use system, holds the potential to contribute to the achievement of at least nine of the 17 Sustainable Development Goals (SDGs). This practice serves as a vital tool for both climate mitigation and adaptation, addressing key challenges in the contemporary world. By integrating trees with crops and livestock, agroforestry combats poverty and hunger, enhances biodiversity, empowers women by increasing their control over resources, and frees up time for women by reducing the labor burden. The importance of studying agroforestry's contribution to the SDGs has become even more evident in the context of the COVID-19 pandemic, which has significantly disrupted progress toward many critical global goals. Agroforestry can directly support SDG-1 (No Poverty), SDG-2 (Zero Hunger), SDG-11 (Sustainable Cities and Communities), SDG-13 (Climate Action), and SDG-15 (Life on Land). By reducing poverty and improving food security, agroforestry fosters resilient and sustainable communities. It also contributes to the development of livable, healthy cities and promotes a sustainable, prosperous environment, particularly under the current climate change conditions. Moreover, agroforestry indirectly supports other SDGs by enhancing health and education outcomes, empowering women, and promoting harmonious coexistence between people and nature. To effectively achieve the objectives of sustainable development, an integrated landscape approach is essential. This approach ensures that the most suitable agroforestry practices and methodologies are implemented in the right places and for the right reasons. By adopting such an approach, agroforestry can play a crucial role in advancing global sustainability efforts, offering a pathway to a more equitable and resilient future for all.

Characterization of Indigenous potato accessions for morphological, resistance and adaptability traits under North Western Himalayas

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Potato, a worldwide known crop, exhibits extensive diversity for various traits, both quantitatively and qualitatively. A total of 30 indigenous SVAM accessions collected from North Eastern India (Meghalaya) were characterized based on DUS morphological, yield/adaptability, late blight and potato cyst nematode (PCN) resistance at CPRS Kufri. Morphological evaluation for DUS traits among these accessions showed wide variability for lightsprout, floral and tuber characters. Based on lightsprout colour, SVAM-19, SVAM-31, SVAM-36 and SVAM-37 had purple colour and remaining were categorized as pink (6), red purple (7) and white-green (13). Floral characterization showed maximum accessions with white flowers (16) and 14 genotypes bear red-violet flowers. SVAM-24 and SVAM-39 had pink, SVAM-33 with yellow, SVAM-20 and SVAM-36 with brown tuber skin while, majority showed whitish-cream (25) as predominant skin colour which is a major preference among consumers of this region. These accessions were further evaluated for foliar blight resistance under natural epiphytotic field condition along with control varieties. Quadruple data recording at seven days interval and AUDPC calculation showed genotypes SVAM-15, SVAM-17, SVAM-22, SVAM-23, SVAM-26 and SVAM-38 to be highly resistant (AUDPC< 250). Potato cyst nematode (Globodera rostochiensis and G. pallida) evaluation through root ball technique based on cyst count at 55 days after planting under glasshouse conditions observed cultures SVAM-3, SVAM-20 as moderately resistant (6-20 female/root ball). SVAM-21, SVAM-26, SVAM-32 and SVAM-37 were best adapter yielding higher average yield per plant over best control. The study identified late blight and/or PCN resistant and high yielding adapted genotypes can be deployed as parental lines for resistance breeding.

Keywords: adaptability, late blight, PCN, potato

Functional analysis of MED8 and MED17 from medicinal plants

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Developmental transitions in plants are tightly regulated by a wide range of regulatory proteins both at transcription initiation and transcription elongation stage. The core machinery involved during transcription process include general transcription factors, RNA polymerase II, activators, repressors, and the mediator complex. The mediator complex is a large modular protein complex that modulates expression by recruiting transcription factors to specific gene sites. Highly conserved mediator proteins are required for regulating most RNA polymerase II transcripts including protein coding and non-coding genes. Mediator and RNA polII function within the pre-initiation complex (PIC), which consists of mediator, polII, TFIIA, TFIIB, TFIID, TFIIF, TFIIE and TFIIH. The mediator complex acts as molecular bridge between gene-specific regulatory proteins and the general transcription apparatus. Artemisia annua and Withania somnifera have a distinctive place in pharmaceutically important plants due to the presence of secondary metabolic compounds having biological activities relevant to human health. A. annua produces artemisinin, an anti-malarial compound, while, W. somnifera synthesizes withanolides and withaferins in its root and leaf. These secondary metabolites are biosynthesized in quite restricted amount in naturally grown wild plants. To enhance the production of these metabolites in planta and reduce the processing cost of their extraction, it is imperative to apply metabolic engineering approaches to modulate pathway gene expression/regulation of secondary metabolism or biomass production. Mediator complex subunit(s) could be target candidates for modulating gene expression or biomass enhancement in these plants. In order to study mediator proteins involved in secondary metabolism and tissue/organ development, homolog(s) of few mediator subunits such as MED8 and MED17 were identified from A. annua and W. somnifera, and cloned in suitable overexpression vectors for functional analysis. Transient overexpression in W. somnifera significantly enhanced withanolides content (Withaferin A and Withanone) in the leaf of transformed seedlings as compared to mock vector control. An increased content of Withanolide A and Withanone A was observed in the root tissue of transiently transformed seedlings as compared to the control. A. annua and N. tabacum xanthi are being transformed for further investigations on functional relevance with respect to secondary metabolism and biomass production.

Extent of agrochemicals usage on cotton crop in Punjab

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Agrochemicals were used basically for the increase in yield. But with time pests and other casual organisms have started building resistance against various agrochemicals due to which its dose and use has been increasing year by year. This study aims at analyzing the doses used by farmers of various agrochemicals such as different fertilizers, pesticides weedicides. It has been found that most of the farmers preferred to grow hybrids developed by private companies. Recommended dose of DAP i.e. 27 kg /acre whereas 70 per cent of them were applying DAP fertilizer at very high rates. Around 90 per cent of the respondents were applying urea fertilizer at very high rates. Most of the farmers were using high doses of agrochemicals as compared to the recommended doses. Some of the farmers were still using obsolete or banned pesticides. Flonicamid was used by 90 respondents out of 100, 22 per cent of them were using it at recommended dose, 78 per cent of them were using the pesticide at high dose. Pendimethalin was used by 70 respondents out of 100, out of which only 28.57 per cent of the respondents were using it at recommended dose whereas 71 per cent of the respondents were using the pesticides at high dose. on an average 24.8 per cent of the respondents use pesticides which belongs to moderately hazardous class.

Key words: Extent**,** Agrochemicals, Cotton and Pesticide.

Influence of microbial consortium on flowering attributes of gladiolus cv. Rose Supreme for sustainable agriculture

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Gladiolus (Gladiolus grandiflora) is a flower of breathtaking beauty with a wide range of color, size and form. The beautiful flower spike has florets of highly dazzling colours of white, red, pink, purple, etc. along with bicolour and multicolour. Infestation of disease became one of the major obstacles to gladiolus cultivation, which hamper the productivity of gladiolus grower. Microbial consortium having diverse group of microorganisms, have ability to act together in a community. They suppress growth of soil-borne plant pathogens by different direct or indirect mechanisms, such as production of phytohormones, mycoparasitism and competence with plant pathogens, decomposition and mineralization of organic matter and enhancing the bioavailability of mineral nutrients. To keep these points in consideration an experiment was conducted at Model Floriculture Centre, G. B. Pant University of Agriculture and Technology Pantnagar during 2022-23 to study the "Influence of microbial consortia on flowering attributes of gladiolus cv. Rose Supreme". Experiment was laid out in factorial concept of randomized block design (RBD) in open field conditions. Medium sized (8-10 cm) corms of gladiolus cv. Rose Supreme were used as experimental material. The consortia applied to the corms or sprayed on plant by different methods of application. The result revealed that most of the flowering attributes (viz. spike length, rachis length, number of florets per spike, etc.) were found to be best with treatment of microbial consortium. On the basis of current findings, it can be concluded that the use of microbial consortium inoculant Rhizobium with PGPRs having various PGP traits would be an effective approach for improving the yield of gladiolus.

Keywords: Microbial consortium, gladiolus, corms, flowering parameters, etc.

Biochemical Characterization and Antioxidant Profile of Fresh Red Flesh Dragon Fruit: Nutritional and Phytochemical Insights

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This study evaluates the biochemical properties of fresh red flesh dragon fruit, providing insights into its nutritional and antioxidant profiles. The moisture content of the fruit is notably high at 83.74±1.67% (wb), indicating its substantial water content. The fruit's carbohydrate content is 11.71±0.63%, with minimal fat (0.69±0.04%) and a low true protein content of 1.57±0.09%. The ash content is recorded at 0.67±0.05%, and crude fiber accounts for 2.59±0.28%, highlighting its dietary fiber presence. The red flesh dragon fruit is rich in bioactive compounds. Betacyanin, a key pigment, is present at 339.78±17.92 mg/L, contributing to its vibrant color. The total phenol content is significant at 225.34±5.43 mg GAE/100g, and total flavonoid content is 323.18±10.18 mg CE/100g, reflecting its antioxidant potential. Correspondingly, the fruit exhibits notable antioxidant activity at 59.72±1.60%. Ascorbic acid, an important vitamin, is found at 21.52±10.76 mg/100g. The fruit has a slightly acidic pH of 4.69±0.03 and a total soluble solids (TSS) content of 14.6±0.42 °B, indicative of its sweetness and flavor profile. These findings underscore the nutritional value and antioxidant benefits of fresh red flesh dragon fruit, making it a valuable addition to a balanced diet.

An Urgent Need of the Hour: Biofortification in Cicer to Enhance Nutrient-Rich Diets for Populations in Semi-Arid Regions

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Micronutrient deficiencies, in particular those arising from zinc (Zn) and iron (Fe), are serious human health problems for billions of people across the globe. Millions of children who predominantly depend upon a cereals-based diet suffer from malnutrition. Chickpea, a primary crop in several developing countries, should be prioritized to enhance its nutritional content and mineral composition since it often lacks sufficient levels of essential nutrients. Most of the nutrients are lost during milling. Biofortification acts as the most promising and economic strategic option to effectively increase the micronutrients in the edible portion of the crop. Agronomic and Genetic Biofortification are the two approaches; however, genetic engineering is becoming more concern for researchers. This uses the techniques to enhance the bioavailability of nutrients and reduce the antinutrient compounds. Though many technologies exist in increasing nutrient contents, biofortification is assumed to be the most sustainable. In this paper, we assess different strategies for chickpea biofortification to overcome the challenges seen during the process. Promising ways to enhance iron lays stress on the iron and zinc content in chickpea, the global chickpea production scenario, malnutrition status, and key challenges. Also thrown some light on the scenario as a whole of various agronomic and genetic approaches of chickpea biofortification against iron and zinc deficiency.

Keywords: chickpea, Biofortification, agronomic and genetic approaches, iron, zinc

Preference: Participation and Abstract Submission

Bio-pesticides market potential, size and trends in world and India

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In nature every ecosystem exists in a balance. Growth and multiplication of each organism depends on the food-chain, its predators, parasites, etc. Bio-pesticides are pest control products derived from natural materials like bacteria, animals, plants, and minerals. In developed countries, a public-private collaboration approach to the development, manufacturing, and marketing of environmentally sustainable pesticide alternatives is a regular requirement. The global bio-pesticides market was valued at USD 5.9 billion in 2022 and is poised to grow from USD 7.52 billion in 2024 to USD 20.46 billion by 2035, growing at a CAGR of 9.5 % during the forecast period by 2024-2035. North America and Europe hold the largest share account for over 60% of the bio-pesticides. Syngenta AG, Bayer AG, BASF SE, and Bioceres S.A. are some of the top players in the world market.

The bio-pesticides industry in India is rapidly evolving, representing increasing global agricultural trade, a changing regulatory climate, and changing customer tastes. The India bio-pesticides market is segmented by forms viz. bio-fungicides, bio-herbicides, bio-insecticides. The India biopesticides market is fragmented, with the top five companies occupying 9.01%. The major players in this market are Coromandel International Ltd, GrowTech Agri Science Pvt. Ltd., Gujarat State Fertilizers & Chemicals Ltd, IPL Biologicals Ltd. and T.Stanes and Company Ltd. **India bio-pesticides market** was valued at **USD 82.2 Million** in 2024 and is expected to reach **USD 204.1 Million** by 2033, at a CAGR of **9.23%** during the forecast period 2024 – 2033.

There is a scope to enhance production and use of biological control agents in the days to come as the demand is on the increase every year.

Keywords : biopesticides, materials, market, formulations, market players, scope.

Gross morphological Studies on the Uterus of Camel (Camelus dromedarius)

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The uterus was a vital organ in the female reproductive system, responsible for housing embryos until delivery. This study focuses on the anatomical features of the uterus in camels, highlighting its unique structure and positioning. The camel's uterus, located between the 5th, 6th, and 7th lumbar vertebrae, was a thick-walled, hollow muscular organ found partially in the pelvic and almost in the abdominal cavities. It was connected to the sides of the pelvic cavity by broad ligaments, which consist of double folds of peritoneum, muscle fibers, and connective tissue, and these ligaments also house the nerves and vessels supplying the uterus. The uterus was divided into two distinct parts: the cranial transverse part, consisting of the free portion of the uterine horns, and the caudal longitudinal part, formed by the fused portion of the horns, which together constitute the uterine body. The uterus of the camel was bicornuate, with the left horn being significantly longer than the right. Interestingly, the camel's uterus resembles a T-shape more than the classical Y-shape observed in other species. Measurements of the uterus revealed that the body was 4.93 ± 0.75 cm in length and 11.17 ± 0.98 cm in circumference, with the left horn measuring 18.68 ± 0.75 cm in length and 10.67 ± 1.25 cm in circumference, and the right horn measuring 16.45 ± 2.29 cm in length and 9.33 ± 1.40 cm in circumference. The thickness of the uterine wall varied from 3 to 10 mm, with the endometrium showing irregularly raised longitudinal folds, particularly in the left horn. The absence of caruncles and the presence of utero-tubal papillae were notable features. This study provides detailed insights into the unique anatomical characteristics of the camel's uterus, contributing valuable knowledge to the field of veterinary anatomy and reproductive biology.

Carbon Sequestration Mapping in Urmodi Basin of Maharashtra Using RS and GIS

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An increase in the concentration of atmospheric CO_2 by 31 % since 1750 necessitates the identification of strategies for mitigating the threat of global warming. Soil erosion is the major land degradation process that removes organic carbon from the soil. Estimates of soil loss and their conservation planning are essential steps to improve soil quality, increase biodiversity and enhance soil organic carbon storage which in turn improves carbon sequestration. Therefore, there is a need to study the magnitude of the impact of conservation measures on carbon sequestration on a watershed basis. The average annual soil loss from the Urmodi basin was 30 t/ha/yr before the adoption of soil and water conservation measures and 8.39 t/ha/yr with scientific planning and execution of soil and water conservation technologies. Total carbon sequestration was expected to increase by 8.35 % to the level of 6.81 million tonnes of CO_2 from Urmodi basin after adoption of soil and water conservation measures and water harvesting structures. So, it is concluded that these conservation technologies would improve soil quality, enhances organic carbon and leads to better productivity of agricultural land.

Keywords: Carbon Sequestration, RS&GIS, USLE, SWC measures

Effect of different levels of pruning intensities and plant geometry on the performance of blooming characteristics and fruit yield attributes of meadow orchard Guava cv. Allahabad Surkha (*Psidium guajava* L.) grown under prayagraj Agro-climatic condition

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An experiment entitled- "Effect of different levels of pruning intensities and plant geometry on the performance of blooming characteristics and fruit yield attributes of meadow orchard Guava cv. Allahabad Surkha (Psidium guajava L.) grown under prayagraj Agro-climatic condition. The research experiment was carried out at Horticulture Research Farm, Central Orchard, Department of Horticulture, Naini Agricultural Institute, (SHUATS), Prayagraj, Uttar Pradesh, during the two consecutive years (2020-2021) & (2021-2022). The experiment was laid out in {FRBD} with 20 treatments and each was replicated thrice. The experiments were constituted on different plant geometry with levels of pruning intensities on newly established meadow orchard Allahabad Surkha guava. The level of pruning intensities and plant geometry which is applied in this study is based on Heading Back stage followed by shoot pruning in guava plants. The heading back in this experiment was carried out at 1 year old wedge grafted plants of Allahabd surkha guava. The experiments were constituted on different plant geometry viz., D_1:2.0 m x 1.0 m,D_2:2.0 m x 2.0 m, D_3:2.0 m x 3.0 m, D_4:2.0 m x 4.0 m and D_5:6.0 m x 6.0m with three levels of pruning intensities viz., 50%, 30% and 10% on blooming characters, fruit yeild and quality of newly established meadow orchard guava (Psidium guajava. L) cv. Allahabad Surkha. The study clearly shows the impact of different levels of pruning intensities and plant geometry on rainy and winter season crop of newly established meadow orchard guava. In which 10 % pruning intensity and 2.0 m x 4.0 m plant geometry was found best for obtaining all blooming characteristics and fruit yielding attributes of newly established Allahabad Surkha guava. As far as interaction between the effects of two factors (pruning intensity x plant geometry) and (plant geometry x pruning intensity) also revealed significant effect on minimum days required to blooming, days required from flower to fruit set, days to required from fruit set to maturity, maximum number of flowers per plant, number of fruits per plant, fruit weight (g), polar diameter (cm), radial diameter (cm) and fruit yield per plant (g) was recorded highest with treatment T_{19}(P3: 10% + D4: 2.0 x 4.0m) during rainy and winter season.

Keywords: Meadow Orchard, Allahabad Surkha, Psidium guajava, Pruning intensity, plant geometry, blooming characters and fruit yield attributes.

Capacity development of farming community for natural farming: A key to sustainable agriculture

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The Indian government's focus on natural farming reflects a growing recognition of the need for sustainable agricultural practices that protect the environment, improve farmers' livelihoods, and ensure food security. Natural farming has become a significant focus for the Indian government in recent years, driven by concerns about the environmental impact of conventional agriculture and the need for sustainable farming practices. Promoting natural farming as a method that emphasizes sustainable practices, minimal use of synthetic inputs, and enhancement of ecological balance which requires a multifaceted approach involving extension strategies and supportive government policies. A comprehensive outline of strategies and policies that could be effective for promoting natural farming by enhancing the capacity building of the farmers. Capacity building refers to a process of change in which people, organizations and institutions improve their performance and refine, strengthen and adapt their capacity over time in response to changing circumstances. Pradhan Mantri Krishi Sinchai Yojana (PMKSY), National Mission on Sustainable Agriculture (NMSA), Paramparagat Krishi Vikas Yojana (PKVY), National Organic Farming Research Institute (NOFRI), Promotion of Farmers' Producer Organizations (FPOs) etc. are some key efforts and programs that government of India has undertaken to build the capacity of farmers and promote natural farming practices. Government support through subsidies and financial support, regulatory framework, policy integration, incentivizing private sector involvement. tax benefits, land use policies etc. can also lead to increase the adoption of natural farming. Extension personnel can play a vital role in capacity building through education and training programs, technical support and advisory services, research and development, farmer networks and cooperatives, incentive programs, community engagement, promotion of natural farming techniques. The successful promotion of natural farming relies on a coordinated approach that combines effective extension strategies with supportive government policies. By focusing on education, technical support, research, financial incentives, and infrastructure, along with creating a favorable regulatory and market environment, it's possible to encourage the widespread adoption of natural farming practices and achieve long-term sustainability in agriculture.

Keywords: Capacity building, Extension strategies, farmers, Natural farming, Sustainable agriculture, government policies

Recent Advances and Future Trends of Antimicrobial Edible Food Packaging

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Recent developments in antimicrobial edible food packaging have opened new horizons for food safety and sustainability. Due to increasing consumer awareness, there is a growing concern over environment-f riendly packaging materials which do not accentuate m icrobial contaminat ion causing foodborne illness and spoilage. Novel edible pac kaging materials embedded with antimicrobial agents h as been developed by scientists to tackle thi s issue. This development aims to increase the shel f life while minimizing the use o f n on-biodegradable plastics. Natural antimicrobial applications are bene fi ci al in these innovations The use of e s sential o ils antimic robial peptides and plant extracts with in biopol yme rs such a s polysa ccharides and proteins for potential antimicro bial edible films has gain considerable attenti on. Furthermore, nanotechnology has significantly improved the mechanical properties and antimicrobial activities of these biopolymers. In future applications, these biological materials may be tailored according to specific food applications, their sensory properties will be improved further by incorporation of different flavours/odours etc., and production processes will be scaled up for commercial purposes. As an emerging trend in this field, smart technology integrated with antimicrobial edible films is also expected to allow consumers to evaluate real-time data on product quality based on freshness indicators such as microbiological contamination. Moreover, future research should develop fully biodegradable film options through nanotechnology-driven scientific research efforts which would influence future packaging industries greatly with less environmental impact while satisfying the demand of the modern society.

Keywords: Antimicrobial packaging, edible packaging, nanotechnology, smart packaging, biodegradable packaging.

A Comparative Study of Callus formation from different Explants of Cinnamomum camphora (L.) Nees & Eberm.

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Callus is the one of the best source for indirect organogenesis. It is considered as a pre-requisite for effective micropropagation. A number of medicinal plants have been in vitro propagated through callus induction during the past years. Among these, Cinnamomum camphora (Camphor tree) is one of them. Present investigation deals with the variability in callusing response in Cinnamomum camphora from different explants. Node, internode and leaf segments were used as explants. After surface sterilization with Mercuric Chloride, 70% alcohol and distilled water, explants were inoculated in Woody plant medium supplemented with different concentrations (0.5, 1.0 and 2.0 mg/l) of 2,4-D and NAA. On 2,4-D supplemented medium, internodal segment showed 100% callus induction within 10 days of inoculation on 2 mg/l of 2,4-D with the formation of good amount of greenish-white, soft and rough callus. Nodal explants produced (90%) whitish-brown, soft and rough callus within 15 days of inoculation. Leaf explants exhibited up to 70% callusing with the formation of moderate quantity of greenish-brown, soft and rough callus on 2 mg/l of 2,4-D. On NAA supplemented medium, internode explants formed whitish callus initially but gradually turned whitish-brown on 2 mg/l of NAA with 100% callus induction occurring in 12 days of inoculation. The texture of callus was soft and rough. On 2 mg/l of NAA, 90% explants formed moderate amount of brownish, soft and rough callus initiated in 16 days of inoculation. Leaf explants exhibited greenish-brown and rough callus (60%) on 2 mg/l NAA.

Keywords: Callus, Cinnamomum camphora, Camphor tree

Protection of Plant Genetic Resource, farmer's Varieties And Farmer's Rights

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Plant genetic resource plays a very important role in crop improvement. Genetic resources may be in the form of improved cultivars, land races, obsolete cultivars, farmers varieties, advance breeding lines, wild forms of cultivated species, wild relatives, mutants etc. As all these resources can be utilized for crop improvement, it needs protection. Farmer's contribution in agriculture includes cultivation of traditional varieties or land races since long back, conservation, improvement and making available plant genetic resources for further crop improvement. Similarly plant breeders are directly involved in development of new improved varieties which are high yielding, nutritionally secured and climate resilient. So it is very necessary to provide an effective system for protection of all these genetic resources and giving rights to farmers, breeders etc. to encourage investment of money in research and development in public as well as private sector for developing new plant varieties and also growth of seed industry in the country. Indian has its own plant variety protection act known as "Protection of Plant varieties and Farmers' Rights Act" enacted in 2001, rules were notified in 2003 and the Authority was established on November 11, 2005. Its head office is at New Delhi and has different branches all over India. This authority is protecting plant varieties by registering farmer's variety, variety of common knowledge, notified varieties, essentially derived varieties, modern cultivars etc. This is the only authority of its kind giving rights to the farmers, plant breeders and researchers. Farmers' rights are protected by providing compulsory licensing and benefit sharing facility, free registration of farmers' varieties, awards and recognition to individual farmers and farming communities. Authority is involved in preparation of crop specific DUS guidelines (Distinctiveness, Uniformity and Stability) and DUS centres in different parts of the country, seed bank at headquarter, identification of Agro biodiversity hot spots, maintenance of National Register on Plant Varieties and Plant Variety Journal of India. These protection and rights in agriculture for the benefit of farming community will help country's growth and development.

Keywords: Plant genetic resource, plant variety, farmers' right, farmer's variety, notified variety, DUS guidelines.

Liquid formulation of Salt and Temperature Tolerant Plant Growth-Promoting Rhizobacteria

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The present study was focused on Liquid formulation of salt and temperature tolerant plant growth promoting rhizobacteria isolated from rhizosphere soil of tomato. The liquid consortium formulated using Six viz. Pseudomonas furukawaii STT-A8, Achromobacter sp.STT-A12, Agrobacterium pusense STT-A39, Priestia flexa STT-K13, Bacillus sp. STT-K24 and Brevibacterium epidermidis STT-N28 extremely salt and temperature tolerant rhizobacteria isolates were tested for their mass production on appropriate standardized medium in the laboratory of department of Agricultural Microbiology, MPKV, Rahuri, Maharashtra during year 2020-2023. Out of five test media (M1, M2, M3, M4 and M5), M3 medium. contained Mannitol (5.0 g), Peptone (5.0 g), Glucose (15.0 g), Tricalcium phosphate (3.5 g), K_2HPO_4 (1.50 g), Potassium aluminium silicate (1.50 g), Calcium phosphate (1.50 g), Calcium carbonate (1.50g), Yeast extract (1.50 g), Ammonium sulphate (0.2 g), $MgSO_4.7H_2O$ (0.2 g), NaCl (0.2 g), K_2SO_4 (0.1 g) was found best. The M3 medium was further formulated by using different concentrations of cell protectants at pH 9.00 was devised as liquid medium L5M3. After prepration of consortium, the optimum population of all six salt temperature tolerant rhizobacteria were observed upto 12 months. The composition of L5M3 media was best that consists of Standard medium (M3), Fe. EDTA (0.30 g), Arabinose (0.60 g), Glycerol (3.0 ml), PVP (16.00 g), Trehalose (1.0 g) and Distilled water (1 lit.). The media were tested and compared for growth by transferring 1 per cent inocula of each extremely salt and temperature tolerant rhizobacteria and the flasks were incubated on rotary shaker at 110 rpm for 72 hrs. After incubation, a loopful culture was streaked on sterilized standard medium (M3). The plates were incubated at 28 ± 20C and observed for growth by compairing cfu count on each devised medium, where the maximum cfu of all salt and temperature tolerant rhizobacteria observed, was selected as standard appropriate salt and temperature tolerant rhizobacteria consortium medium. The luxuriant cell count (cfu) of all salt and temperature tolerant rhizobacteria was observed on the L5M3 medium and devised as a consortium medium. The experiment was done to prepare liquid formulation of salt and temperature tolerant PGPR that would be a crucial inoculum to enhance tomato plant growth and development in a salty environment.

Keywords: liquid formulation, standardized medium, salt and temperature tolerant, plant growth promoting rhizobacteria.

Influence of Varied Integrated Nutrient Management Strategies on the Yield and Economics of Sesame (Sesamum indicum L.)

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A field experiment was conducted at the Faculty of Agriculture, Annamalai University during the summer of 2022 for yield maximization in sesame through nutrient management practices (NPK, FYM, PMC, Urea, KCl, GA_3). The field experiment comprised of 13 treatments laid out in a Randomized Block Design (RBD) replicated thrice. Sesame test variety VRI(SV)2 was sown at a distance of 30 cm ×30 cm in clayey loam soil. The treatment details are T_1 - 100 % RDF, T_2 – 50 % RDN + 50 % of N on equivalent basis of FYM , T_3 -50 % RDN + 50 % of N on equivalent basis of PMC , T_4 – T_2 + Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_5 – T_3 + Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_6 – 75 % RDN + 25 % N on equivalent basis of FYM, T_7 - 75 % RDN + 50 % of N on equivalent basis of PMC, T_8 – T_6 + Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_9 – T_7 + Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_{10} – 100% RDN+ 25 % N on equivalent basis of FYM, T_{11}- 100% RDN+ 25 % N on equivalent basis of PMC, T_{12} – T_{10}+ Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages, T_{13} - T_{11}+ Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stage. The result revealed that T_{13} - 100% RDN+ 25 % N on equivalent basis of PMC + Two foliar spray of GA_3 100 ppm + Urea (0.4%) + KCl (1.0%) at flowering and capsule formation stages recorded the highest yield attributes viz., number of flowers/plant (110.23), number of capsules/plant (69.09) and at harvest (135.39), number of seeds/capsules (66.47), 1000 seeds weight (3.13g), grain yield (773 kg ha^{-1}) and stover yield (2640 kg ha^{-1}) and B: C ratio (2.35) of sesame.

Keywords: Integrated nutrient management, Sesamum, yield attributes, Economics.

Assessment of Pre and Post Weed Management Practices in Single Cross Maize Hybrid

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A research on "Optimizing the pre emergence herbicide and time of post emergence weed management practice in irrigated maize" was conducted from 2017 to 2020 at Maize Research Station, Vagarai (TNAU) to assess the pre and post emergence herbicide dose and optimize the time and method of post emergence weed management in maize The result of the experiment revealed that a significant higher grain yield (9,251 kg/ha) was recorded in the application of atrazine @ 1.0 kg/ha as pre-emergence and followed by spraying of tembotrione @ 120 g a.i./ha at 15 DAS than control and recommended practice. The highest net returns of Rs.1,17,864/- per hectare and BCR of 3.04 in application of atrazine @ 1.0 kg/ha followed by tembotrione @ 120 g a.i./ha at 15 DAS. Total weed population was significantly lesser in atrazine 1.0 kg/ha (PE) fb mechanical weeding at 25 DAS) at 15 DAS followed by application of atrazine 1.0 kg/ha (PE) fb tembotrione @ 120 g a.i./ha at 15 DAS) at 25 DAS (12.7 nos./m^2 at 15 DAS and 11.0 nos./m^2 at 25 DAS). The total weed dry weight was also significantly lesser (5.7 g/m^2 and 5.0 g/m^2) in atrazine 1.0 kg/ha (PE) fb tembotrione @ 120 g a.i./ha at 15 DAS at 15 DAS and at 25 DAS. Whereas at 50 DAS, the significant lesser total weed dry weight (5.2 g/m^2) was found in atrazine application @ 1.0 kg/ha (PE) fb One hand weeding at 30-35 DAS. The WCE was significantly higher (83.7 %) when atrazine applied @ 1.0 kg/ha (PE) fb mechanical weeding at 25 DAS in 15 DAS and at 25 DAS, followed by application of atrazine @ 1.0 kg/ha (PE) fb tembotrione @ 120 g a.i./ha at 15 DAS) (90.5 %).

Keywords: Herbicide optimization, Maize, Grain yield, pre-emergence, post emergence, weed control efficiency

Unveiling the Secrets of new potential fruit crop in Punjab- Dragon fruit

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Dragon fruit (Hylocereus spp.) also known as Pitaya, Strawberry pear, or Scaly fruit is a highly nutritious fruit that originated in tropical regions of central South America. It is a perennial climber of the Cactaceae family. Its commercial cultivation is being carried out in tropical as well as sub-tropical areas. Based on pulp colour, the dragon fruit can generally be categorised into 'red pulped' and 'white pulped' varieties. Red pulped varieties are very rich in antioxidants as these have a high content of phytochemicals such as beta-carotene, xanthophyll, phenols, flavanols etc. Dragon fruit is also very rich in minerals such as calcium, zinc and magnesium various vitamins, and dietary fibres. Due to precocious bearing, long plant life and extended fruiting period, tolerance to various biotic & abiotic stress factors, ease of propagation and high nutritional value and market price, dragon fruity become one of the most preferred fruits worldwide. Dragon fruit can be best grown on sandy-loam soils with good drainage and rich in organic matter. Planting of dragon fruit can be done in the months of February-March and July-September. As the dragon fruit is a climbing cactus, it requires a proper and strong training system. Generally, a single pole system or trellis system can be established for its training. In a single pole system, poles can be fixed at 10x10 feet or 12x8 feet distance and at each pole site, 4 plants can be planted on each side of the pole. Trellis system can also be used. A drip irrigation system must be used to maintain soil moisture during plant growth and fruit development periods. Keeping in view the importance and potential of this exotic fruit crop, Punjab Agricultural University also recommended two varieties of dragon fruit viz. Red dragon-1 and White dragon-1 for commercial cultivation in the state.

ENHANCING FARMERS' INCOME THROUGH VALUE ADDITION OF FRUITS

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Fruits are staple food in human diet. The varying weather conditions of these country provide suitable environment for growing variety of fruits for it is an increasing production at the global level. Nutritionists recommend that fruits must form an important constituent of the daily diet. Different fruits' colour, varied aroma and taste make them palatable and freshen over mind and body. A significant amount of fruit produced is lost or wasted due to poor post-harvest management. Although known for its high nutritional value and is available only for a short period of time. Therefore, processing fruits into value-added products is one of the strategies to reduce post-harvest losses and promote consumption of fruits. In this transaction, processing of fruit crops into a variety of products, these products have good consumer demand because of its nutritional and medicinal value; with extended shelf life provides opportunity to consumers all over the country to enjoy them throughout the year. Adding value to the original crop also helps the farmer not only to overcome the spoilage and losses, but also fetches high returns due to the newly added technology. It provides convenience & safe food to consumers and promotes diversification and commercialization of agriculture by providing effective linkage between consumers and farmers and moreover, it will make farm produce more exportable and it provides the employment opportunity for rural mass, increases export demand of value-added products and increase income of farmers than that increase the economy of the country.

Keywords: Fruit, human diet, post-harvest management, value addition, shelf-life, income

Enhancing profitability and Fostering Entrepreneurship in Value-Added Meat Products

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The global meat industry is undergoing significant transformation, driven by changing consumer preferences, sustainability concerns, and the need for economic resilience. In this context, enhancing profitability and fostering entrepreneurship in value-added meat products have become critical priorities. Profitability in the meat sector can be significantly improved by focusing on value addition, which involves processes such as advanced processing, innovative packaging, and strategic branding. These activities not only increase the economic value of meat products but also align them with consumer demands for quality, convenience, and sustainability. Entrepreneurship in the meat products industry plays a critical role in driving innovation, meeting consumer demands, and fostering economic growth. Entrepreneurs in this sector have the ability to identify emerging trends, such as the increasing demand for sustainable, organic, and ethically sourced meat products, and capitalize on these opportunities by developing new products or improving existing ones. Several Indian entrepreneurs have made significant strides in the meat industry, focusing on innovation, sustainability, and catering to evolving consumer preferences e.g. Nagasamy Vellaisamy (TenderCuts), Abhay Hanjura and Vivek Gupta (Licious), Shan Kadavil (FreshToHome), Siddharth Rastogi (Zappfresh) etc. Furthermore, entrepreneurial initiatives can drive the adoption of new technologies and sustainable practices, leading to more efficient production processes and reduced environmental impact. This, in turn, enhances the overall profitability of the meat industry. Additionally, the abstract highlights the importance of an enabling ecosystem that supports entrepreneurial ventures in the meat sector, including access to funding, market intelligence, and regulatory support. The findings underscore the need for a collaborative approach involving policymakers, industry stakeholders, and entrepreneurs to create a dynamic environment where value-added meat products can thrive. By prioritizing both profitability and entrepreneurship, the meat industry can not only meet evolving consumer expectations but also contribute to broader economic and environmental objectives, ensuring its long-term sustainability and growth.

Keywords: Value addition, entrepreneurship, profitability, meat products, economic value

Extended Spectrum Beta-Lactamase Producing Escherichia coli from Fish Pond Water Samples in Manipur and Mizoram, India.

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A total of one hundred and forty eight Escherichia coli (n=148) isolated between February, 2023 to July, 2024 from fish ponds water samples in Manipur and Mizoram, India were characterized for their bla_{ESBL} genes, and other resistant genes respectively. Out of the 148 E. coli isolates, 14.18% (21/148) were found to be bla_{ESBL} positive isolates, whereby $bla_{CTX\text{-}M\text{-}1}$ (n=6), bla_{TEM} (n=2), bla_{SHV} (n=4), aac(3')IIa (n=3), aac(6')Ib (n=3), and tetA (n=3) were the antibiotic resistant genes detected. Phylogrouping showed that the E. coli isolates belonged to group A (65/43.91%), B1 (32/21.62%), B2 (21/14.18%) and D (30/20.27%). Congo red binding test showed that 65 (43.91%) isolates were positive. Antimicrobial susceptibility test was performed using twenty three antibiotics, and it was found that oxacillin has the highest resistant (86.48%), followed by rifampicin (81.75%), and clindamycin (81.08%). On conjugation assay, only 12 isolates were able to transfer the resistant genes to a susceptible E. coli recipient with transfer rates ranging from 2.0×10^{-3} to 5.0×10^{-4} per donor cell. Among the 7.43% (11/148) pathogenic E. coli isolates detected; 27.27% (3/11) were EAEC, 27.27% (3/11) were UPEC, 18.18% (2/11) were NMEC, 18.18% (2/11) were EHEC, and 9.09% (1/11) were EPEC. Genotyping of the bla_{ESBL} isolates using Repetitive Extragenic Palindromic-Polymerase Chain Reaction (Rep-PCR) of the bla_{ESBL} isolates showed a distinct and similar clonality.

Keywords: Escherichia coli, ESBL, Pond water, CTX-M, TEM, SHV, Pathotypes

In vitro evaluation of botanical extracts, bioagents and chemical fungicides against French bean anthracnose Colletotrichum lindemuthianum.

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Anthracnose of French bean caused by Colletotrichum lindemuthianum (Sacc. and Magnus) Briosi & Cavara is one of the devastating disease that restrict the production of beans around the world causing both qualitative and quantitative yield loses. The investigation was undertaken during 2021-2022 at Department of Plant Pathology, VNMKV, Parbhani. For developing its effective management strategy in vitro studies were carried out for botanical extracts of water-based and ethanol-based, biocontrol agents as well as seven systemic fungicides and four non-systemic and three combi-product fungicides to check their efficacy against C. lindemuthianum. Three replications were maintained for each treatment and control plate and the per cent mycelial inhibition over control was calculated using Vincent (1927) formula. Results of in vitro water-based plant extracts revealed that Garlic bulb at 10% and 20% and in vitro ethanol-based plant extracts revealed that Ginger rhizome and Garlic bulb at 10% and 20% were found to be most effective in mycelial inhibition of C. lindemuthianum over other botanicals and untreated controlled. In vitro evaluation of bioagents using dual culture technique revealed that the minimum mycelial growth and maximum inhibition over control was observed in Trichoderma asperellum and in vitro evaluation fungicides revealed that in systemic fungicides, Tebuconazole, Propiconazole, Iprobenfos and Carbendazim were shown to be most effective at 500, 1000, 1500 ppm and Difenoconzole at 1000 and 1500 ppm. In vitro evaluation of non-systemic and combi fungicides showed that Carbendazim 12%+ Mancozeb 63% WP and Mancozeb 50%+ Carbendazim 25% WS were found to be most effective in inhibiting mycelial growth at 1000, 2000 and 3000 ppm.

Keywords:- French bean, Colletotrichum lindemuthianum, Bioagents, Fungicides.

Genetic Diversity Analysis in Multihead Inbred Lines of Sunflower (*Helianthus annuus* L.)

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CITAAS/AB/2024/321

Sixty-one sunflower (*Helianthus annuus* L.) multihead inbred lines including one check were evaluated to study the morphological variations for twelve characters by using Mahalanobis D2 statistics. These genotypes were grouped into 7 clusters, among which the cluster I with 52 genotypes was the largest followed by cluster II with 4 genotypes. Maximum inter cluster distance was recorded between cluster II and VII (740.36) followed by clusters I and VII (426.99). Hence hybridizing between these divergent groups may lead to higher variation in segregating population. Among 7 clusters, IC-597575, EC- 601938, EC-640337, IC-438395 and SS-2038 were most divergent lines compared to other and crosses may be affected among the genotypes of these clusters to get more heterosis among the hybrids. The study revealed that the characters viz., Plant height (cm), Oil content (%), No of branches per plant contributed more to the total genetic divergence in the genotypes.

Keywords: D2 statistics, Sunflower, Genetic divergence

To compare the oocyte quality and recovery rate between slicing and aspiration method in goat ovaries

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The present experiment was conducted to compare the efficacy of the oocyte quality and recovery rate between slicing and aspiration method. The cumulus oocyte complex (COC) recovered by Aspiration and Slicing technique were pooled separately in Petri dish (90 mm) for searching and Gradings of oocyte. A total of 130 Ovaries were subjected to the study which on harvested by two retrieval methods viz aspiration and slicing yielded a total of 923 oocytes. 60 ovaries were subjected to Aspiration and 70 Ovaries were subjected to Slicing. The yield of oocytes under each technique was 295 oocytes by Aspiration and 628 oocytes by Slicing. The mean yield of oocytes per ovary was found to be (4.92 ± 144) by aspiration method and (8.97 ± 0.225) by slicing method. It was found that Aspiration and Slicing method differ significantly in mean yield of oocytes. The mean yield of oocytes per ovary was found to be (4.92 ± 0.14) by aspiration method and (8.97 ± 0.22) by slicing method. It was found that aspiration and slicing method differ significantly in mean yield of oocytes and quality of oocytes. Slicing yielded significantly high number of COCs and good quality COCs per ovary.

Keywords: Cumulus oocyte complex (COC), Aspiration technique, Slicing technique, Ovaries

Evaluating the Effects of Fertility Variations on the Growth, Yield, and Economic Returns of Adzuki Beans (Vigna angularis) in Uttarakhand

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Azuki bean [Vigna angularis (Willd.) Ohwi & Ohashi] belongs to a group of legumes that includes mungbean [V. radiata (L.) Wilczek], known as the Asian Vigna. China is the largest producer of adzuki followed by Japan. In India, it is considered as a potential crop and its cultivation is limited to the North-eastern and Northern hill zones. It occasionally grows in Chamba, Kangra, Mandi and Bilaspur districts of Himachal Pradesh where it is mainly grown as an intercrop with maize. The current investigation was conducted in Kharif 2022, at Research and Extension Centre, Gaja, College of Forestry, Ranichauri (Tehri Garhwal). The experiment comprised of two factors viz., fertility levels (F): F1- Control, F2- 75 % NPK, F3- 100 % NPK and F4- 125 % NPK in main plot and genotypes (V): V1- EC0000264, V2- IC455396, V3- IC469174, V4- IC469175 and V5- HPU-51 in sub plot with total of 20 treatment combinations that were evaluated in split plot design with two replications. The data was analysed using Op Stat with figures from SAS (proc glm). Among the different fertility levels, F3 (100% NPK) performed well in field conditions compared to others. Among various genotypes, V3 showed maximum growth and V2 showed yield attributes and economics adzuki bean as compared to other fertility levels and genotypes. Based on the study, it can be concluded that application of recommended fertilizer (100% NPK) enhance the growth, seed yield and economic of adzuki bean of V2 (IC455396) genotype.

Effect of different intercopping patterns and Nitrogen levels on Yield of mustard and chickpea in Mustard- Chickpea intercropping system of Punjab region.

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A field experiment was carried out during Rabi season 2020-21 at a research farm of Lovely Professional University, Jalandhar, Punjab. The experiment was designed in Randomized Block Design with two different row proportion and three different nutrient management practices viz. T_1 (sole mustard with Recommended Dose of Fertilizer [RDF]), T_2 (sole chickpea with RDF), T_3 (3:1, 100 kg N ha^{-1}), T_4 (3:1, 75 kg N ha^{-1}), T_5 (3:1, 50 kg N ha^{-1}), T_6 (4:2, 100 kg N ha^{-1}), T_7 (4:2, 75 kg N ha^{-1}) and T_8 (4:2, 50 kg N ha^{-1}) having three replications. According to the research investigation, application of 100 kg N ha^{-1} with row proportion of 3:1 performed better in terms of dry matter accumulation, mustard equivalent yield (MEY) and land equivalent ratio (LER). Nitrogen application of 100 kg N ha^{-1} in row proportion 3:1is significantly higher in dry matter accumulation, seed yield, straw yield and Land equivalent ratio (LER) (84.13gm, 19.26q/ha, 1.56q/ha), respectively. Overall, the intercropping pattern of mustard and chickpea could be more productive due to the nitrogen fixing capacity of the leguminous crop and also by reducing the weed infestation which will directly influence the yield and helps in maintaining cropping system sustainability.

Keywords: Intercropping, row proportions, mustard and chickpea.

Grafting performance of Khasi mandarin on different rootstocks

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The present investigation was conducted at the Department of Horticulture, SAS, Nagaland University, Nagaland during 2022-2023 to find out the grafting performance of Khasi mandarin (Citrus reticulata Blanco) on various rootstocks under shade net condition. The experiment was carried out in a completely randomized design (CRD) with eight treatments and three replications; viz. Indian wild oranges (Citrus indica Tanaka.), Tasi orange (Citrus sinensis Osbeck.), Rangpur lime (Citrus limonia Osbeck.), Khasi papeda (Citrus latipes (Swingle) Yu. Tanaka), Citrange (Poncirus trifoliata L.), Karna khatta (Citrus karna Raf.), Kachai lemon (Citrus jambhiri Lush.) and Rough lemon (Citrus jambhiri Lush.). The findings showed that Rough lemon exhibited superior performance with highest bud take rate (91.30%), graft success rate (89.17%), scion height (13.63 cm), scion diameter (4.86 mm), and number of scion leaves (24.55). In contrast, C. indica rootstock took maximum time for bud sprout (19.02 days). Additionally, Citrange rootstock recorded the highest total chlorophyll, chlorophyll 'a', and chlorophyll 'b' content, while the maximum leaf area was observed in Rangpur lime. Based on the evaluations, Rough lemon proved to be the most vigorous rootstock for Khasi mandarin, followed by Karna khatta and Rangpur lime, whereas C. indica and Khasi papeda has lower grafting success rate.

Keywords: Citrus species, Grafting success, Khasi mandarin, Rough lemon, Rootstock.

Harnessing Agroforestry Potential and Tactics for Adaptation and Climate Change Mitigation: A Comprehensive Review

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At present India and the entire world are facing and worried about the serious problem of climate change and its negative impact specially on agriculture, environment, ecology and humans also. Agroforestry has become the science, tactics and boon for solving climate change and forest-related problems. Globally, agroforestry is practiced on around 1 billion ha of land area, by more than 1.2 billion people, as well as in India, around 25.32 million ha area comes in practicing under agroforestry. In the ongoing battle against climate change and agriculture, Agroforestry is a beacon of hope, offering many ways to reduce atmospheric carbon dioxide. This review will take an in-depth look at the practical applications of agroforestry as a tool to combat against climate change. In addition, we are exploring the transformative potential of agroforestry to sequester atmospheric carbon, reduce the carbon emissions and become more sustainable, enhancing biodiversity conservation. We are investigating the role of the agroforestry system and forestry in improving carbon sequestration and reducing carbon emissions in India. By integrating recent advances in agroforestry research, we provide insight into the potential of agroforestry to reduce carbon emission from the atmosphere through agroforestry systems and to mitigate climate change. The review emphasized the potential of agroforestry systems for climate change mitigation and adaptation.

Keywords: Agroforestry, Climate change, Carbon Sequestration, Biodiversity Conservation.

HETEROSIS STUDIES FOR EARLINESS, FRUIT YIELD AND YIELD ATTRIBUTING TRAITS IN CHILLI (Capsicum annum L.) OVER ENVIRONMENTS

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A study was conducted in chilli to estimate the magnitude of heterosis for earliness, fruit yield and its twenty yield attributing traits. Thirty F_1 hybrids were derived from crosses between ten female lines and three testers using line x tester analysis. These F_1s and parents were evaluated during rabi, 2017-18 using a Randomized Block Design. A wide range of heterosis over better parent was observed in F_1 generation for yield per hectare and its attributing traits. Among 30 F_1s crosses, based on economic heterosis calculated over Sindhur, Arka Haritha and Arka Meghana, it can, therefore, a good number of crosses showed the presence of desirable heterotic response for different characters. EC-399533 x PBC-81, LCA-999 x PBC-81, LCA-625 x AVPP0514, Warangal Chapata x PBC-81 and SR-3429 x AVPP0514 were recognized as the best heterotic cross for fruit yield per hectare as it exhibited highest positive for 20 traits studied with consistency over the year in each locations (Rajendranagar, Warangal, Adilabad) and also pooled over environments. Hence, they could be further evaluated to exploit the heterosis or utilized in future breeding programmes to obtain desirable segregates for developing superior genotypes.

Keywords: Chilli, Heterosis, Earliness, Fruit yield and Genotypes.

PHYSICOCHEMICAL CHARACTERIZATION OF BREWER'S SPENT GRAINS (BSG) FROM ALE AND LAGER BEER

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The present study aimed to identify the variation in brewer's spent grains which were derived from ale and lager beer for their physicochemical properties. The spent grains were dried, grounded, vacuum packed and stored at room temperature for further analysis. The spent grains were evaluated for proximal analysis viz. crude fiber (14-16%), protein (18-20%), ash (3-4%), fat (9-10%) and carbohydrates (43-50%). The BSG was also evaluated for heavy metal analysis, antioxidant potential and structurally characterized using FTIR (Fourier-transform Infrared Spectroscopy).The results showed some differences in all analyzed parameters, though a similar pattern was observed in some properties. The results indicated high potential of BSG to be valorized for food and biotechnological applications.

Identification and Selection of Drought Tolerant Rice Genotypes Using Drought Tolerant Indices in the Red Laterite Zone of West Bengal

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Drought is the major abiotic stresses influencing crop productivity, and it is the major constraint for higher yield production and yield stability in rice. Rice (Oryza sativa L.) is also an important cereal crop in South and Southeast Asia. To develop high yielding drought tolerant rice variety, it is necessary to screen number of varieties for drought tolerance. We aim to identify and select rice genotypes based on some stress tolerant indices. The present investigation was carried out under a diverse set of water stress conditions at two locations Regional Research Station (Red & Laterite Zone) Bidhan Chandra Krishi Viswavidyalaya, Jhargram and Regional Research Station Sub (Red and Laterite Zone) Bidhan Chandra Krishi Viswavidyalaya, Raghunathpur, Purulia of West Bengal, India in Kharif-2018. Forty rice genotypes were assessed for 8 drought tolerant indices. The yield reduced significantly under drought stress condition during reproductive stage as compared to well irrigated condition in both the locations. Four rice genotypes Rashi, Gautam, Turant and Khandagiri possessed high level of drought tolerance as these varieties exhibited high YI, REI, DTE, STI, MPI value and low value for SSI and TOL compared to the check varieties Sahabagi Dhan and Vandana in both the locations. The yield reduction percentage under water stress condition was also less for these genotypes as they performed better than other genotypes under drought stress condition in Jhargram as well as Purulia location. The genotypes Rashi, Gautam, Turant, Khandagiri, Vnadana and Sahabagi Dhan showing tolerance to drought with high yield potential under water stress condition irrespective of locations could be selected for further hybridization with elite parents for breeding of high yielding drought tolerant lines.

Keywords: rice, stress, drought tolerant indices, selection, grain yield

Economic Impact of Climate Smart Agricultural Practices on Paddy Crop in Punjab

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Climate change is a worldwide threat particularly to agriculture, affecting millions of people. In response, climate-smart agriculture practices (CSAPs) such as adoption of short-duration varieties (SDVs) of paddy, laser land levelling (LLL) and Direct Seeding of Rice (DSR) have been introduced to counter with this growing threat. Multinomial logit and multivalued treatment effects models were employed to assess the key determinants affecting CSAP adoption in paddy crop and the impact thereof, respectively, by conducting a field survey of 240 farmers selected through a multistage sampling technique during 2020-21. The major determinants for CSAP adoption are the age of the household head, operational landholding, and farmer training. Adoption of SDVs, and LLL increases paddy crop yield by 6 % ($p<0.01$) each. The impact on farm income is significantly more substantial by 10.37 %, 9.32 %, and 9.56 % for paddy farmers who adopt SDVs, LLL, and DSR, respectively. Our research highlights the economic benefits of CSAPs on paddy yield and income while also identifying the determinants of CSAPs adoption in Punjab. Hence, government and policy makers should develop strategies to boost the uptake of these practices in the region.

Socio-economic impact of Farmer Producer Organisation on farmers in Rajasthan

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Farmer Producer Organisations (FPOs) are highly beneficial for farmers. FPOs enhance the agency of farmers by facilitating collective bargaining and fostering an entrepreneurial mindset in agriculture, particularly among small-scale landholders. The FPO was studied in Bikaner district, Rajasthan, to assess its impact and determine the factors that contributed to its success and sustainability. The study was conducted during December to March 2022-23. Both quantitative and qualitative data was collected with the help of a standardized questionnaire from a total of 210 respondents which were stratified randomly selected, out of this 105 were members (Treated), and 105 were non-members (Control). The assessment of FPO impact was conducted using the Difference in Difference (DID) and the factors contributing to the success of FPO was analysed using Garrett Ranking method. The analysis was conducted using Excel and R. FPO had a significant impact on various socio-economic aspects of FPO members' lives in comparison to non member farmers, such as on their income, employment, saving, educational, nutritional, health, and social well-being. The socioeconomic study will provide policy planners, academicians, scheme-implementing agencies, and researchers with a comprehensive understanding of the socioeconomic traits of farmers. This will enable them to conduct thorough research and implement policy modifications aimed at enhancing the sustainable livelihoods of small and marginal farmers.

Keywords: Farmer Producer Organisation; Impact; Difference in Difference, Garrett Ranking Method

IMPACT OF FRONTLINE DEMOSTRATIONS OF BROAD BED FURROW (BBF) ON YIELD AND ECONOMICS OF SOYABEAN CROP

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Present study was conducted at farmer's field of Nanded district, Maharashtra state, India during Jun –October of 2023 to appraise the effect of Broad Bed Furrow(BBF) technology on soybean yield as well as economics. In this study, BBF planting technology was compared with the farmers practice (Normal tractor drawn seed drill). In comparison with the conventional method, the sowing of soybean with the BBF method found to be superior in the seed yield and average soyabean productivity with BBF planter was 2160 kg ha-1, with a yield increase of 20 per cent over conventional method of sowing (1800 kg ha-1). Similarly, the economics of soybean were found to be highest with BBF method in terms of gross return (Rs 108000 ha-1) and net return (Rs 61750 ha-1) with B:C Ratio of 2.33:1 compared to conventional method which generated the gross return of Rs 90000 ha-1 and net return of Rs 41250 ha-1 with a B: C ratio of 1.84 :1

Keywords: Soybean, Broad Bed Forrow, Yield, Economics

Influence of Split Nitrogen Fertilization and Weed Management on Nutrient Uptake and Productivity of Wheat in Central Punjab

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A field experiment was conducted during winter (rabi) seasons of 2018-19 and 2019-20 at Research Farm of Mata Gujri College, Shri Fatehgarh Sahib to study the effect of nitrogen scheduling and weed management on nutrient uptake and yield of wheat. The experiment was laid in split plot design replicated thrice with nitrogen scheduling (N_1: ½ Basal + ¼ at 4 WAS + ¼ at 8 WAS, N_2: ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS and N_3: ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS) as main plot and weed management (W_0: Weedy check, W_1: Weed free, W_2: clodinafop @ 60 g ha^{-1}, W_3: sulfosulfuron @ 25 g ha^{-1} and W_4: carfentrazone @ 20 g ha^{-1}) as sub plot which resulted in 15 treatment combinations. The mean results showed that significantly higher N (139.28 kg ha^{-1}), P (27.58 kg ha^{-1}) and K (153.67 58 kg ha^{-1}) uptake in crop and grain and straw yield were recorded with application of N_3: ¼ at 4 WAS + ¼ at 6 WAS + ¼ at 8 WAS + ¼ at 10 WAS). It was statistically at par with the N_2: ⅓ at 4 WAS + ⅓ at 8 WAS + ⅓ at 10 WAS. Application of W_3: sulfosulfuron @ 25 g ha^{-1} recorded significantly maximum N (140.55 kg ha^{-1}), P (26.82 kg ha^{-1}) and K (152.37 kg ha^{-1}) uptake in crop and grain and straw yield which was statistically at par with W_4: carfentrazone @ 20 g ha^{-1}.

Keywords: Nitrogen, Weeds, Herbicide, Nutrient Uptake, Yield

Enhancement of biodiversity and crop resilience through intercropping of cabbage

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Intercropping is a strategy for boosting diversity in an agricultural ecosystem. This novel cropping system not only produces higher total crop yield per unit area but also provides insurance against total crop failure, reduces incidences of pests and diseases, control soil erosion and provide food security by efficiently using the available resources. So, keeping these things on sight the existing experiment is designed to boost the profitability in cabbage through intercropping at Regional Research and Technology Transfer Station (OUAT), Keonjhar, Odisha. The trial was conducted under the Randomized Block Design by incorporating 9 treatments and 3 replications in rabi season of the year 2022-23 and 2023-24. The main crop was cabbage which was intercropped with amaranthus, fenugreek (leaf purpose), palak and coriander (leaf purpose) under different treatments i.e. T1: Sole cabbage, T2: Sole amaranthus, T3: Sole fenugreek, T4: Sole Spinach, T5: Sole Coriander, T6: Cabbage+ amaranthus(1:1), T7: Cabbage+ fenugreek (1:1), T8: Cabbage+ Palak (1:1), T9: Cabbage + Coriander (1:1).The result depicted that the crop equivalent yield in terms of cabbage was found to be the highest in the treatment consisting cabbage as main crop and coriander as intercrop (408 q/ha) followed by the intercropping of cabbage with Spinach (401 q/ha) while the treatment with solitary cabbage cultivation resulted 319 q/ha.

Keywords: Intercropping, Yield, Amaranthus, Fenugreek, Palak, Coriander, Cabbage

Innovative Applications of IoT and Sensors in Environmental Monitoring and Precision Agricultural Systems

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The integration of Internet of Things (IoT) and sensor technologies has heralded a transformative era in addressing pressing environmental challenges. With increasing concerns over pollution, resources and agricultural productivity depletion, and climate change, a shift towards smart environment monitoring (SEM) systems is essential. From monitoring air and water quality to advancing precision agriculture and enhancing disaster response, these technologies provide invaluable insights and actionable data vital for the health of our planet. Environmental sensors, energy sensors, weather sensors, motion and presence sensors, camera and image sensors, water quality sensors, gas sensors etc. are some examples of prime sensors used under this technology. Sensor data is abundant with insights, capturing the dynamic characteristics of the environment and the diverse interactions within it. Data security and privacy concerns are critical, particularly when handling sensitive environmental information. The real advantage of IoT-enabled sensors lies in their ability to gather data instantaneously. Some of the prime aspects of data are real-time data processing, machine learning algorithms, anomaly detection and data visualization. Air and water quality monitoring, energy management, disaster monitoring and response, precision farming, weather forecasting, wildlife conservation are some of the real-world applications of IoT and sensors. IoT-driven environmental monitoring promotes resource efficiency, a key factor in addressing water scarcity and climate change. By integrating soil moisture sensors with meteorological data, precision irrigation in agriculture is enhanced, optimizing water use and boosting crop yields. In smart buildings and cities, sensors regulate lighting, heating, and cooling systems according to occupancy and environmental conditions, thereby reducing energy consumption and greenhouse gas emissions.Calibration, regular maintenance, and quality assurance procedures are essential to prevent inaccurate information, particularly in critical areas like disaster monitoring or public health safeguarding.Nonetheless, realizing their full potential requires overcoming obstacles related to data security, interoperability, and cost-effectiveness. Achieving a sustainable and climate resilient future requires finding a balance between harnessing the potential of these technologies and addressing the associated challenges with higher precision and efficiency.

Keywords: climate change, data processing, internet of things, precision irrigation, sensor

The Environmental Behavior of Deforestation and Forest Degradation

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The tropics are seeing an unprecedented rate of deforestation and forest degradation (D&D), seriously endangering the forests and the livelihoods of those who rely on them for their resources. Policy papers and scientific publications frequently name smallholder farmers as significant D&D agents. On the other hand, little is known about the primary motivations behind smallholders' exploitation of forests. Smallholder farmers' decisions are influenced by habitual activities, contextual circumstances, and attitudes, all captured by some behavioral sciences methodologies. Various findings show that the context—that is, socio-demographic, production factor constraints, policies, governance difficulties, and certain influences from routine operations like wood extraction for construction and fuelwood—is what drives farmers to participate in D&D. These elements can be generally categorized as market-driven, governance-driven, and necessity-driven. D&D is mostly caused by necessity demands and governance issues in the woods under study. The magnitude and impact of D&D are mostly exacerbated by causes external to the forest landscape, even though the majority of the elements are inherent to the setting of smallholders. Thus, to minimize forest losses in a range of socioeconomic, ecological, and resource governance circumstances, policy initiatives to reduce D&D should closely examine the context, the drivers, and the associated enablers.

Keywords: deforestation; farmers; exploitation; livelihoods; policies

Long term (14 years) impact of organic nutrient management on soil biological quality under rice-wheat cropping system

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Soil biological properties are more sensitive and response quickly to soil management than soil physiochemical properties providing immediate information on the soil microbial activity that reflects agriculturally important microbiological processes. Assessments of soil biological properties are therefore essential to track the changes in soil quality due to long term nutrient management practices. The main objective of the study were to identify the key biological indicators of soil quality and incorporate them into a unified soil biological index (SBQI), in order to select the best organic nutrient management practices for rice-wheat cropping system in Inceptisol. The impact of five organic manure combinations and its different time of application in three rice-wheat systems, on selected microbial properties were assessed after fourteen cropping cycles of rice-wheat. Principal component analysis (PCA) was used to identify the key biological indicators and their weighting for SBQI. Three biological indicators –alkaline phosphatase activity (AlkPA), dehydrogenase activity (DHA) and microbial metabollic quotient (MMQ) merged as the most sensitive biological indicators of soil biological quality under organically managed rice-wheat cropping system of Semi-arid sub-tropical India. Results revealed that organic nutrient management strategies and its time of application influence the soil biological indicators and periodical monitoring of the three sensitive biological indicators instead of large number of biological indicators might be advantageous while developing SBQI for assessing management induced changes of organically managed cropping system. Conjoint application of all the organic sources- farm yard manure, green manure (Sesbania/Leucaena green leaf manuring) and bio-fertilizer (Blue green algae/ Azotobacter) was the most effective organic nutrient management strategy for enhancing the biological indicators of soil quality. Prolong application of the treatment increased SBQI and rice equivalent yield (REY) of rice + wheat (Mg ha^{-1}) of the rice-wheat cropping system.

Keywords: soil biological quality index, biological indicators, microbial activity, organic nutrient management, time of application, rice –wheat system

limate-Smart Disease and Pest Management in Sericulture

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Climate-smart pest and disease management involves a holistic approach that combines environmental, economic and social dimensions to build resilience against climate change impacts. The silk industry, like other agricultural sectors is increasingly challenged by climate change which has escalated pest and disease pressures. To address these challenges, climate-smart approaches emphasize the development and application of pest- and disease-resistant mulberry varieties and silkworm races enabling adaptation to shifting climatic conditions and reducing reliance on chemical inputs. Central to this approach is the implementation of Integrated Pest Management (IPM) strategies, which combine biological control agents, cultural practices and minimal chemical use to effectively manage pest populations while minimizing environmental damage. Advanced monitoring and forecasting systems also play an important role in anticipating pest and disease outbreaks, allowing farmers for timely and targeted interventions. The shift towards climate-smart pest and disease management offers multiple advantages. Environmentally, it leads to minimized chemical use, which reduces soil and water pollution and promotes biodiversity by safeguarding beneficial organisms. Economically, it increases the productivity and sustainability of sericulture, resulting in higher yields and superior silk quality. Socially, the health and well-being of farming communities gets enhanced by reducing the exposure towards harmful chemicals. Therefore, the adoption of climate-smart disease and pest management tactics are necessary for the long-term sustainability of sericulture ensuring its resilience in the face of climate change while providing benefits to the environment, economy and society at large.

Keywords: Climate, sericulture, pressure, strategies, sustainable.

Effect of Gibberellic Acid and Maleic Hydrazide on Growth and Yield of Okra (Abelmoshus esculentus L. Moench)

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Field experiment on the "Effect of Gibberellic Acid and Maleic Hydrazide on Growth and Yield of Okra (Abelmoshus esculentus L. Moench" revealed that the combined application of Maleic Hydrazide and Gibberellic Acid led to significant improvements in various growth parameters and yield attributes of okra. The results indicated that significantly higher growth parameters such as plant height (98.00 cm), leaf area index (2.016) were recorded with application of Maleic Hydrazide 60ppm + GA3 60ppm. Number of leaves per plant (33.18), branches per plant (4.46) at 75 DAS were recorded with application of Maleic Hydrazide 100ppm + GA3 60ppm. Days to early flowering (36 days) and was recorded with application of Maleic Hydrazide 100ppm + GA3 60ppm.Significant increase in fruit characters like fruit length (14.35 cm), fruit girth (18.09 mm) and fruit weight (11.56 g) was recorded with application of Maleic Hydrazide 100ppm + GA3 60ppm. Maximum fruit yield per plant (240 g), fruit yield per plot (7.2 kg) and fruit yield kg/ha (6000) was obtained with application of Maleic Hydrazide 100ppm + GA3 60ppm.

Keywords: Gibberellic acid, Maleic hydrazide, Plant Growth Regulators.

Harnessing the potential of the native isolates of turkey tail (Trametes sp._).

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Trametes spp., known for its vibrant, multicolored appearance, is among the most easily recognizable polypore mushrooms found on a diverse range of wood types. This mushroom is circumpolar and is widely distributed across temperate, subtropical, and tropical regions around the globe. One of its most notable species, T. versicolor, commonly referred to as "turkey tail," is treasured for its medicinal properties and has been extensively studied. From ancient times Japan and China, utilized this mushroom as a constituent of traditional medicine. Turkey tail mushrooms are renowned for their anti-cancer, anti-inflammatory, antioxidant, and anti-viral properties, and they play a role in stimulating the immune system. Additionally, these fungi play a crucial role in decomposition of lignin in decaying wood, into soft, spongy cellulose, thereby contributing to nutrient recycling in the soil.

Survey at Thiruvananthapuram, Kollam and Pathanamthitta (AEU 1 and 2) districts yielded five isolates designated as Tr1, Tr2, Tr3, Tr4 and Tr5 with lignicolous habitat and occurrence in clusters. The morphology of the native Trametes were fan shaped with striations. The pileus was white to off white in colour brownish or greenish striations. The mushrooms were sessile. The mushrooms isolated on Potato dextrose agar (PDA) gave white fluffy mycelia. The native isolate was identified as Trametes sp. using cultural, morphological and molecular characterization. The native isolate was compared with the standard culture of Trametes versicolor (DMRO-211). The best media for T.versicolor and Trametes sp. was malt extract agar followed by peptone potato dextrose agar. In malt extract agar both the species of Trametes had fluffy growth and completed full growth in petridish in 5 days. The optimum pH for the mycelial growth was between 5.5-6. The acidic and alkaline pH of 4.5 and 7.5 were unsuitable for its growth. The optimum temperature for T.versicolor and Trametes sp. was 30^{o}C. But mycelial growth was observed even at 15 ^{o}C for native Trametes sp. when compared to DMRO-211.

Study of genetic diversity and association mapping in Lowland rice of Nagaland using SSR markers.

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Nagaland state is one among the four states in north east India viz: Arunachal Pradesh, Manipur, Nagaland and Tripura having surplus production of rice with a potential to give rise to an improved variety from available local landraces. The farmers of this region are persistent in growing local landraces with low yield over the improved high yielding varieties as this attributed to their adaptability to environmental conditions, resistance to pests, diseases, grain quality, taste, aroma and also marketability, which are not present in many of the improved varieties. Knowing this potential an experiment was conducted during Kharif 2020 and 2021 to study a total of 81 genotypes from various places of Nagaland including two check varieties Ranjit and RCM09 to assess genetic diversity through important physical, chemical quality and yield traits. For this 40 SSR markers were used for traits and marker association. ANOVA revealed significant variation among the genotypes. The PIC value ranges from 0.23 to 0.99 with average value of 0.64. A total of 102 alleles were detected with average 2.55 alleles per locus. AMOVA revealed the presence of 13% variation among the population, 87% variation among the individuals and 0% variation within the individual. Two subpopulations with 10 admixtures were observed from STRUCTURE analysis. Association with SSR markers were observed between quality traits and some important yield. Therefore, the observed association between traits and markers can be an important information that can aid in further development of an improved grain quality of rice with higher yield.

Keywords: Lowland rice, Nagaland, Quality, SSR markers, Yield

Laser-Driven Weed Management: Advancing Precision Agriculture with Laser Technology

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Globally, weed infestations create significant challenges for crop production, making it difficult to increase yields and meet the food demands of an expanding population. The widespread use of herbicides often results in environmental contamination, as these chemicals often affect unintended areas or be lost due to spray drift. Although herbicides are the primary method for weed control in modern agriculture, their overuse has led to the emergence of herbicide-resistant weed strains. Mechanical weeding is sometimes used on organic farms and in combination with herbicides on conventional farms, but it also has its own set of limitations. It can disturb beneficial soil organisms, including predatory insects and earthworms, and contribute to soil erosion, moisture loss, and nutrient leaching. They can also cause unnecessary mineralization of soil organic matter and potentially stimulate the germination of new weed seeds. Moreover, the increase in herbicide-resistant weeds and the lack of new herbicide modes of action have made weed management even more challenging. As a result, there is an increasing demand for novel weed control methods to supplement or replace traditional techniques. Laser technology offers a promising solution by focusing concentrated energy on a specific area. Laser weeding eliminates weeds by directing lasers at their growth points (meristems), effectively heating, damaging, or destroying the plants. This innovative approach uses advanced artificial intelligence and robotics to precisely target and eliminate weeds while minimizing harm to surrounding crops and the environment. Key steps in this technique includes calibration, survey and mapping, weed identification, real-time detection, deployment, energy regulation, continuous monitoring, adjustment with optimization, field review and effective assessment. By minimizing soil disturbance and water requirement, it preserves soil structure and organic matter, which enhances soil carbon sequestration and improves its resilience to extreme weather events. Additionally, the precise nature of laser weeding reduces the need for mechanical tillage, which can further cut greenhouse gas emissions. The technology supports sustainable farming practices that adapt to changing climate conditions, ultimately contributing to more resilient agricultural systems with enhanced productivity and food security.

Keywords: Carbon sequestration, Herbicide, Laser weeding, Precision, Sustainable farming

A COMPREHENSIVE STUDY ON MAIZE PRODUCTION AND MARKETING IN TELANGANA STATE – AN ECONOMETRIC APPROACH

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Telangana state ranks third position in Maize cultivation area and it is cultivated across the state in approximately 12.68 lakh hectares. This research aims to comprehensively analyze the production and market dynamics of maize in Telangana State. By understanding historical trends, forecasting future production and market prices, and evaluating the economics of maize production and marketing, this study seeks to provide insights into the state's maize production. Additionally, it aims to examine price transmission between key markets in Telangana and India, identifying constraints in production and marketing and proposing policy measures to address these challenges, ultimately aiming to enhance the efficiency and sustainability of the maize sector in the region. Warangal Rural, Siddipet and Kamareddy districts of Telangana, which ranked top three in area under maize cultivation in the state were purposively selected for the study. Similarly, top two mandals in each district and top two villages in each sample mandal were selected. The required primary data for the study was gathered from 240 randomly chosen sample farmers from the selected villages using pre-tested, well-structured schedules through personal interviews for the agricultural year 2019-20. District wise time series data on area, production, productivity and market prices of maize for the period from 1966-67 to 2021-22 were collected from different secondary sources. Trend analysis, cost and return analysis, marketing efficiency and co-integration analysis were employed to achieve the set of objectives and draw meaningful conclusion.

The results of the study revealed that maize productivity in Telangana improved significantly, rising from 3204 kg/ha in 2001-02 to 6713 kg/ha in 2020-21. The average market price of maize in Telangana has shown an upward trend, increasing from ₹ 555/qtl in 2001-02 to ₹ 1669/qtl in 2020-21. The study also reveals that maize cultivation in Telangana follows intricate growth patterns, possibly influenced by a combination of factors. The cubic and power models provided better insights into these trends compared to simpler models. Using the ARIMA (2,1,2) model, it was forecasted that maize prices in Telangana would be ₹ 2182.16 in January 2023 and ₹ 2067.90 in December 2023 and also maize production in Telangana was forecasted to be 23.10 LT in 2022-23, 23.46 LT in 2023-24, and 23.82 LT in 2024-25. Price transmission between the markets explained unidirectional causality in Nagarkurnool-Badepally, Siddipet-Badepally, and Nizamabad-Nagarkurnool pairs, where changes in the former market affected price formation in the latter market. The remaining markets did not exhibit causality, indicating that price changes in one market did not feedback to influence the other.

The findings also revealed that the average overall cost of cultivating maize per hectare was Rs. 80536.70, Rs. 80875.84, and Rs. 80264.72 in the districts of Warangal Rural, Siddipet, Kamareddy, respectively. The same on pooled farms was found to be Rs. 80775.57. With regard

to gross income, Warangal Rural district reported the highest ₹ 144,619.75 per hectare, showcasing strong revenue generation from maize cultivation. Siddipet had the lowest gross income at ₹ 120,119.64 per hectare. Warangal Rural is the most profitable district for maize cultivation, while Siddipet is the least profitable among the studied regions. With respect to the marketing efficiency, price spread was ₹ 470.66 per quintal for Channel I and ₹ 449.30 per quintal for Channel II. The analysis of marketing margin and marketing efficiency in maize marketing revealed variations in prices, margins, and efficiency between the two channels. The Garette ranking analysis depicted uncertain rainfall (83.13) and shortage of labour (79.95) as the major constraints faced by farmers in maize production with maximum scores. In case of marketing, more number of middlemen in the market (82.65) and price fluctuations (79.13) were found as the major marketing constraints.

The study presents a comprehensive overview of maize production, market trends, and constraints in Telangana State, highlighting significant improvements in productivity and price escalation over the years. Notably, maize productivity doubled between 2001-02 and 2020-21, while prices experienced a substantial upward trajectory during the same period. Forecasting models revealed anticipated price and production figures for 2023-24 and 2024-25, aiding in future planning. Price transmission analysis identified key market relationships, delineating causality and inter-market influences. Additionally, cost analysis per hectare and gross income across districts unveiled varied profitability, with Warangal Rural emerging as the most lucrative region for maize cultivation. Constraints such as uncertain rainfall and limited access to inputs and credit were highlighted, particularly affecting small and marginal farmers. The study underscores the potential positive economic impacts of maize farming on farmer incomes and the state economy, offering valuable insights for farmers and policymakers to optimize farming practices, investments, and policy interventions.

The results of the study suggested that, shifting focus towards cost-effective production technologies and farm machinery will boost productivity and farmers income. Public sector initiatives to produce high-quality maize seeds at affordable rates can compete with the private sector, ensuring seed availability. Encouraging farmer cooperatives for collective production and marketing can elevate income levels. Establishing widespread marketing systems for fair maize procurement can incentivize farmers to continue cultivation. Low-cost storage infrastructure and market tie-ups with industrial units will prevent market gluts and strengthen the maize value chain. Additionally, setting up feed manufacturing units in major growing areas can further expand maize production, while disseminating price forecasts through digital platforms can mitigate price risks and volatility, aiding farmers in decision-making regarding production, storage, and marketing strategies. Implementing these policy implications can significantly enhance maize farming in Telangana State.

Keywords: Production, Marketing, Forecasting, Co-integration, Trends, Market Prices, Constraints.

Optimizing Development in Children with Intellectual Disability through Theme-based Interventions

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The developmental trajectory of children with intellectual disabilities (ID) often presents unique challenges that necessitate specialized and adaptive educational strategies. This research explores the impact of theme-based interventions on optimizing the developmental outcomes of children with ID, focusing on a holistic approach that integrates cognitive, social, emotional, and motor skills development. Theme-based interventions, characterized by their structured yet flexible nature, provide a consistent and engaging framework that supports learning through thematic units, such as 'body parts' or 'plants,' which are integrated across various activities. The research sample comprised 11 children with intellectual disability in the vocational unit of ARPAN, Vadodara. This study employed a mixed-methods design, incorporating quantitative measures like the Developmental Milestones Checklist and maintaining skill acquisition data to track developmental progress. Qualitative observations were meticulously documented to capture the nuances of child engagement and responses to the interventions. This involved assessing and recording the extent of active participation by children in each activity, as well as their levels of interest and enthusiasm. Additionally, observations focused on documenting the children's emotional responses and their adaptability to various interventions. Thematic plans were implemented over a six-month period in both individual and group settings. The findings reveal that theme-based interventions significantly enhance children's ability to understand and retain concepts by providing a familiar and repetitive structure, thus improving memory, attention, and task completion. Furthermore, these interventions promote social interaction and communication by encouraging collaborative activities that are centered around the theme, thereby fostering a sense of inclusion and peer learning. This research underscores the effectiveness of theme-based interventions as a comprehensive approach to supporting the development of children with ID. The implications for educators, therapists, and caregivers are substantial, suggesting that theme-based frameworks can be a key component in early intervention programs, ultimately contributing to the enhanced well-being and integration of children with intellectual disabilities in educational and social contexts.

Keywords: Developmental outcomes, Early Intervention, Emotional response, Sensory-Rich Activities, Skill Acquisition

Proline metabolism and free radical scavenging activities play an intriguing role in mediating resistance in pigeonpea against Maruca vitrata infestation

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Pigeonpea (Cajanus cajan), an economically important legume crop is a rich source of dietary protein. Maruca vitrata, a lepidopteran polyphagous spotted pod borer, feeds on different plant parts, causing significant yield losses in pigeonpea. There is need to identify defense mechanism in pigeonpea against insect infestation. The purpose of present study was to ascertain the role of proline metabolizing enzymes and free radical scavenging activities in reducing oxidative stress caused by insect infestation in pigeonpea. The study evaluated proline metabolism enzymes and free radical scavenging activities in leaves, flowers, and pods of MN 1 (susceptible) and AL 1747(moderately resistant) pigeonpea genotypes under control and infested conditions. AL 1747 has higher activities of proline metabolism enzymes like glutamate dehydrogenase (GDH), ornithine aminotransferase (OAT), and pyrroline-5-carboxylate synthetase (P5CS) and lower activity of proline dehydrogenase (ProDH) which results in proline accumulation, making it more resistant to insect infestation-induced damage to leaves, flowers, and pods than MN 1. The higher activity of NADPH oxidase in AL 1747 plays a crucial role in neutralizing reactive oxygen intermediates by regenerating reduced glutathione, thus combating oxidative stress. Higher free radical scavenging activities such as Ferric reducing antioxidant power (FRAP), 2,2-diphenyl-1-picryl hydrazyl (DPPH), hydroxyl ion, superoxide anion and nitric oxidein AL 1747 might be responsible for lowering the accumulation of ROS thereby mitigating insect infestation induced oxidative stress.

Survey and surveillance of failure to implement melon fruit fly, Bactrocera cucurbitae management in West Tripura

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The melon fruit fly (Bactrocera cucurbitae) poses a critical threat to cucurbit cultivation in West Tripura District, where it has led to substantial crop losses and economic hardships for local farmers. Despite ongoing efforts, the management of this pest has largely been unsuccessful, resulting in widespread and persistent damage. The failure to control melon fruit fly infestations can be attributed to several key factors. Firstly, the lack of comprehensive pest monitoring systems has limited the ability to detect and respond to outbreaks in a timely manner. Farmers often lack the knowledge and tools needed to identify early signs of infestation, leading to delayed or inappropriate responses. Additionally, awareness and training programs for farmers have been insufficient, resulting in a limited understanding of effective pest control methods, particularly those that involve integrated pest management (IPM) strategies. Moreover, the adoption of IPM practices has been hindered by the unavailability of necessary resources, such as biological control agents, pheromone traps and resistant crop varieties. The financial constraints faced by smallholder farmers further exacerbate the problem, as they are often unable to afford or access advanced pest control technologies. The continued impact of this pest highlights the urgent need for a more robust and integrated approach to pest management. This should include enhanced extension services, greater investment in farmer education and improved access to sustainable pest control methods. Addressing these challenges is essential to reducing the damage caused by the melon fruit fly, securing food production and improving the livelihoods of farmers in West Tripura District.

Keywords: Awareness, Integrated Pest Management, Infestation, Melon fruit fly, Training programme.

Hydrological assessment of Yerekoppi -1 model micro watershed of Haveri District, Karnataka

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The Yerekoppi - 1 micro watershed (Mankur sub watershed) of Ranebennur taluk was established as a Model micro watershed (MWS) for Haveri district. The Yerekoppi -1 micro-watershed (4D4D2c08) is located in between $14^0$32'47" – $14^0$35'38" North latitudes and $75^0$37'51" – $75^0$39'13" East longitudes, covering an area of about 941.07 ha, bounded by Magod and Mankur villages. The climate is hot dry sub humid with dry summer and mild winter with an average annual rainfall of 700.7 mm. The maximum of 376.3 mm precipitation is received during south–west monsoon period from June to September, north-east monsoon contributes about 162.1 mm and prevails from October to early December and the remaining 162.4 mm is received during the rest of the year.

The number of rainy days (>2.5 mm) varied from 9 to 24 days per year. On an average the number of rainy-day events likely to produce runoff (20 to 30 mm) are about 2 to 7 rainy days per year with moderate variation across the years. The surface soils of the micro-watershed are sandy loam, clay, sandy clay loam, sandy clay to clay loam in texture. The average range of Ground water level of Yerekoppi-2 micro-watershed during Kharif, rabi and summer was 8-11, 12-14 and 19-28 mbgl, respectively. The surface soil moisture during kharif, rabi and summer was 32 %, 28% and 16 %, respectively. The Actual Evapotranspiration (AET) over the years 2014-2021 in the Yerekopp-i-1 micro-watershed varied from 307 to 614 mm. During 2014 – 2021, the average annual AET was 474.0 mm; which was less than the average rainfall (700.7 mm). The average AET/P ratio between 2014 - 2021 was about 0.86 which is higher than the sustainable limit of about 0.80. During 2017 and 2018, AET/P ratio were 1.19 and 1.01, respectively, which indicates receipt of less rainfall in the years and also possibility of ground water being augmented to maintain crop water requirement. A maximum area of about 888 ha (94.32 %) requires graded bunding and 18.4 ha (1.86 %) area requires contour bunding. The soil and water conservation plan generated may be presented to all the stakeholders including the farmers and after considering their suggestions, the soil and water conservation plan for the sub-watershed may be finalized in a participatory approach.

Survey of Cotton Diseases at East Nimar Khandwa and Dhar Districts of MadhyaPradesh

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Cotton is one of the most important commercial crops in India and world . Cotton constitutes approximately 59% of the Indian textile industry's raw material consumption basket. Annual cotton consumption exceeds 300 million bales (170 kg each). Cotton crop in India is known to suffer from many fungal, bacterial, viral and nematode diseases from early stage to maturity so that the roving survey was conducted at east nimar Khandwa and Dhar distrrict of Madhya Pradesh during the kharif seasson 2023-24. Survey was conducted in 35 villages at east nimar Khandwa and 15 villages of Dhar district of madhya pradesh. During the visit of farmers fields, it was observed that the Bacterial blight incidence was occurred during 32 SMW 2023 with 0-2.5% intensity and reached up to 13.33 percent on 34 SMW where max. temperature varied between31.5^{0}C -29.8 ^{0}C and the min.Temp. 24.9^{0}C -23.5^{0}C and total rain fal was 10.5 mm during the period in the farmer's fields and cotton research station Khandwa. The crop were in early stage of growth in the farmers fields. The Alternana leaf blight disease was first observed in the farmer's field during 8-14 October with 5.00 % incidences and reached up to 12.5 % during 19-25 November. where max. temperature varied between 35.9^{0}C -32.3 ^{0}C and the min.Temp. 22.8^{0}C -16.2 ^{0}C and total rain fall was 19 mm during the period . The Grey mildew was first noticed in first week of October and the disease incidence was 5.00% and reached up to 17.50 % in 44-45 SMW where max. temperature varied between35.3^{0}C -32.0 ^{0}C and the min.Temp. 20.8^{0}C -15.5 ^{0}C and total rain fall was 00 mm during the period . The Corynespora leaf spot (CoLS) was first noticed in first week of August where the crop was in early stage and the disease incidence was 2.5.00% and reached up to 20.50 % in 44-45 SMW. During the visit of Dhar district Para wilt ,Alternaria leaf spot (ALS), Cercospora leaf spot and potassium deficiency symptoms were noted in few places. The Para wilt incidence was noted between 2.5-to- 12. 50percent in Sardarpur and Longsari block and ALS ranged between 2.5 to 10.20%. The Potassium deficiency symptoms were most prominent in Longsari and Sardarpur block of Dhar district with range of 60-to 45 percent .

IDENTIFICATION OF STABLE INBREDS THROUGH GGE BIPLOT ANALYSIS IN MAIZE (Zea mays L.)

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The components of GGE biplot analysis PCA 1 and PCA 2 together accounted for more than 95 percent of total variation which is more satisfactory to explain genotype + genotype x environment interaction for days to maturity, ear length, number of kernels per row and 100 seed weight and grain yield per plant. Heypool was identified as the winning inbred for ear length and 100 seed weight in all the seasons; grain yield per plant in kharif and rabi and number of kernels per row in kharif and summer. For number of kernels per row, DFTY was found more responsive in kharif and summer. Summer season was found to have more discriminating ability for days to maturity, number of kernels per row, 100 seed weight and grain yield , while rabi had the discriminating power for ear length. Kharif season was found to be more representativeness for ear length, number of kernels per row, 100 seed weight and grain yield per plant and rabi for days to maturity. The inbreds viz., DFTY, Heypool, PDM 1452 and PDM 1474 were moderately stable for grain yield per plant. All these inbreds registered stability for ear length number of kernels per row and 100 seed weight. The inbreds viz., DFTY, PDM 1452, Heypool and PDM 1474 with mean and stability for ear length , number of kernels per row and 100 seed weight in that order were close the ideal genotype. Inbreds viz; DFTY, PDM 1452 and PDM 1474 with moderate stability in performance over seasons may be recommended for improving parental lines and developing high yielding hybrids in maize.

Keywords: Maize , Kernel yield, Biplot analysis , Genotype –Environment interaction

Opportunities and Challenges in Organic Farming: Sustainable Agriculture

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Organic farming focuses on sustainable and eco-friendly methods for growing crops and raising livestock. Its main goal is to produce food while minimizing the use of artificial inputs and chemicals, maintaining soil health, and promoting ecological balance. Organic farmers avoid synthetic pesticides and fertilizers, opting for natural pest control and soil enhancement techniques instead. This approach involves various stages, from planning and soil preparation to planting, cultivation, harvesting, and beyond. Organic farming is a continuous and adaptive process, with farmers adjusting to changing conditions and incorporating new knowledge and techniques to sustain environmentally friendly practices. Achieving a balance between challenges and opportunities in organic farming requires collaboration among farmers, policymakers, consumers, and researchers to create a supportive environment for its development and sustainability. Education is crucial in promoting organic farming by raising awareness, imparting knowledge, and encouraging sustainable agricultural practices. Organic farming offers both challenges and opportunities for farmers, consumers, and the environment, and understanding these aspects is key to developing effective strategies for its promotion and sustainability.

Keywords: Environment, Conservation, Challenges, Eco-friendly, Ecology

Optimizing Siderophore Production in Bacillus subtilis to Enhance Seed Germination and Biocontrol Efficacy Against Alternaria triticina and Bipolaris sorokiniana

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Bacillus subtilis (UP11) is a gram-positive, plant growth-promoting rhizosphere bacterium (PGPR) isolated from the rhizosphere soil of wheat. It produces an active compound i.e., siderophore. Siderophores are low-molecular-weight and high-affinity molecules produced by bacteria under iron-limited conditions. In present study, we optimized the culture condition for siderophore production and also investigated the antagonistic activity against the foliar blight pathogens. Therefore, the optimum pH 7 was found maximum siderophore unit (62.95%), mannitol as carbon source (59.14%), ammonium nitrate as nitrogen source (63.04%), heavy metal $Pb(NO_3)_2$ shows (61.36%) highest yield in the succinate broth. The optimal iron concentration 50 µM for siderophore production. All these parameters and their effects were investigated using the one-factor-at-a-time (OFAT) approach. The resulted optimized siderophore is partially purified as in ethyl acetate extract which shows (59.64%,50.88%) mycelial fungal inhibition against Alternaria triticina and Bipolaris sorokiniana. After that, this filtrate tested for germination potential, resulted shows that it potential act both biocontrol and plant growth promoting agent. It enhances the % germination, root and shoot length. Our findings indicate that Bacillus subtilis can produce substantial quantities of siderophores, which exhibit potent antagonistic activity and promoting growth of plant. This finding holds promise for advancing the development of novel biological control agents.

Organic farming as a climate change adaptation and mitigation strategy

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Recent decades have transformed Indian agriculture from traditional methods to a mechanized system reliant on fossil fuels, chemical fertilizers and pesticides, increasing greenhouse gas emissions and impacting global climate. Higher greenhouse gas levels, including carbon dioxide, methane and ozone are likely, causing the observed rise in air temperatures and leading to significant climate shifts. In most subtropical regions, a 4°C rise in global temperatures is anticipated to reduce groundwater and surface water, heightening food demand and threatening global food security. Climate change denotes long-term, significant alterations in climate measurements. A production system that maintains the health of ecosystems, soils and human populations is known as organic farming (IFOAM, 2006). Organic farming is energy-efficient and reduces greenhouse gas emissions by minimizing chemical and fossil fuel use, while enhancing soil carbon, biodiversity and fertility. It reuses plant and animal waste to restore soil nutrients, relies on renewable resources and supports sustainable, low-pollution management. Organic farming not only helps to mitigate climate change but also provides lasting benefits as an adaptation strategy. Effective nutrient management and carbon sequestration in soils are crucial for adapting and mitigating climate change across diverse temperature zones and local conditions.

Keywords: Greenhouse gas, Adaptation, Climate change, Mitigation and Organic farming.

Macro morphological Studies on the Ovaries of Camel (Camelus dromedarius)

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This study conducted a gross morphological examination of the ovaries from six female camels (Camelus dromedarius). The ovaries were found at the level of the 6th and 7th lumbar vertebrae, attached to the broad ligament, with the left ovary typically located more cranio-ventrally than the right. The ovarian ligament connected the ovaries to the broad ligament, which was thinner in younger camels than in older ones. Each ovary was enclosed by an ovarian bursa, and the fimbriae of the oviduct were attached at the hilus. The size and shape of the ovaries varied depending on the camel's age and reproductive status, becoming more irregular and lobulated as they aged due to the presence of follicles, corpus luteum, and corpus albicans. Each ovary had two borders, two ends, and two surfaces, with visible follicles and corpora lutea during the breeding season. Generally, the left ovary was larger than the right, and the mature corpus luteum was compact and spherical. The Graafian follicles measured between 1.5 and 3.0 cm. The study concluded that the left ovary was larger in all dimensions than the right ovary.

Advances in Remote Sensing Technologies and Their Agricultural Applications

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Application of Remote Sensing has made a significant impact to monitor, manage and analyze the agricultural land. These technologies that entail obtaining information on the state of the surface of the Earth without necessarily having to physically touch it has evolved rapidly in the last couple of years and holds promises in aspects such as precision farming, crop observation, and ecosystem stewardship. This chapter aims at discussing the new insights in the field of RS technologies with emphases on their revolutions in agriculture. Advances made in satellite imaging together with improved high resolution sensors have made it possible to acquire accurate information on the spatial distribution of crops and their health status, qualities of the soil, and water supply. Techniques like multispectral and hyperspectral imaging let for recognition of minor changes in the plant's physiological conditions that are not noticeable by the naked eye allowing for the early recognition of stress factors which include nutrient deficiencies, pests, and diseases. Also, recent developments such as remote sensing coupled with GIS and analytical methods have opened avenues in precision agriculture. Daily by using information schemes, farmers are able to schedule irrigation, apply fertilizer in the right places, and manage crop more effectively hence increasing yields and coming up with better solutions that conserve the environment. Another major innovation is ' drones ', which are synonyms to Unmanned Aerial Vehicles (UAVs) and are convenient and relatively inexpensive tools for imaging and monitoring the status of agricultural fields in real time. The chapter also addresses future possibilities of the increasingly developing technologies like LiDAR and radar remote sensing for higher advancement of the agriculture applications which focuses on topography mapping, biomass assessment and changes in structural characteristics of crops.

Key Words- Remote Sensing, Drones, Unmanned Aerial Vehicles, LiDAR

Performance evaluation of power operated paddy drum thresher cum winnower machine

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The traditional method of paddy threshing is labor-intensive, has low output, high grain damage, and is costly. To address these challenges, a power-operated paddy drum thresher cum winnower was designed and developed to increase mechanization, reduce drudgery, and improve cost-effectiveness. The physical properties of three paddy varieties (Devbhog, Mahamaya, and Rajeshwari) were measured at five moisture levels (7, 10, 14, 18, and 22% db) using Completely Randomized Design (CRD). Results indicated that length, width, thickness, sphericity, terminal velocity, coefficient of friction, angle of repose, bulk density, and true density increased with moisture content, while porosity decreased. Key components, including the threshing drum, blower, reciprocating sieve, and sieves, were developed at the Department of Farm Machinery and Power Engineering, SVCAET and RS, FAE, IGKV Raipur. The optimum settings for the blower unit were 14.5% moisture, 4.5 m/s blade speed, and curved blades, resulting in a blower capacity of 204.028 kg/h, efficiency of 81.56%, and losses of 1.96%. The sieving unit's optimal settings were 14.5% moisture, 1.04 m/s sieve speed, 2 mm lower sieve, 12 mm upper sieve, and 6° sieve angle, yielding a sieving capacity of 163.36 kg/h, efficiency of 80.4%, and losses of 2.66%. For the threshing unit, the best results were obtained with a feed rate of 275 kg/h, peripheral speed of 11 m/s, and 14.5% moisture, achieving a threshing efficiency of 98.7%, capacity of 210 kg/h, cleaning efficiency of 90.1%, and total grain loss of 1.96%. The operation cost was Rs. 1.04 per kg, with a breakeven point and payback period of 124.13 hours per year and 2 years, respectively.

Keywords: - Threshing efficiency, threshing capacity, breakeven point, feed rate and total grain loss

Photosynthetic pigments and chlorophyll fluorescence in wheat ear head under terminal soil moisture stress

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Drought is the most detrimental abiotic stress affecting wheat crop production and productivity worldwide. Terminal soil moisture stress is a major challenge, that occurs during the reproductive phase, particularly in rain-fed environments, and significantly reduces wheat grain production. The wheat ear head is an important component of the wheat plant, contributing to the yield through its photosynthetic activity. In this study, photosynthetic pigments and chlorophyll fluorescence in the ear head were studied in drought tolerant genotype WH 1021 and drought sensitive genotype WH 1105 under terminal drought stress. Terminal drought stress was induced by withholding water to 50 % of field capacity from the booting stage. Photosynthetic pigments and chlorophyll fluorescence were estimated at anthesis and 10 days after anthesis stages. Chlorophyll a, total chlorophylls, and carotenoids content in the ear head were higher in WH 1021 (drought tolerant genotype) compare to WH 1105 (drought sensitive genotype) at both stages under terminal drought stress. Chlorophyll fluorescence (Fv/Fm) in glumes of the ear head, which indicates photosystem II efficiency, was also found to be higher in WH 1021 under terminal drought stress. Grain yield and thousand grain weight were higher in WH 1021 compared to WH 1105 under terminal drought stress. Overall, the study indicated that retaining higher photosynthetic pigments and efficiency of photosystem II in the ear head under stress conditions helps in better photosynthetic activity of ear head and helps in improving the drought tolerance capacity of wheat plants. In addition to photosynthesis related traits, biochemical and molecular studies can be taken up in wheat ear head for further understanding the role of ear head, especially under stress conditions.

Key words: Wheat, Ear head, Glumes, Drought stress, Chlorophyll, Carotenoids, Fluorescence

Is potash required for sugarcane in Punjab, India for improved growth, yield, and quality parameters?

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To date in Punjab, India potash is not recommended for sugarcane while there are concrete recommendations for other crops viz. wheat, rice, etc. for deficient soils. This could be a reason for the lower performance of sugarcane in the state as far as yield and recovery are concerned as compared to the other states viz. Uttar Pradesh and Maharashtra where potash is already recommended. Considering this fact and standardizing the potash dose in the state for deficient soils, present experiments carried out at the three different locations viz. Amritsar, Kapurthala, and Gurdaspur at deficient soils for both plant (2019-20) and ratoon (2020-21) seasons. Different potash treatments include K_1, K_2, K_3, and K_4 plots fertilized with 0, 40, 80, and 120 kg K_2O ha^{-1}. A pooled study showed that K_2, K_3, and K_4 plots had higher germination (11.9, 19.5, and 25.6%) and re-sprouting (5.8, 12.8, and 18.0%) than control plots in 2019-20 and 2020-21, respectively. Cane length during plant season at K_2, K_3, and K_4 plots, respectively, had significantly higher lengths of 3.3, 5.6, and 7.9% in 2019–20 and 3.0, 10.4 and 14.3% in 2020–21 compared to control plots, while girth at these plots had non-significantly higher girths of 4.6, 3.9, and 8.8% in 2019–20 and significantly higher variations of 1.9, 5.4, and 6.9% in 2020–21. Early shoot borer (Chilo infuscatellus) incidence was 7.5, 13.6, and 6.0% in 2019-20 and 7.9, 14.1, and 4.8% in 2020-21 in K_2, K_3, and K_4 plots, respectively, compared to control plots. Top borer (Scirpophaga excerptalis) incidence was 7.4, 14.9, and 7.4% in K_2, K_3, and K_4 plots compared to control plots in 2019–20 and 9.8, 17.2, and 8.6% in 2020–21. Stalk borer (Chilo auricilius) incidence was 4.4, 8.7, and 0% in 2019-20 and 6.1, 10.8, and 1.5% in 2020-21 in K_2, K_3, and K_4 plots, respectively, compared to control plots. Potassium fertilizer also considerably reduced pokkah boeng in plant and ratoon crops in all areas. Compared to control plots, Sucrose improved 1.44, 5.10, and 5.00% in K_2, K_3, and K_4 plots in 2019–20 and 6.9, 9.1, and 11.2% in 2020–21. Compared to control plots, K_2, K_3, and K_4 plots had CCS (%) gains of 2.1, 4.6, and 3.7% during plant season and 6.8, 9.2, and 11.2% during the next ratoon cane season. Cane yields (t ha^{-1}) in K_2, K_3, and K_4 plots improved from control plots to 1.23, 3.21, and 3.78% in 2019–20 and 1.08, 4.17, and 4.72% in 2020–21. However, sugar yields (t ha^{-1}) in K_2, K_3, and K_4 plots compared to control plots improved by 3.62, 7.74, and 7.84% in 2019-20 and 7.98, 13.70, and 16.41% in 2020-21. Finally, the benefit-cost ratio at Amritsar, Gurdaspur, and Kapurthala in K_2, K_3, and K_4 plots was 1.35, 1.96, and 1.57; 2.05, 2.23 and 1.92 and 1.00, 1.54 and 1.00 respectively during the plant and 0.58, 1.51 and 1.15, 1.72, 1.80 and 1.53, and 0.57, 2.18 and 1.47% during the ratoon season. Thus, both plant and ratoon sugarcane at deficient locations K_3 plots fertilized with 80 kg K_2O ha^{-1} reported higher growth, yield, quality, and benefits.

Keywords: Sugarcane; Potash; Insects; Pokkah boeng; CSS (t ha^{-1}); Benefits

Growth and Economic Return of Quinoa (Chenopodium quinoa Willd.) under Different Plant Spacing and Fertility Conditions

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Quinoa (Chenopodium quinoa Willd.) is a native of the Andes that has sparked a worldwide interest due to its unique nutritional value. Quinoa seed have an orthodox magnificent nutritional food quality and were also called “the mother grain”. To achieve optimal crop yield, farmers must meticulously manage various factors, ensuring a balanced approach to fertility levels, irrigation, and pest control. It is crucial for farmers to find a delicate balance in achieving specific nutritional and yield targets. The current investigation was conducted in kharif 2022, with genotype “EC507742” at Research and Extension Centre, Gaja, College of Forestry, Ranichauri, Tehri Garhwal, Uttarakhand, India. The experiment comprised of two factors viz., geometry (S): S1- 20 x10 cm, S2- 30 x 10 cm and S3- 40 x 10 cm in main plot and fertility levels (F): F1- Control, F2- 75% NPKS, F3- 100% NPKS and F4- 125% NPKS in sub plot with total of 12 treatment combinations that were evaluated in split plot design with three replications. The data was analysed using OPSTAT with figures from SAS (proc glm). Among the geometries, S2 (30 x 10 cm) excelled in field conditions and economics relative to others. Among different fertility levels, F3 (100% NPKS) demonstrated the greatest growth, yield characteristics, yield, and higher returns for quinoa compared to other fertility levels. The interactions between geometry and fertility levels were also found significant for growth, yield attributes and yield with higher in S2F3. Thus, it can be concluded that using the recommended fertilizer (100% NPKS) with the ideal spacing of 30 x 10 cm improves growth, yield and profitability of Quinoa.

Genome-Wide Association Study Reveals Genetic Variants Associated with Production and Stature Traits in Karan Fries cattle

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The livestock industry plays a pivotal role in India's economy, with cattle comprising a significant portion of its livestock population. According to India's 20th Livestock Census, the cattle population in the country is an impressive 193.46 million, comprising 51.36 million exotic or crossbred cattle and 142.11 million indigenous cattle. To enhance milk production in indigenous cattle, crossbreeding with exotic breeds has become a popular strategy. In a notable advancement, ICAR-NDRI successfully developed a new composite cattle breed in 1982 by crossing Holstein-Friesian and Tharparkar cattle, resulting in the "Karan Fries" breed. Genome-wide association studies (GWAS) offer a powerful tool for identifying genetic markers associated with desired traits. This facilitates the identification of biologically meaningful candidate genes that are closely linked to significant SNPs, which can then be explored further for breed improvement. This study aimed to identify such genetic markers in Karan Fries cattle using a GWAS approach. Employing the Illumina Bovine 777k HD Beadchip, we genotyped 44 Karan Fries cattle. After quality control and LD pruning, 3,47,621 SNPs remained for association analysis. Using estimated breeding values (EBV) as dependent variables for each trait, linear regression analysis in PLINK was applied to detect multiple SNPs associated with these traits. Our analysis revealed 48 SNPs significantly associated with first lactation total milk yield (FLTMY) and stature (ST), surpassing the genome-wide suggestive threshold with a p-value 10^{-5} after genomic control correction. Additionally, 66 candidate genes were identified within a 25 kb region upstream or downstream of the associated SNPs. Especially, 17 SNPs were located in the intronic regions of key genes such as RARB, PPFIA2, PLXNB2, FIP1L1, LRP6, NAV3, R3HDM4, MIOX, SCO2, ODF3B, CBLB, PRKCE, KALRN, GRID2IP, ANKH, and CPPED1. The identified SNPs could be valuable for future studies in Karan Fries cattle and may contribute to marker-assisted selection for improving milk production and stature traits.

Keywords- GWAS, SNP, Karan Fries, Genes

Management of sheath blight disease of rice by using chemicals

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Sheath blight disease of rice caused by Rhizoctonia solani Kuhn [teleomorph: Thanatephorus cucumeris (Frank) Donk] has been considered a major disease of rice in almost all the rice-growing states of India causing up to 69 % loss in yield. Managing the disease is quite difficult because of its soil-borne nature as the fungal sclerotia remain viable in the soil for many years. Due to the lack of resistant donor lines, chemical control is still the most effective means for managing the disease and getting the full yield potential. Many fungicides belonging to different groups were found effective against the disease but use of the same chemical year after year may develop resistance in the pathogen. Screening of newer fungicides should be a continuous process to overcome the situation. Therefore, chemicals were evaluated to find their effectiveness against Rhizoctonia solani both in vitro and under field conditions. Among the seven chemicals tested against the disease, thifluzamide 24 SC @ 0.8 ml/l gave the best result by reducing the disease severity in terms of Percent Disease Index (PDI) to 12.96 from 61.73 in the control plots and increasing the yield to 51.2 q/ha from 39.5 q/ha in the control plots. Thifluzamide also gave the best result in vitro by 100 % inhibition of mycelial growth of Rhizoctonia solani at both 200 and 500 ppm concentrations. It recorded 66.8 % reduction in disease severity and 29.6 % increase in yield over the control plots with the highest benefit-cost ratio of 1.53 and was found to be the best of all the chemicals tested. No phytotoxicity symptom was recorded within seven days of each spray of the tested chemicals; hence the chemical may be considered safe for use in the rice crop.

Influence of Climatic Parameter on the Population Dynamics of Helicoverpa armigera infesting chickpea genotypes

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Chickpea, Cicer arietinum Linn. is an important pulse crop due to its nutritional value and ecological benefits and also known as the "King of Pulses". Among these, the gram pod borer Helicoverpa armigera Hubner is the most destructive pest, affecting chickpea from the vegetative to the pod development stage. The findings of the two-year study on the relationship between weather parameters and the population dynamics of Helicoverpa armigera on various chickpea genotypes in the tarai region of Uttarakhand (Pantnagar) show that, despite of the genotypes under consideration, the Helicoverpa armigera larva and adult population peaked in the second week of March during the first year and in the last week of March during the second year of the experiment at the podding stage of the crop. Throughout both years of the study, the highest pest density was observed in the chickpea variety CSJ 138, while the lowest was found in the variety NbeG 506. Correlation analysis revealed that the Helicoverpa armigera population had a positive relationship with maximum and minimum temperatures, wind speed, and sunshine hours. However, it was negatively associated with maximum and minimum relative humidity and rainfall, regardless of the experimental year. The maximum temperature showed a significant correlation with pest population across all varieties, except for CSJ 138 in the first year and NbeG 506 in both years. Additionally, wind speed demonstrated a significantly positive correlation with pest density in the CSJ 138 variety during both years. Regression analysis identified maximum temperature as the primary factor influencing pest population predictions across chickpea varieties in both years of the experiment.

Bioprospecting techno-functional properties of novel yeast YB1 for its application in functional foods

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Diet and nutrition are vital for maintaining human health, with the gut microbiome being integral to metabolic processes and gut integrity. The natural fermentation process of sourdough introduces specific strains of lactic acid bacteria and yeasts that positively affect gut microbiota composition. These microorganisms facilitate the degradation of complex carbohydrates and improve their digestibility, thereby, enhancing the nutritional profile of sourdough products. However, type I sourdough fermentation involves back slopping which takes longer time for completion and makes the overall process costly. Hence, type II sourdough starters need to be explored and characterised w.r.t. techno-functional properties. The present study was carried out with the objective to explore the techno-functional properties of novel yeast YB1. The yeast exhibited xylan and phytic acid degradation ability with positive results. Furthermore, antimicrobial activity tests against Escherichia coli MTCC 3222, Salmonella typhimurium MTCC 3224, and Aspergillus sp. CTS1 exhibited clear zones of inhibition. The culture was found to be susceptible to tetracycline, rifampin and isoniazid and ampicillin. In addition to this, the yeast was able to ferment various carbohydrates, including xylose, mannose, and lactose. The cells of YB1 showed higher degree of auto-aggregation and cell surface hydrophobicity. The culture also exhibited good growth at 37 °C and tolerance at 0.3 % bile salt concentration and pH ranging from 2.5 to 3.5. Thus, the techno-functional properties highlight the potential of yeast YB1 for its suitable applications in the development of functional foods.

Keywords: Sourdough fermentation; functional foods; gut microbiome

Rural Women and Agricultural Development in Sirsa

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Agriculture was the first culture that humans used as a means of subsistence. It is the foundational sector of the economy. This sector employs most of the rural populace. India's self-employed farmers are women. Above 70% of rural women engaged in agricultural work active or passive. It has been observed that women work 8-9 hours per day in agriculture and 4-5 hours in domestic activities. Some agricultural operations in which females are considered superior to males such as cotton farming. The current analysis is relevant to recent trends regarding the various roles played by women in the agri-sector of Sirsa. Agriculture is necessary for national growth. Overall development depends on increasing food security and income of rural countryside people. Women are the vast majority of smallholder farmers and food producers. Rural women contribute significantly to subsistence agriculture and food security; they are the primary source of farm labour at the very initial stage of crop activity. They work all aspects of agricultural production, including crop and livestock production, and are in charge of all households. These roles are divided into three: productive, reproductive, and social. The productive role is filled by both men as well as women and focuses on earning activities. Women perform reproductive roles, which are household maintenance, and society roles, which are related to well-being. They make these contributions despite having unequal access to capital, institutional credit, technical skills, agricultural extension, irrigation, modern inputs, and land. They work heavier workloads than males. However, women's contributions to agriculture are overlooked. As a result, the purpose of the analysis is to compile information on the role of rural women in agriculture and development, as well as to identify constraints that limit women's participation in the process. On the other hand, many opportunities exist as the government's commitment, donors, NGOs and women themselves, all of which contribute to agricultural or rural development. As a result, special attention must be paid to female agriculturists providing farmer identity and essential resources such as land rights, credit, inputs, and extension services. Improve mainstreaming gender issues into agricultural policies to ensure successful agriculture and rural development.

Keywords: Agricultural, Rural, Triple, Development.

Enhancing Idli Pre-Mix: Incorporation of Black Cumin Seeds (Nigella sativa) for Improved Nutritional and Functional Properties

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Fermented foods and beverages have been integral to human diets for centuries, produced either spontaneously or with the addition of starter cultures. This process Beverages local raw materials from plants or animals, transforming them through the activity of microorganisms. These microorganisms enhance the nutritional and biochemical properties of the raw materials, improving taste, texture, and aroma. The methods of producing and consuming fermented foods vary across different cultures and ethnic groups. Despite their numerous health benefits, the consumption of fermented foods globally is declining due to the effects of globalization and changing dietary habits. In India, some of the most popular fermented foods include idli, dosa, appam, porridge (koozh), dhokla, gundruk, dahi, sinki, rumba, fermented rai, kanji ka, and handua. These foods were traditionally favored for their extended shelf life achieved through acetic acid and alkaline fermentations. Fermentation enriches foods biologically, increasing the content of proteins, essential amino acids, essential fatty acids, and vitamins, while reducing anti-nutrients. This process also enhances flavor and aroma, improves digestibility, and offers various health benefits.

Keywords: Traditional Fermented Food, Breakfast Food, Cereals and Pulses, Digestibility, Low Fat Content, Essential Amino Acids, Vitamins and Minerals.

INFRARED THERMOGRAPHICAL STUDY OF ESTRUS IN DAIRY ANIMALS

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The present investigation was planned to evaluate the usefulness of Infrared thermorgraphical camera for discrimination of various stages of estrus i.e. onset of estrus, standing heat and non estrus conditions in sahiwal cows. The experiments were conducted on ten healthy, cyclic sahiwal cows maintained at DDD farm of LFC at DUVASU, Mathura. In present study behavioural attributes such as flehmen reaction score of teasure bulls for cows, restlessness and bellowing were observed to be significantly ($P<0.01$) high during onset of estrus, as compaired to standing heat and non estrus stages whereas number of mountings and frequency of frequent urination were observed to be significantly ($P<0.01$) high during standing heat condition. The mean values for rectal temperature (38.90±0.07ºC), respiration rate (23.20+0.42per minute), RBC (6.79±0.10 $X10^6/mm^3$), WBC (10.65±0.18 $X10^3/mm^3$), PCV (33.41±0.54%), and haemoglobin (11.47±0.15 mg/dl) of experimental cows were found to be significantly ($P<0.01$) high during standing heat condition as compared to onset of estrus and non estrus stages. Interestingly, no significant difference for any of the bio chemical attribute except alkaline phospahtase in sahiwal cows could be observed during three different stages of estrus. The mean value for alkalin phosphatase was significantly ($P<0.01$) high during standing heat (138.78±0.27IU/L) condition as compared to other two stages. This finding indicated that none of the bio chemical attribute except alkalin phospahatase is helpful in discrimination of the above said three stages of the estrus in sahiwal cows. The mean plasma concentration of estrogen and cortisol during standing heat stage (22.25±1.89 ng/ml and 12.90±0.44 ng/ml, respectively) of sahiwal cows were significantly ($P<0.01$) high as compared to onset of estrus and non estrus stages of estrus. The mean infrared thermographical temperature of muzzle and vulva of sahiwal cows during standing heat stage (34.72±0.21 and 39.15±0.15ºC, respectively) were found to be significantly ($p<0.01$) high as compared to two other stages of estrus. Thus, from present study it was concluded that infrared thermoradiography may be used as the efficient tool for detection of estrus and its different stages in sahiwal cows.

Response of Oil seed crop (Brassica napus L.) to the application of zinc levels.

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This study at Lovely Professional University's research farm investigated the impact of zinc application on the growth, yield, and quality attributes of Gobhi Sarson (Brassica napus L.), focusing on the GSC-7 variety during the Rabi season of 2022-2023. Using a Factorial Randomized Block Design (FRBD) with 16 treatments replicated thrice, the study comprised 48 plots, each measuring 5×4m^2, with plants spaced 45 cm apart. Parameters such as plant height, leaf count, fresh and dry weights, chlorophyll content, branch count, and yield attributes were assessed to understand the effects of varied zinc levels. Additionally, the investigation explored zinc's influence on yields and post-harvest soil nutrient availability. The findings provide insights into optimizing zinc levels for enhanced Gobhi Sarson productivity, benefiting farmers and agricultural stakeholders.

Keywords: Gobhi Sarson, Brassica napus L., Growth, yield, Zinc, Agricultural importance, Crop sustainability

Estimation of Soil Loss using RUSLE Model and GIS Techniques in Dapoli Watershed, Maharashtra

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Soil and water are the two basic natural resources for the survival of living organisms. These resources should be carefully monitored and managed for the beneficial of the society. Proper soil and water conservation work can change the lives of the farmers by ensuring a sustainable livelihood. In this present study, Dapoli watershed located in the Konkan region of Maharashtra, having a total geographical area of 26,635.08 ha has been considered as the study area for the estimation of soil loss using RUSLE model and GIS techniques. The Revised Universal Soil Loss Equation (RUSLE) takes into consideration important factors such as rainfall erosivity (R) factor, soil erodibility (K) factor, slope length steepness (LS) factor, cover management (C) factor and support practice (P) factor. SRTM DEM (30m resolution) and SENTINEL 2 (10m resolution) satellite imagery were used to delineate the watershed and prepare various thematic maps like slope, LULC and NDVI map. The required RUSLE factor maps were also generated and multiplied on the raster calculator in the GIS environment. The results of this study was classified into six classes as per Indian conditions i.e. slight, moderate, high, very high, severe and extremely severe class. The estimated average annual soil loss for Dapoli watershed was 29.45 t/h/yr. The highest amount of soil loss was observed in the extremely severe (>80 t/h/yr) class with 47.57% and least soil loss in the moderate (5-10 t/h/yr) class with 1.58% of the total soil loss. This study revealed that maximum soil loss occurred in regions having high slope gradient thus proper soil conservation structures should be implemented to control extreme soil loss in those areas of the watershed. Furthermore, RUSLE model coupled with GIS techniques serve as an efficient and convenient tool for estimating soil loss and can be used for future research in similar watersheds.

Keywords: RUSLE, GIS, LULC, NDVI, DEM, SENTINEL Thematic maps

Effect of addition of inulin on chemical, organoleptic, microbiological and rheological properties of Peda

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Peda is highly nutritious khoa based sweet as it contains milk solids plus sugar and other additives. The quantity of peda produced in India exceeds than other khoa based sweets. Now a day's dietary fiber is gaining more importance in human diet due to its important role in human health. Inulin is a natural soluble dietary fiber derived from chicory root, garlic, wheat, bananas, and artichokes, and so it has always been part of the human diet. The supplementation of inulin in dairy foods modifies its structure and composition as well as the probable relation among components, giving rise to perceptible changes in flavor, color and particularly in texture, at high concentration inulin can alter the texture profile of products because of its physico-chemical significance.

In order to solve this problem, dietary fiber can be used, which can improve the textural and sensory properties of products in addition to being functional. Milk and milk products considered as a vehicle for dietary fiber would not only take care of their own role in human health but could also enhance the heath fullness of the diet as a whole. The experiment was conducted with the aim to investigate suitable method for incorporation of inulin in peda having suitable treatment combinations. After preliminary trials four levels viz. 1, 3, 5 and 7 per cent were selected to add inulin in peda.

The objective of this study was to examine the effect of inulin on chemical, organoleptic, microbial and rheological properties of peda. It is observed that addition of inulin content in peda up to 7% level had significantly ($P<0.05$) decreases moisture, fat, protein, total carbohydrates content in peda whereas, ash, fiber, total solids content increases significantly ($P<0.05$) as compare to control. It was observed that addition of inulin had significant ($P<0.05$) effect on body and texture as compare to flavour, color and appearance, sweetness and overall acceptability of the peda. In respect to the microbiological properties, increasing the level of inulin decreases the Total Plate Count and Yeast and Mould count in peda. Incorporation of inulin influenced the rheological properties of peda. As the level of inulin increases it significantly ($P<0.05$) increases the hardness, cohesiveness, gumminess and chewiness of peda as compare to control whereas, adhesiveness and springiness decreases. Our results suggest that inulin can be added into peda up to 7% without affecting its overall quality characteristics.

Keywords: Peda, inulin, rheological, organoleptic, microbial, physico-chemical etc.

Organic Farming; Challenges and Opportunities

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Organic farming, an agricultural method that emphasizes natural processes over synthetic inputs, has seen a notable increase in popularity recently. The health benefits and environmental perks of organic produce are attracting more consumers. Soil fertility and nutrient management are vital for sustainable agriculture. Organic farmers enhance soil health using natural techniques like crop rotation, composting, and green manures to sustain nutrient levels and foster long-term productivity. These methods not only boost soil structure and fertility but also aid the ecosystem by minimizing the use of synthetic fertilizers and enhancing biodiversity. Nonetheless, organic farming is a complex field with its own set of challenges and opportunities. A major challenge is pest and disease management, where farmers typically depend on conventional methods and natural predators, which may not be as effective as synthetic pesticides. Weed management in organic farming is labor-intensive with mulching, and crop rotation rather than herbicides. On the opportunity side, there is a growing consumer demand for products that prioritize health, sustainability, and ethical production practices. Governments worldwide are beginning to recognize the value of organic agriculture, enacting policies to promote its growth. This includes providing financial incentives to farmers, allocating research funds, and supporting the development of organic infrastructure. These advantages are becoming increasingly significant as we address climate change and other environmental issues. By tackling these challenges with sustainable practices and innovation, organic farming can lead the way to a resilient and prosperous agriculture.

Scaling Natural Farming: The Crucial Role of Extension Services in Sustainable Agriculture

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Natural farming, a practice that minimizes external inputs and relies on ecological processes, is pivotal for achieving sustainable agriculture. Despite its potential to enhance environmental health, biodiversity, and food security, the adoption of natural farming remains limited, particularly in developing countries. Agricultural extension services play a critical role in overcoming barriers to adoption by facilitating knowledge transfer, capacity building, and community engagement. Extension services act as intermediaries between research institutions and farmers, enabling the practical application of scientific knowledge. Studies have shown that farmers receiving extension support are 40-60% more likely to adopt sustainable practices, including natural farming. Extension officers disseminate information on key natural farming practices, such as zero-tillage, green manuring, crop rotation, and integrated pest management, which have been shown to increase yields by up to 20% while reducing input costs by 30-40%. Through training programs, workshops and field demonstrations, extension officers equip farmers with the skills needed to implement and sustain natural farming practices. For instance, data from India's Andhra Pradesh Community-managed Natural Farming (APCNF) program indicates that farmers who participated in extension-led training observed 25% increase in crop productivity and 50% reduction in chemical fertilizer use within three years of adoption. Participatory approaches, such as farmer field schools and peer-to-peer learning groups, have been shown to enhance knowledge retention by 35% and adoption rates by 50%. These methods encourage collaboration among farmers, leading to the creation of community-based support networks that are crucial for the long-term success of natural farming.

Keywords: Natural Farming, Agricultural Extension, Sustainable Agriculture,Capacity Building and Community Engagement.

Seed priming: A Strategic Approach to Climate-Resilient Crop Production

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In regions with limited rainfall, challenges like poor seedling emergence and inadequate stand establishment are common. To counter these problems, Seed priming is a viable option. Seed priming is well-regarded for its ability to improve germination, speed up emergence, and enhance crop uniformity and stand establishment. This involves controlled hydration of seeds to start the metabolic processes required for germination, without allowing the radicle to emerge. Seeds are immersed in a specific solution or water for a set period, allowing them to absorb water and begin essential metabolic processes such as breaking down seed reserves, activating enzymes, and repairing damaged cellular components. Hydro-priming, halo-priming, osmo-priming, hormonal priming, biopriming, chemo priming, thermo priming, nano priming, solid matrix priming are some of the prime examples of seed priming. Specific metabolic changes occurs when seeds transition from dormancy to active germination, and it is essential for seed priming. When seeds absorb water, they initiate several cellular processes, such as the synthesis of nucleic acids and proteins, ATP production, and activation of DNA repair and antioxidant systems. Priming treatments initiate controlled water absorption, which activates DNA repair mechanisms like Base-Excision Repair (BER) and Nucleotide-Excision Repair (NER), essential for maintaining genome integrity. Furthermore, transcription-coupled Nucleotide-Excision Repair (TC-NER) is triggered to address lesions on the transcribed strands of active genes. The role of DNA helicases and microRNAs that target these helicases in DNA repair highlights the critical role of priming in maintaining seed vigour. This process enhances germination rates, seedling vigour, and stress tolerance, giving plants an early advantage. This results in faster establishment, improved resource utilization, and ultimately higher yields, promoting water conservation, efficient nutrient use, and greater crop uniformity, making it both environmentally friendly and cost-effective. As agricultural challenges grow due to climate change and increasing population, seed priming becomes a crucial tool for farmers and researchers to optimize crop performance and ensure food security under adverse conditions.

Keywords: biopriming, chemo priming, crop uniformity, germination, seed priming

ADVANCED TECHNIQUES IN HI-TECH HORTICULTURE: INNOVATIONS IN FLORICULTURE

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Hi-tech horticulture, particularly in the field of floriculture, represents the convergence of traditional gardening practices with modern technological advancements. This innovative approach has revolutionized the cultivation, production, and distribution of ornamental plants and flowers. The integration of precision agriculture, biotechnology, and automation in floriculture has enabled growers to enhance the quality and yield of floral crops while minimizing environmental impact.

Key technological interventions include controlled environment agriculture (CEA), hydroponics, and vertical farming, which allow for year-round production and efficient use of space and resources. These systems are supported by advancements in sensor technology, which provide real-time monitoring of plant health and growth conditions. Furthermore, genetic engineering and plant breeding techniques have led to the development of new flower varieties with improved traits such as color, fragrance, and disease resistance.

Automation and robotics play a significant role in modern floriculture, from planting and harvesting to post-harvest handling and packaging. These technologies reduce labor costs and increase operational efficiency, ensuring a consistent supply of high-quality flowers to the market. Additionally, the use of data analytics and artificial intelligence (AI) has enabled predictive modeling for crop management, helping growers make informed decisions about resource allocation and pest control.

High-tech floriculture places a strong emphasis on sustainability, making attempts to minimize chemical inputs, reduce water usage, and encourage the use of renewable energy sources. Innovative solutions such as rainwater harvesting, integrated pest management (IPM), and organic cultivation methods are increasingly being adopted to meet consumer demand for environmentally friendly products.

In hi-tech horticulture in floriculture is transforming the industry by combining cutting-edge technology with sustainable practices. This approach not only enhances productivity and profitability but also contributes to the preservation of natural resources and the environment. As the global demand for flowers continues to rise, the adoption of hi-tech horticultural techniques will be essential for meeting future challenges and opportunities in the floriculture sector.

Keywords: Hi-tech horticulture, floriculture, precision agriculture, controlled environment agriculture, automation, sustainability, genetic engineering, artificial intelligence.

Enhancement of sesamum yield with split application of nitrogen under irrigated conditions

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The experiment was conducted during rabi season for three years i.e., 2020-21 to 2022-23 at Agricultural Research Station, Utukur, Kadapa, Andhra Pradesh, India to study the growth and yield performance of sesamum under different levels of nitrogen application in different split doses. The treatments included four levels of nitrogen viz., 40, 60, 80 and 100 kg/ha and four split doses as 50:50 basal and 30 DAS, 25:75 basal and 30 DAS, 25:37.5:37.5 basal, 20 and 40 DAS and 0:50:50 basal, 20 and 40 DAS which were laid out in split plot design with levels of nitrogen in main plots and time of nitrogen application in sub plots in three replications. The variety YLM-66 was sown at a spacing of 30 cm × 10 cm. Maximum plant height was recorded with application of 100 kg N/ha which was on par with 60 and 80 kg/ha and the number of branches per plant was not significantly influenced by nitrogen. The number of capsules plant^{-1}, number of seeds capsule^{-1} and seed yield were higher with application of 80 kg N ha^{-1} indicating this as an optimum of nitrogen fertilizer in contrast to the present recommended dose of 40 kg N ha^{-1} and regarding the time of application and number of splits, application of 80 kg N ha^{-1} in three splits in the ratio of 25-37.5-37.5 at basal, 20 and 40 days after sowing might be recommended for getting higher seed yield in sesamum under irrigated conditions in YSR Kadapa district of Andhra Pradesh.

Studies on the Influence of Integrated Nutrient Management (INM) on Quality Parameters and Economics of Carrot (*Daucas carota* L.) cv. KurodaImproved under Southern Telangana Conditions

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A field experiment was conducted during rabi 2017-2018 at Vegetable Research Block, College of Horticulture - Mojerla, SKLTS Horticultural University, Hyderabad, Telangana, India, to study the effect of integrated nutrient management (INM) on quality parameters and economics of carrot (Daucas carota L.) cv. Kuroda improved. The experiment was laid out in randomized block design with nine treatments and three replications. The results pertaining to quality parameters indicated that higher percentage of total soluble solids (12.40 %), ascorbic acid content (5.33 mg/100 g), carotene content (4.73 mg/100 g) and cortex to core ratio (0.90) were recorded in T_9 (25 % RDF + 50 % FYM @ 6 t/ha + 50 % Vermicompost @ 3 t/ha + 50 % Rhizosphere Bacteria) while lower percentage of cracked roots (3.83 %) and forked roots (3.70%) were recorded in T_2 (FYM 12 t/ha) and T_3 (Vermicompost @ 6 t/ha) respectively. The highest gross return (Rs. 3,72,000), net return (Rs. 2,99,467) and best benefit cost ratio (4.13) were recorded in the treatment T_9 (25 % RDF + 50 % FYM @ 6 t/ha + 50 % Vermicompost @ 3 t/ha + 50 % Rhizosphere Bacteria).

Keywords: Carrot cv. Kuroda improved, INM, Quality and Economics.

Molecular characterization of the white tip nematode of rice, Aphelenchoides besseyi

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Rice (Oryza sativa), which provides sustenance for millions of people worldwide, is one of the most vital staple commodities. Nonetheless, this plant is vulnerable to various pests and diseases, including the rice white tip nematode, Aphelenchoides besseyi. As a result of its ability to disseminate via seed, it is presently widespread in virtually all rice-growing regions of the globe. Diverse races or biotypes of A. besseyi have been documented in different rice-growing regions across the globe; however, there is a scarcity of comparative molecular characterization and phylogenetic studies comparing populations that are indigenous to foreign species. It is imperative to comprehend the molecular attributes and genetic variability of this nematode in order to formulate efficacious management approaches. Molecular techniques are among the most effective methods for characterizing the genetic diversity of populations of Aphelenchoides besseyi originating from various geographic regions. Nematode populations are isolated from rice fields in various regions and their genetic diversity is analyzed through the use of molecular markers. These markers allowed us to assess genetic variation within and between populations. This will facilitate the identification of variations in conserved gene sequences among indigenous and non-indigenous populations of A. besseyi. The discovery of specific primers or markers will contribute to the advancement of diagnostic tools for A. besseyi detection and the establishment of standardized operating procedures for accurate identification. Molecular characterization of populations of Aphelenchoides besseyi will yield significant insights regarding the evolutionary history and genetic diversity of this economically vital nematode. Gaining insight into the genetic composition of these nematodes can facilitate the selection of resistant rice cultivars and quarantine organizations for seed health testing, thus making a valuable contribution to the promotion of sustainable rice production and the development of targeted control strategies.

Keywords: conserved gene, genetic diversity, phylogenetic studies and seed health testing

Sleep quality and its relationship with psychological wellbeing of women undergoing in vitro fertilization

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Infertility is a male or female reproductive system disease, in which individual fail to achieve a pregnancy after regular unprotected sexual intercourse. Infertility is a stressful condition and couples experiencing infertility may experience inappropriate circadian rhythm and their quality of sleep may be impacted. Additionally, the IVF treatment also interrupts the regular sleep routine. The present study aimed to assess sleep quality and psychological wellbeing among undergoing in vitro fertilization and its interrelationship. The study was conducted on 284 women (142 women with in vitro fertilization and 142 women with natural pregnancy) selected through purposive and snowball sampling techniques from fertility care centres, maternity clinics and women referees of Telangana and Karnataka states. A correlational and differential research designs were employed in the study. Self-structure questionnaire to elicit general information, Pittsburgh Sleep Quality Index (PSQI) measures sleep quality and Depression, Anxiety and Stress Scale (DASS-21) used to assess psychological health of women undergoing in vitro fertilization. The results revealed that women undergoing in vitro fertilization had significantly poor sleep quality than women with natural pregnancy (85.91 Vs 65.49). Most of the women undergoing in vitro fertilization had sleep latency and sleeping for less duration problems. Women undergoing invitro fertilization exhibited extremely severe depression (49.29%), moderate anxiety (41.54%) and stress (42.25%), significantly differed with natural pregnant group women. Sleep quality shown a statistically significant positive relationship with depression and anxiety among women undergoing in vitro fertilization. Therefore, the study recommends to promote integrative care model which ensures that women receiving comprehensive care which meets both physical and mental health care needs.

Keywords: in vitro fertilization, natural pregnancy, sleep quality, psychological wellbeing

Soil Health as a Determinant of Mulberry Yield and Quality

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Soil health is a fundamental determinant of mulberry (Morus spp.) cultivation which is essential for silkworm rearing. The health of the soil directly impacts the growth, yield and quality of mulberry plants making it crucial for the success of silk production. Soil health indicators (physical, chemical and biological properties of the soil) serve as vital tools for assessing the overall vitality and sustainability of any agricultural ecosystems. In the context of mulberry cultivation, these indicators provide essential insights into the soil's capacity to support robust plant growth, high yields and quality leaf production. Key soil health indicators such as organic matter, nutrient availability, pH levels, cation exchange capacity (CEC) and soil microbial activity play a distinct role in maintaining soil functionality. Organic matter content enhances soil structure, water retention and nutrient cycling while nutrient availability directly influences mulberry growth and leaf quality. Similarly, optimal pH levels ensure nutrient balance and prevent toxicities or deficiencies and cation exchange capacity (CEC) measures the soil's ability to retain and supply essential nutrients. Soil biological activity supports nutrient cycling and overall soil fertility. Regular monitoring and management of these soil health indicators are crucial for maintaining optimal conditions for mulberry cultivation. By understanding and improving these indicators, one can enhance soil fertility, reduce dependency on chemical inputs and promote sustainable practices that ensure long-term productivity. Sustainable soil management practices such as organic amendments, biofertilizers and reduced chemical input are essential for maintaining soil fertility and enhancing the long-term viability of sericulture. A deeper understanding of the integral relationship between soil health and mulberry cultivation offers insights into practices that can optimize yield and quality while promoting environmental sustainability in sericulture.

Keywords: Soil, mulberry, indicators, quality, sustainability.

Molecular Detection of Mungbean yellow mosaic disease on soybean outbreak in Marathwada region

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Soybean (Glycine max L.), (2n=40) is a worldwide major oil seed crop. The soybean crop is affected with number of biotic and abiotic stresses. Among the biotic stresses, the important diseases like, rust, sclerotium wilt, fusarium wilt, bacterial blight and more than 50 various viruses are known to strike soybean. Out of 50 viral diseases, the yellow mosaic disease is the major viral disease of soybean. In present study, survey was conducted in Marathawada district of Maharashtra to measure the natural incidence of the yellow mosaic disease of soybean during 2022. In kharif season of soybean, yellow mosaic the highest disease incidence was recorded. infected soybean leaves were collected from the farmer`s fields. The diseases are transmitted by the insect vector by whitefly Bemisia tabaci. Typically symptoms observe on soyabean light and dark green patches, diseased plant have stunted growth and reduced yield.

In this study symptomatic leaves of Mungbean yellow mosaic virus on soybean were collected from different regions of Marathwada in Maharashtra. Molecular detection was done by isolating DNA from infected leaf sample of soybean and was amplified by using Coat protein gene specific primer which shows amplification of 719bp. Hence, there is necessity for awareness and implementation of effective management practices for soybean yellow mosaic disease among the farming communities of the disease affected districts.

Keywords: Mungbean yellow mosaic virus (MYMV), gene-specific amplification, coat protein (CP) gene

Standardization of Biodegradable film preparation

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The development of biodegradable films using biopolymers offers a more environmentally friendly alternative to petrochemical-based packaging materials. When creating biodegradable films, the choice of material for casting the film is crucial. During the development process, we poured the film solution onto various materials including glass (petriplate), steel trays, aluminum foil, and polyester sheets. Our analysis of the developed films revealed the following: films were difficult to peel from glass, films developed on steel trays were opaque and showed some color formation, films developed on aluminum foil were of good quality, and polyester-based films were easy to peel and of good quality. We found that the strength of films developed using acetic acid was greater than those developed using lactic acid, and films developed using glycerol as plasticizer were superior to those developed using sorbitol. Additionally, the addition of plasticizers increased the color values and the opacity of the films was lower in those developed using glycerol.

Keywords: Films, biodegradable, base material, plasticizer

Study of Genetic Variability, Heritability and Genetic Advance in okra [Abelmoschus esculentus L.]

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Studies on genetic variability, heritability and genetic advance were carried out with thirty seven genotypes of okra using randomized block design (RBD) with three replications. In the present study the high genetic variability observed for the characters i.e. number of primary branches, internodal length, number of locules per fruit, number of seeds per fruit, number of fruits per plant, fruit yield per plant, chlorophyll content and indicates the significance of these characters to be used for selecting superior genotypes. High heritability coupled with high genetic advance as per cent of mean indicates operation of additive gene action which was observed in characters viz., plant height, number of primary branches per plant, intermodal length, days to 50 %flowering, fruit length, fruit diameter, number of locules per fruit, number of seeds per fruit, number of fruits per plant, fruit yield per plant, seedsweight per fruit, seedling length, seedling dry weight, vigour index I, vigour index II and chlorophyll content.

Keyword: Okra, Genotypes, Genetic variability, Heritability and Genetic advance.

Influence of conservation tillage and crop residue mulch on weed control in wheat

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Tillage and residue mulching play key roles in weed control in wheat. Tillage disrupts weed seeds, reducing emergence, while residue mulch creates a barrier that limits weed growth by suppressing germination. Together, these practices can effectively reduce weed pressure, leading to better crop performance and improved soil health. Therefore, field trials were conducted at MARS, University of Agricultural Sciences, Dharwad, Karnataka during two consecutive years (2020-21 and 2021-22) to know the effect of tillage and crop residue mulch on weed control and yield of wheat crop. Treatment details of the experiment are tillage system (Conventional and minimum tillage), residue mulch (no residue, soybean, maize, ground nut residue and glyricidia mulch) and outside control (weed free check). Results of the two years data indicated that conventional tillage recorded significantly lower total number of weeds, total dry weight of weeds at 20 and 40 DAS. Higher weed control efficiency (51.2, 58.4 and 40.4, 38.6%) and grain yield (32.64 and 33.38 q/ha) and lower weed index (21.9 and 21.7%) were observed under conventional tillage compared to minimum tillage. Minimum tillage recorded lower weed control efficiency (32.6, 38.7 and 24.7, 25.9%), grain yield (29.25 and 30.07 q/ha) and higher weed index (30.1 and 29.6%). Among the crop residue mulch application, glyricidia mulch recorded significantly lower total number of weeds, total dry weight of weeds compared to no residue, ground nut, soybean and maize residue. Significantly higher weed control efficiency (64.5, 77.5 and 57.9, 59.3%), grain yield (34.58 and 35.46 q/ha) and lower weed index (17.3 and 16.9%) recorded in glyricidia mulch. No residue recorded lower total number of weeds, total dry weight of weeds, weed control efficiency (11.5, 13.5 and 5.0, 4.2%) grain yield (25.78 and 26.44 q/ha) and higher weed index (38.5 and 38.1%). Weed free check recorded higher weed control efficiency (100%) and grain yield (41.73 and 42.59 q/ha). These results suggested that conventional tillage with glyricidia mulch was the best treatment in order to minimize the diverse weed flora in wheat.

Introgression of Sheath Blight resistance QTL (qSBR11.1) into 'Maudamani' through Marker Assisted Backcrossing

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Rice, the principal food crop, serves as staple food for more than half of global population and the demand for rice is still increasing day-by-day. However, biotic stresses are being major obstacle for the growth, development and production of rice. Sheath blight (ShB) is one of the major biotic stresses causing significant yield loss in rice. In order to guard against the threat posed by this disease, it is important to make use of varieties of rice incorporated with resistance genes/QTL. Sequential transfer of several resistance genes/QTL to elite variety via traditional breeding is difficult and time consuming. However, the use of closely linked and direct molecular markers for various traits through gene stacking is very useful strategy to transfer many genes/QTL simultaneously to the recipient parent. 'Maudamani' (CR Dhan 307) is a very high yielding popular rice variety of Odisha with average yield of 5t/ha but highly affected by ShB. Therefore, we targeted this Maudamani variety as recipient for incorporation of ShB resistance QTL to make it more robust with higher production in adverse conditions. In this study, we have successfully incorporated major sheath blight resistance QTL (qSBR11.1) into the recurrent parent Maudamani through Marker Assisted Breeding approach. 'Tetep' was used as donor to introgress ShB resistance to Maudamani. The results obtained from the foreground selection at BC_1F_1 generation confirm the presence of resistance QTL which can be further used for subsequent backcrossing. This will result in an improved version of 'Maudamani' with durable resistance to ShB disease. Also, the pyramided lines can be used as potential donors in different breeding programs.

Keywords: Rice, sheath blight, marker-assisted backcrossing.

Phytoremediation potential of Medicinal and Aromatic plants.

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The rise in industrialization and urbanization has resulted in release of large quantities of heavy metals (Pb, As, Hg, Cd, Cr, etc.,) into the soil. These heavy metals accumulate in the environment and subsequently contaminate the food chain, thus posing a significant threat to soil, plant, animal & human health. Hence, a sustainable approach to mitigate heavy metal contamination is need of the hour.

"Phytoremediation" is the process of transformation, stabilization, degradation & detoxification of toxic effects of heavy metals in the environments with the use of plants and/or associated soil microbes by making use of the inherent biological mechanisms of microorganisms & plants. It is relatively recent technology and is perceived as cost-effective and eco-friendly technology with good public acceptance.

Medicinal & Aromatic plants hold great significance in containing heavy metal contamination. Being non-edible crop, plants possess minimum or no risk of food chain contamination. They act as potential phytostabilizers (immobilize heavy metals in the soil), hyper accumulators (absorb and store heavy metals in their tissues) & bio-monitors. Metal stress in certain medicinal and aromatic plants leads to increase in secondary metabolites & essential oil percentage, thus enhancing their monetary value. Ashwagandha is a good candidate for phytoremediation as the plant can absorb and store heavy metals in its roots. Basil plants have been shown to grow well even in soil contaminated with cadmium. Geranium plants produced high levels of certain chemicals (isomenthone, linalool, geraniol and citronellol) when grown in soil with nickel and lead.

Heavy metal pollution poses a significant threat to environment. Phytoremediation is a green solution to restore polluted soils and promote environmental health. Medicinal and aromatic plants effectively phytoremediate contaminated soil due to their unique properties enabling them to extract, tolerate & indicate heavy metals. These plants are valuable assets in phytoremediation, providing dual benefit viz., remediation of contaminated site and economic benefit in return. Future research should focus on proper industrial waste disposal, extensive field trials for identifying ideal hyperaccumulators, exploring metal uptake genes and integrating biotechnology for improving plant biomass, tolerance and plant remediation abilities.

The Role of Education in Promoting Environmental Awareness and Action

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Education is essential for developing environmental awareness and prompting action on global challenges. It is pivotal in intensifying understanding of issues like climate change and biodiversity loss. By integrating environmental education across disciplines and educational levels, individuals gain the knowledge and skills necessary to make informed decisions and adopt sustainable practices. Early exposure to environmental concepts fosters a sense of responsibility and stewardship among students, encouraging active engagement in conservation efforts.Additionally, educational institutions provide a platform for fostering innovative approaches to environmental issues, encouraging collaboration and critical thinking among students. Practical learning experiences such as field trips and hands-on projects deepen students' understanding of ecological principles and cultivate empathy towards nature and communities affected by environmental degradation.Furthermore, education empowers people to actively support policy reforms and join collective initiatives aimed at promoting environmental sustainability. Educational efforts are pivotal in molding individuals who are environmentally aware and capable of making positive contributions towards a sustainable future that benefits everyone. It emphasizes that through education, people not only gain awareness of sustainability challenges but also learn how to take proactive steps towards mitigating environmental impact and fostering resilience in the face of global environmental changes. Ultimately, education equips citizens with the tools and mindset necessary to participate actively in creating a world where environmental sustainability is prioritized and achieved.

Keyword: Education, Climate change, Environmental impact, Biodiversity loss, Knowledge, Sustainability

Thermal Pollution's Effect on Microbial Community: A Review

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Thermal pollution, caused by the construction of nuclear power plants to meet rising electricity demands, may have detrimental effects on the microbial community in aquatic ecosystems. The artificial warming of lakes and rivers can alter the composition and behavior of microorganisms, which can have a ripple effect on the entire ecosystem. The impact of temperature on microbial populations is significant, as it affects their reproduction, food requirements, and enzyme and chemical composition. Research has shown that different microorganisms can adapt to different temperatures, leading to selective enrichment and changes in the dominance of certain species. However, disruptions to the microbial community can have significant consequences for the purification of natural waters, as well as the decomposition of organic pollutants. It is important to consider the potential impacts of thermal pollution on aquatic ecosystems and to develop strategies to mitigate these effects.

Keywords: Thermal Pollution, Microbial Community, Biodiversity

Transforming Perishable Plant Residues into Sustainable Biofertilizers: A Green Approach to Waste Valorization

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The study explores an eco-friendly method for managing plant waste by converting it into valuable biofertilizer. Perishable plant waste, such as arrow bamboo, mango tree, and pigeon wood, was collected from Uka Tarsadia University and decomposed using a microbial blend containing Bacillus subtilis, Lactobacillus spp., and Aspergillus niger, known for efficient organic waste degradation to transform the waste into nutrient-rich compost. The waste was then analysed for its macronutrient content, specifically nitrogen, phosphorus, and potassium. Field trials with Kalmegh (Andrographis paniculata) plants showed significant improvements in soil quality after applying the Plant-Based Biofertilizer (PBB). The experiment included a control group (Positive and Negative Control) and five treatment groups, each replicated three times, totalling 21 units. Soil analysis 15 days after applying the Plant-Based Biofertilizer (PBB) revealed significant improvements compared to controls. In the field trials, treatment 2 (Soil + PBB at 7 kg/25 gm) had the highest nitrogen content (208 kg/ha), while treatment 3 (Soil + PBB at 7 kg/35 gm) had the highest phosphorus (302 kg/ha). Treatment 3 stood out with maximum plant height (88 cm), highest branches (19), longest leaf (2.40 cm), widest leaf (1.82 cm), shortest days to flowering (70 days), whereas the highest fresh leaf weight (3.92 gm) and highest dry leaf weight (0.65 gm) was observed in treatment 2. Overall, all treatments demonstrated superior growth and nutrient content compared to the controls, with treatments 2 and 3 identified as optimal for enhancing soil fertility. The Two-way ANOVA results showed significant differences among treatments, with Treatment 2 demonstrating the most effective combination for optimal growth, resulting in the best growth characteristics for Kalmegh.

Keywords: Plant Waste, Composting, Microbial Decomposition, Biofertilizer, Nutrient Analysis, ANOVA, Waste Management.

The Impact of Digital Overuse on Mental Health and Well-Being

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The growing use of digital technologies in the contemporary society has birthed a number of worries in terms of influence on mental health. This topic discusses negative consequences of technology use exposing its impact on psychological health, emotional status, and interpersonal relations. Spending too much time with technological gadgets especially the smart mobile phones and social networks increases incidences of anxiety, depression, and sleeping disorders. It is thought that constant connection with technology and exposure to stressors leads to interference with sleep, increased stress and feelings of incompetence due to the presented role models on the social media platforms. The abstract looks at how all these factors practically reduce mental health. Furthermore, its negative impact is on cognitive abilities that include the ability to focus and the memory. This brings about mental exhaustion and hence, decreased working efficiency or slow thinking amongst individuals. Main focuses on how a normal functioning of the brains is likely to be distorted and the consequences on overall efficiency of task performances. Openness has its negative consequences as well; which are social effects such as deteriorating the strength of personal face to face interactions and the overall destruction of social relations. Saying few words to fewer people, this topic describes the impact of diminished interpersonal touch on social includedness/affective relatedness. Therefore, concluding this abstract, the author calls for moderation in digital usage while stressing that people should employ certain methods that can help avoid the negative impact of digital products on their mental health. This abstract show that, through increased awareness and proper interventions, potential adverse effects of excessive use of digital technologies can be reduced, and an individual's well-being improved.

Keywords- Mental health, Negative consequences, Digital technologies, Stress

Women empowerment and gender-inclusive approaches

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The agricultural sector in India has traditionally been male-dominated, often overlooking women's significant contributions. However, women play a crucial role at all stages of the agricultural value chain, from production to marketing. Despite their substantial contributions, women farmers face discrimination, marginalization and limited access to resources. This marginalization is exacerbated by a triple divide—digital, gender, and rural—that rural women face in accessing technology, resulting in significant disparities compared to men. As male workers migrate to urban areas for better income and livelihoods, the feminization of agriculture in India is becoming increasingly evident. This shift places greater responsibility on women farmers requiring them to manage their farms alongside their traditional roles, which often results in significant physical and mental strain. Electronic databases such as Google Scholar, Web of Science, Semantic Scholar, SCOPUS, and PsycINFO were searched for the period from 2000 to 2024 using keywords including "psychological empowerment," "women in agriculture," "digital divide" and related terms. The findings indicate that, in India, women make up nearly 75% of full-time farm workers and are responsible for 60-80% of food production, with significant involvement across various allied sectors. Similarly, in developing and underdeveloped countries, women contribute significantly more to agricultural production than is often acknowledged. Literature suggests that most women in agriculture experience medium to low levels of psychological empowerment. This may be attributed to factors like low literacy rates, lack of self-confidence, limited skills, restricted opportunities to independently initiate and manage work processes, and fear of failure. Additionally, social, cultural, mobility, access, control, and financial barriers obstruct the technological empowerment of rural women. In conclusion, addressing the challenges faced by overworked and underpaid women is essential. To promote gender equity and empower them, a comprehensive approach is needed. Empowering women requires a bottom-up approach, emphasizing strategies that enable them to analyse their own situations and identify the societal changes necessary for their advancement. Policies focusing on land access, credit facilities, input provision, gender sensitization, and women's organization through FPOs and SHGs can effectively empower these vital contributors to India's food security.

Keywords: Psychological empowerment, Women in agriculture, Women empowerment, Technology

AQUATIC VEGETABLES A SOURCE OF UNDERUTILIZED VEGETABLES

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Aquatic vegetables are naturally available in plenty. Most aquatic vegetables naturally occur in areas with lots of water bodies, such as lakes, lagoons, ponds, ditches, and marshy, moist areas. India is considered one of the suitable niches and most of the boundaries have got unique gift of nature of unprecedented high rainfall and unique topography to harvest and preserve the natural drop, resulting in round the year availability of green lustrous aquatic edible greens, carbohydrate rich rhizomes and nutritionally packed flowers and fruits suitable for various vegetable uses.

Wetland communities in India rely on these sources for their daily needs of veggies and as an essential component of their way of life. Lotus and Water chestnut are some of the few examples which have been in use on various religious occasions since time immemorial. Aquatic species such as Eleocharias dulcis, Ipomoea aquatica and Nelumbo nucifera are among the most consumed vegetables. These are eaten in mean daily quantities exceeding 50g and contain high Ca, Fe and β-carotene concentrations. Water chestnuts (Eleocharias dulcis), Lotus (Nelumbo nucifera) and Water spinach (Ipomoea aquatica) are grown as aquatic vegetables.

Present food habits indicate that most consumers are fond of rhizomes of lotus. Starch and fat-rich horned fruits of Trapa bispinosa form a staple food. Young leaves, stems and roots of Ipomoea aquatica are eaten, as common vegetables. Using aquatic vegetables as food could alleviate protein shortages in the local population. Concerted efforts are needed to assess the food value of the native aquatic flora for their exploitation at a commercial scale.

Keywords: Aquatic Vegetables, Lotus, Water chestnut and Water Spinach

Vermicompost, the story of organic gold

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Vermicompost is a good nutrient organic fertilizer with diverse microbial communities, it plays a major role in improving growth and yield of field crops, vegetables, flower and fruit crops. Vermicomposting is the process of conversion of organic wastes into finely degraded peat like substances using earthworms, it is an alternative method for waste management through which vermicompost is produced with relatively higher nutrient content than compost and manures. Vermiwash is another important product obtained during vermicomposting, it is the liquid that is collected after the passage of water through a column of worm action. Vermiwash is rich in enzymes, plant growth hormones, vitamins along with micro and macronutrients which in-creases the resistance power of crops against various diseases and enhances the growth and productivity of crops. The concept of vermiculture of organic material with earthworms provides most useful organic manure on one hand and on the other hand it also minimizes the environmental pollution and health hazard. It maintains the soil in a proper homeostatic state. It also removes excessive amounts of heavy metals such as copper and lead and thereby serves as a means of detoxification. Vermicomposting is the best solution to the immediate problem of declining soil fertility and for production of food thus is the best means of abating pollution, soil degradation and discriminate use of chemical fertilizers.

Keyword- Vermicompost, Earthworm

Vertical Farming: A New Frontier in Urban Vegetable Production

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Vertical farming is a transformative innovation in urban agriculture, providing a sustainable and efficient method for producing vegetables in densely populated areas. As urbanization increases and arable land becomes scarce, vertical farming offers a viable alternative to traditional agriculture, which is often limited by space, seasonal changes, and environmental impact. This approach involves growing crops in vertically stacked layers within controlled indoor environments, such as repurposed warehouses or specially designed vertical structures. By utilizing advanced technologies like hydroponics, aeroponics, and LED lighting, vertical farming allows for precise control of growing conditions, optimizing factors such as light, temperature, and nutrient delivery. This not only maximizes space use but also reduces water consumption by up to 90% compared to conventional farming and eliminates the need for pesticides.

A key advantage of vertical farming is its ability to produce fresh vegetables year-round, independent of external climate conditions. This continuous production cycle ensures a consistent supply of high-quality produce and enables frequent harvesting, resulting in higher yields per square foot than traditional farming methods. Additionally, by locating farms closer to urban centers, vertical farming reduces the carbon footprint associated with transportation, contributing to environmental sustainability and improving urban food security.

However, the widespread adoption of vertical farming faces significant challenges, including high initial costs, energy demands, and the need for specialized technical knowledge. While energy consumption, particularly for lighting and climate control, remains a major operational expense, advancements in energy-efficient technologies are helping to mitigate these issues. As the industry continues to evolve, overcoming these challenges will be crucial to making vertical farming a more accessible and cost-effective solution for urban vegetable production, ultimately enhancing food security and reducing the environmental impact of agriculture in increasingly urbanized settings.

Keywords:- Vertical farming, Urban agriculture, Controlled environment agriculture (CEA), Hydroponics, Aeroponics, Sustainable agriculture, Urban food security.

Design and Development of Steam Generation System Compatible to Scheffler Solar Concentrator for Elephant Foot Yam (Amorphophallus paeoniifolius.)

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In present scenario solar energy had wide scope in solar thermal sector, because prices of conventional fuels are increasing day by day. In present experiment solar steam generation system based on Scheffler solar concentrator for steaming of Elephant foot yam (Amorphophallus paeoniifolius.) was design and developed. To overcome the problem of traditional cooking, efforts are made to design and develop steaming vessel for proper uniform steaming of Elephant Foot Yam slices in solar based steaming unit. During study system components such as copper receiver, header tank, and steaming vessel were fabricated and installed at the experimental site. For the tracking purpose solar photovoltaic based tracking mechanism was provided which needed one time manual adjustment at morning throughout the day.

The performance of steam generation system was carried out by conducting three consecutive trials in summer and winter season each. A known quantity of 30 liter water was filled in the storage tank and was heated by concentrating radiations reflected from the scheffler solar concentrator on receiver. The receiver painted with black paint absorbs and converts the concentrated solar radiation reflected from the Scheffler concentrator in to heat, which is used for steam generation. During winter and summer season initial 1.5-2 hours were required for sensible heating of water from room temperature to boiling point, thereafter gradually steam pressure increased due to convection current and it showed continuously increasing trend for all consecutive trials. It was observed that, the average overall thermal efficiency of steam generation system was 19.96 %.

Keywords: Scheffler solar concentrator, copper receiver, steaming vessel, Elephant Foot Yam, etc.

VRT in Agriculture Crops.

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Variable rate technology (VRT) is a new and powerful advancement in the precision agriculture revolution. VRT reduces input and labor costs while maintaining whole-farm profitability and increasing the sustainability of a grower's farming practices. VRT is a tool that allows farmers to apply fertilizer, water, chemicals, and seed at different rates across a field. VRT works by using GPS and GIS technology to locate precise locations in the field for material application, combined with collected data that informs a VRT-enabled piece of equipment, such as a seeder, sprayer or fertilizer spreader, exactly where and at what rates to apply products.The first advance in variable rate technology (VRT) to take farmers and growers by storm was the use of variable rate fertilizers (VRF) in the early 1990s. There are many forms of technology that are used in variable rate application for precision agriculture. They include everything from drones and satellites, to artificial intelligence (AI) and hyperspectral imaging. Regardless of which variable rate application technology is used, it is important to understand the general way in which this technology is applied.

Diversity and Taxonomy of Weevils from South India-Peninsular Curculionids

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South India is the southern part of the Deccan Peninsula in India. The region includes the states of Andhra Pradesh, Karnataka, Kerala, Tamil Nadu and Telangana, as well as the union territories of Lakshadweep and Puducherry. South India is a region of significant biodiversity and species richness, because it includes most of the Western and Eastern Ghats. Weevils (Curculionidae) are successful inhabitants of the world, inhabiting almost all ecosystems. These weevil species include several serious pests of agricultural crops, horticultural crops, forest trees, stored grains and some of them also act as pollinators and weed control agents. The weevil fauna of this ecologically important area is scarce, and the present study was therefore undertaken with the aim of providing information on the diversity of curculionids. A total of 2180 weevil specimens were collected from different parts of South India. From the collected specimens, 39 species were identified under the 18 genera of the family Curculionidae. Among the identified species, Odoiporus longicollis is abundant and widespread in all the study areas, followed by Myllocerus viridanus, Paramecops fainosa and Myllocrus discolor. Four new species have been described under the genus Myllocerus (two species), Imera (one species) and Orsophagous (one species) for the first time from India. Another new genus of flea weevil under the subfamily Rhynchaeninae has been identified on the plant Asian tarenna, Tarenna asiatica (Rubiaceae) from Tamil Nadu. Another interesting new aquatic weevil species has been identified under the genus Bagous, which was collected from the weed Nymphoides indica in the lake near Savandurga, Karnataka. Similarly, another potential weed control agent, Calotropis weevils, Paramecops farinosa adults and mature larvae were collected and documented the different life stages. The survey and collection will be extended to other regions of the Eastern Ghats of India, such as Andhra Pradesh and Odisha. However, more systematic efforts need to be made for the collection of the important insect family Curculionidae from all habitats of India.

Effect of silica nanoparticles on yellow rust disease and productivity in wheat

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Yellow rust or stripe rust is a fungal disease that affects cultivation of wheat and cause severe loss to crop productivity as well as economy. Wheat is the second largest cultivated food crop in India and consumed by a large part of population. Decrease in its yield will pose vital nutritional and socio-economic challenges. Fungicides have traditionally been used for disease management, but concerns about their environmental impact have prompted the search for alternative strategies. Nanoparticles have emerged as a promising and eco-friendly solution. The foliar spray of commercially available silica nanoparticles was investigated for managing yellow rust disease in wheat. Nanoparticles were characterized using standard techniques such as SEM, FT-IR, DLS, etc. revealing their irregular shape and approximately 267 nm size. A field experiment evaluated the effects of silica nanoparticles at concentrations of 50 ppm, 100 ppm, 150 ppm, and 200 ppm on the tolerance to yellow rust disease and yield of yellow rust infected sensitive wheat variety PBW-343. The research revealed that foliar spray of silica nanoparticles significantly diminished the severity of yellow rust disease resulting in the high control efficiency, reaching 77.77%, along with a decrease in disease incidence, and the percentage disease index. There was also a notable reduction in the area under the disease progress curve (AUDPC). Silica nanoparticle treatment inhibited germination and caused abnormalities in the morphology of urediniospores. Morpho-physiological traits like shoot length, root length, leaf area, total chlorophyll, and carotenoid content in yellow rust-stressed plants significantly improved with silica nanoparticle treatment. Antioxidant enzymes, including superoxide dismutase, guaiacol peroxidase, catalase, and defense-related compounds such as phenolic content and phenylalanine ammonia-lyase (PAL) activity in yellow rust infected wheat showed remarkable elevation at the 200 ppm concentration. Silica nanoparticle application significantly improved the crop yield of infected wheat plants. Thus, the study suggests that silica nanoparticles play an important role in mitigating yellow rust stress and improving yield in PBW-343 and can be recommended for yellow rust disease tolerance in wheat at 200 ppm concentration.

Fostering Entrepreneurship through Mushroom Cultivation: A Case Study from West Tripura District

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Mushroom cultivation has emerged as a promising avenue for entrepreneurship development in the West Tripura District, offering significant opportunities for income generation and employment, particularly among the rural population. This study examines the potential of mushroom farming as a sustainable entrepreneurial venture, focusing on the production, processing, and marketing aspects. Through a series of training programs and support initiatives, farmers and local entrepreneurs have been equipped with the necessary skills and knowledge to engage in mushroom cultivation. The findings highlight the economic benefits, challenges, and the role of support systems in fostering entrepreneurship in this sector. The study also discusses the socio-economic impact on rural households, emphasizing the potential of mushroom cultivation to enhance food security and improve livelihoods. The insights derived from this research could inform policy decisions and further interventions aimed at promoting agricultural entrepreneurship in the region.

Keywords: Entrepreneurship development, Mushroom cultivation, West Tripura District, Rural livelihoods, Sustainable agriculture, Economic impact, Agricultural entrepreneurship, Food security.

Organic Farming and Sustainable Agriculture

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Organic farming and sustainable agriculture are approaches to growing food that aim to be more environmentally friendly and health-conscious. Organic farming avoids using synthetic chemicals like pesticides and fertilizers. Instead, it relies on natural methods to nourish the soil and protect crops. For instance, organic farmers might use compost, which is decomposed plant material, to enrich the soil. They also use natural predators to control pests rather than harmful chemicals. This approach helps to maintain soil health, supports biodiversity, and reduces pollution. Sustainable agriculture, on the other hand, focuses on practices that meet current food needs while ensuring that future generations can also produce food. This involves not only avoiding harmful chemicals but also using resources like water and soil in a way that prevents depletion and environmental harm. Sustainable methods can include crop rotation, which means changing the types of crops grown in a field each season to keep the soil healthy, and conservation tillage, which minimizes soil disturbance. Both organic farming and sustainable agriculture share the goal of protecting the environment, promoting animal welfare, and supporting the health of communities. They encourage practices that are less harmful to the planet and emphasize long-term agricultural productivity. In essence, these approaches strive to create a more balanced and resilient food system that benefits both people and the environment. Keywords: Organic farming, sustainable agriculture, pesticides, fertilizers, biodiversity.

Synthesis and Evaluation of Efficacy of Phytogenic Silver nanoparticles (AgNPs) in Contributing Heat Resilience in Wheat (*Triticum aestivum* L.) varieties.

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The present study was conducted to synthesize Silver nanoparticles (AgNPs) and to evaluate the effect of these phytogenic nanoparticles in contributing heat resilience in different varieties of wheat (*Triticum aestivum* L.). DBW 187 and Black wheat were subjected to field and isolated laboratory trials. Green synthesis of Silver nanoparticles (AgNPs) was performed by using leaves of Camellia sinensis and effect was observed. The synthesized nanoparticles were characterized for their size, shape and concentration by UV-Vis spectroscopy, FESEM, EDX, FTIR, DLS and AAS techniques. These techniques confirm the synthesis of Ag nanoparticles mostly in the range between 50-70 nm. The concentration of Ag nanoparticles in the solution were found to be 196 ppm. Different concentrations (12.5mg/l, 25mg/l, 50mg/l, 75mg/l and 100mg/l) of silver nanoparticles were formulated and applied on both the trials at different growth stages. Heat stress was applied in the range of 35-40˚C for 3h/day for three consecutive days in the laboratory trial. Exposure to heat stress alone reduced plant germination percentage (25% & 15.38%), plant height (42.44% & 19.25%), root length (28.84% & 15.25%), shoot length (47.96% & 21.92%), number of leaves (11.11% & 4.34%), fresh weight (13.33% & 12.85%) and dry weight (13.95% & 17.94%) in both Black wheat and DBW-187 respectively. In field trial both the varieties of wheat showed significant elevation in germination percentage, plant height, number of effective tillers, spike length, grains/spike, yield/plant in tested combinations, compared to control. The most significant enhancement in growth parameters were observed in plants treated with 75mg/l AgNPs. The study concludes that the optimized concentration of silver nanoparticles (AgNPs) can effectively improve heat stress resilience in wheat. Keywords: Silver nanoparticles, Triticum aestivum, Black wheat, DBW-187, heat resilience, growth parameters, crop improvement.

Advancing Finger Millet (Eleusine coracana) Through Genomic Resources and Breeding Strategies: Present Impacts and Future Prospects

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Eleusine coracana, also known as finger millet, is a staple grain that is highly valued in both Africa and Asia due to its remarkable nutritional content and ability to withstand challenging agro-ecological conditions. A promising route to improving global food and nutritional security is the advancement of finger millet through cutting-edge genetic resources and contemporary breeding methods. Genomic technologies have been employed in recent times to explore the genetic variety of the crop and find critical features related to disease resistance, production, and nutritional quality. Through focused breeding, these developments have sped up the creation of better kinds, allowing for a speedier response to changing environmental problems. Enhancing finger millet's resilience, nutritional content, and productivity further could help farmers and consumers in the future as breeding techniques and genetics advance.

Keywords: Finger millet genetics, Innovative genomic tools, Resilient crop improvement, Food security strategies, Optimized nutritional content

Severity of native Rhizoctonia strain and its morpho-pathological diversity determination

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Sheath blight of rice, caused by Rhizoctonia solani has emerged as a serious threat to various cereals and vegetable cultivars. Diverse anastomoses group and quick adoptability makes it more vulnerable at diverse geographical locations. Prevalent weather condition nearly 25-30º C coupling with 70-90% relative humidity triggers disease progress. Present investigation was conducted to detect the morphological variability of the pathogen, pathogenicity analysis by performing a seed mortality test using six different rice germplasms and the virulent host by detach leaf assay using In-vitro cross inoculation technique (IVCT). Cultural variability study was estimated on diverse nutritional media viz: Potato dextrose agar (PDA), Czapek dox agar, Oat meal agar, V8 agar media. Highest mycelial growth of R. solani isolates was observed in PDA and Czapekdox agar with diameter of 87.0 mm and 86.7 mm respectively. On PDA the mycelium exhibited and abundant growth appearing off white while V8 agar showed yellow color hallow in the central portion of the culture plate. Oat meal agar produced maximum no. of sclerotia (53), followed by PDA (51), Czapex Dox agar (43) and V8 agar media (39). In the seed mortality test, six rice germ plasms were evaluated viz: BB-11(V1), GB-3(V2), MTU-56 (V3), Sonamukhi (V4), NCR- 33892 (V5), Jaya (V6). Post inoculated 9 DAI (Days after inoculation), V6 exhibited the highest percentage of seed infection (100%), followed by V3, V4 with the same percent of infection (96%), V5 (93%), V2 (86%) and V1 (83%). The highest PDI (percent disease incidence) was recoded in rice (94.44%) after 96 hr. of inoculation followed by maize (83.33%) and green gram (75%) in the IVCT test. R. solani showed a higher disease incidence in rice compare to other crops. Present investigation is a concise draft of morpho cultural behavior of R. solani.

Keywords: Sheath blight, R. solani, Virulent, IVCT, Sclerotia.

Smart Agriculture – Adaption of A.I. driven applications to promote sustainable agriculture

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The application of artificial intelligence has emerged as a transformative technological development, revolutionizing various industries. AI-powered systems possess the capability to analyze substantial volumes of data gathered from sensors, satellite imagery, and other sources, thereby generating real-time insights into the health of crops, soil conditions, and prevailing weather patterns. Leveraging these insights, farmers can make more informed decisions pertaining to the allocation of resources, such as optimizing irrigation schedules, tailoring the application of fertilizers, and implementing targeted pest management strategies. A further significant application of artificial intelligence in agriculture is in the realm of post-harvest management. AI-powered systems can evaluate data from diverse sources, such as sensor networks, to optimize storage environments, forecast product shelf life, and detect potential spoilage or contamination. This empowers farmers and food processors to diminish waste and enhance the quality of their produce. By harnessing this technology, farmers can enhance the efficiency of their operations, boost crop yields, and better adapt to the pressing challenges presented by climate change and resource constraints. The Indian government has undertaken numerous initiatives to encourage the adoption of technology within the agricultural domain. One such effort is the National E governance Program in the Agricultural Sector, a Mission Mode Project spanning the agriculture, livestock, and fisheries sectors. The government is also collaborating with startups to develop and scale up technological solutions for farmers. The government's National Agricultural Policy has highlighted the significance of information and communication technologies in catalyzing expedited growth within the agricultural domain. This policy impetus has culminated in the implementation of diverse e-agriculture initiatives, such as the development of web based platforms, data management systems, and the reinforcement of IT infrastructure to enhance farmers' accessibility to information. The underlying assumption is that the use of ICTs can address the persistent problem of information deficit faced by Indian farmers, significantly reducing costs and enhancing market participation.

Biological control of invasive pest species

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Invasive insect pests are a significant and accelerating threat to agricultural productivity in India. Introduction biological control,the introduction,release,and establishment of host-specific efficacious natural enemies,is an effective management tool for permanently suppressing the invasive pest population over vast areas.Biological control of invasive pests likely to become increasingly important in the future with no evident abatement in the rate of invasion by pest worldwide.This presentation explores the principles and practices of biological control,highlighting successful case studies and innovative approaches.we also discusses the benefits and challenges of using predators,parasitoids, pathogens and nematodes to control invasive pest as well as future directions for research and development. By using biological control, we can reduce the usage of chemical pesticides, protect ecosystems and promote environmentally friendly pest management strategies.

Advancing Sustainable Agriculture in Longleng: Integrating Traditional Knowledge and Modern Practices for Environmental and Socio-Economic Resilience.

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Sustainable agriculture in Nagaland, with a focus on Longleng, represents a critical approach to enhancing agricultural productivity while preserving environmental health and socio-economic stability. In this context, sustainable practices integrate traditional knowledge with modern techniques to address the unique challenges faced by farmers in the region. Emphasis is placed on promoting organic farming, utilizing local resources effectively, and adopting conservation practices that protect soil fertility and biodiversity. Key strategies include the development of neem-based pesticides, which offer an eco-friendly alternative to synthetic chemicals, and the implementation of integrated pest management (IPM) systems tailored to local conditions. Additionally, the promotion of crop diversification and the use of indigenous plant species support resilience against pests and diseases, thereby ensuring food security. Educational programs and farmer training initiatives are crucial in disseminating knowledge and fostering skills necessary for sustainable practices. By leveraging community involvement and focusing on adaptive strategies that respect local customs and knowledge, sustainable agriculture in Longleng aims to achieve long-term agricultural productivity while safeguarding natural resources and improving the livelihoods of local farmers. This holistic approach not only enhances agricultural efficiency but also aligns with broader goals of environmental stewardship and socio-economic development in the region.

Keywords: Sustainable agriculture, Longleng, Organic practices, Neem pesticides, Community involvement, Resilience.

Genome-Wide Association Study to Identify QTNs for Quality Traits, Seed Parameters and Yield Related Traits in Bread Wheat and KASP validation of Robust SNPs under Heat Stress Regime

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Wheat (Triticum aestivum L. em. Thell) is a major cereal crop of the world and contributes about 35% of world grain production and 50% of the world grain trade. However, due to the drastic climatic changes from last few decades, wheat has been a victim of several abiotic stresses. Ambient temperatures have increased since the beginning of the century and are predicted to continue rising under climate change. Such increases in temperature can cause heat stress: a severe threat to wheat production in many countries, particularly when it occurs during reproductive and grain-filling phases and is so called end-of-season or terminal heat stress. In general, heat stress under late sown conditions has more negative impact on grain yield and seed morphometry whereas, most biochemical parameters shows positive behavior under such circumstances. The generation of heat-tolerant cultivars may be an efficient and cost-effective strategy to reduce the severe and devastating impacts of heat stress on crops. Wild relatives and landraces are the primary sources of QTNs/genes for the development of HS-tolerant cultivars. To identify the new sources of improving grain yield and nutritional quality under heat stress conditions, we performed genome wide association study (GWAS) using a collection of 126 bread wheat accessions. The phenotypic diversity was studied for 19 yield related, 11 seed morpho-metrical and 5 biochemical parameters. In current study, 35K-SNP Axiom array was utilized that contains 35144 markers derived from SNP genotyping of selected wheat genotypes and finally 15805 polymorphic SNPs were selected for the target traits using minor allele frequency threshold of 0.1 (10%). Each chromosome had an average of 752.6 polymorphic SNP markers, which ranged from 287 for Chr4D to 1140 for Chr2B and were evenly distributed across the 21 chromosomes. Population structure analysis revealed two subgroups (SP1 and SP2) in the current association panel. Furthermore, linkage disequilibrium across whole wheat genome was assessed at $r^2 = 0.17$ and LD decayed the fastest in sub-genome A (3.16 Mb), followed by sub-genomes

D (3.18 Mb) and B (4.81). For detecting significant and novel genomic regions/QTNs and their putative candidate genes, multilocus GWAS (ML-GWAS) was employed with six different models (mrMLM, FASTmrMLM, FASTmrEMMA, pLARmEB, ISIS EM-BLASSO, and pKWmEB). All the models were set at a logarithm of the odd (LOD) score ≥3 or p-value of 2×10^{-4}. For yield related traits, a total of 433 QTNs were detected by at least two models. Out of these, 198 QTNs were found using three or more models, of which 155 QTNs fall into the multi-model and single location group and the remaining 43 QTNs fall into the multi-model and multi-location category with phenotypic variation ranged from R^2 = 3.4476% to 57.83%. Additionally, 14 novel and 9 pleiotropic yield related QTNs have been identified in this case. For seed morphometrical traits, 232 QTNs have been identified by at least two models. Among these, 102 QTNs were detected using three or more models, of which 90 QTNs belong to the group of multi-model and single location category, while the remaining 12 QTNs falls under multi-model and multi-locations group with the phenotypic variation ranged from R^2 = 4.34 % to 52.89 %. Furthermore, 12 novel and 3 pleiotropic QTNs were discovered for seed morphometrical traits. For grain quality parameters, 67 significant QTNs have been identified by atleast two models. Among these, 38 QTNs were detected using three or more models, with 21 QTNs belonging to the multi-model and single location category, and the remaining 17 QTNs belonging to the multi-model and multi-locations group with the phenotypic variation ranged from R^2 = 3.1991% to 32.56%. 17 novel QTNs were identified in this case. However, no pleiotropic QTN was discovered for the same. Among various models used in ML_GWAS, mrMLM has proved to be most powerful in identifying QTNs for yield related and seed morphometrical traits. However, for QTNs of biochemical parameters, FASTmrMLM proved to be the best one. Additionally, gene annotations were done only for the highly significant and consistent QTNs since they were thought to be more reliable and capable of performing well in all environments. Furthermore, six significant SNP makers were validated through KASP marker analysis. At the end we identified 8 heat tolerant accessions for yield, 5 for protein, 4 for amylose, 4 for iron and 3 for zinc. The findings of this study can be utilized variously in crop improvement programs viz., development of HT varieties, biofortification, MAB, and value addition to national gene bank.

Keywords: Bread wheat, heat stress, yield, seed morphometry, grain quality, SNP, ML-GWAS, QTNs, KASP validation, pleiotropic QTN

Exploring the Growth-Enhancing Capacities of Groundnut Root Nodule Endophytes from Gujarat

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Groundnut (Arachis hypogaea), also known as peanut, stands as a pivotal oilseed and protein-rich crop globally. India is 2nd largest groundnut producing nation followed by China across globe. Gujarat being the leading producer, accounting for a substantial portion with nearly 46% of total production of nation. The Saurashtra region, a key hub for groundnut cultivation, plays a significant role in Gujarat's production landscape. However, sustainable groundnut production in Saurashtra faces multifaceted challenges including adverse weather conditions, moisture stress, soil fertility issues, and biotic stresses such as fungal infections. In addressing these challenges, Plant Growth Promoting Rhizobacteria (PGPR) emerge as promising solutions due to their diverse beneficial traits including nitrogen fixation, phosphate solubilization, and phytohormone production. The symbiotic relationship between leguminous plants and nitrogen-fixing bacteria in root nodules presents a unique opportunity for harnessing indigenous microbial resources to enhance crop productivity and soil fertility. In this research, potential of groundnut root nodule endophytes sourced from organic farming fields to promote plant growth has been explored. Investigation focused on evaluating various parameters such as nitrogen fixation, phosphate and zinc solubilization, ACC deaminase production, HCN production, and siderophore production among isolated bacterial strains have also been carried out. In addition, HPLC analysis to identify organic acids responsible for pH drop and phosphate solubilization, including but not limited to gluconic, citric, malic, succinic, glucoronic, oxalic, fumaric, and ascorbic acids was conducted. Twenty-five groundnut nodule- entophytes isolated from the various organic farming fields were evaluated for their PGP potentials. Results indicated nineteen bacterial isolates were potent for nitrogen fixation and phosphate solubilization, two for zinc solubilization, eighteen for ACC Deaminase, three for HCN Production and four for siderophore production. Seven were found to be potent producers of gluconic acid, glucoronic acid, maleic acid and citric acid. 16s rDNA sequencing revealed that isolates belong to Rhizobium and Pseudomonas species. Notably, Rhizobium species exhibited significant potential in glucoronic acid production, while Pseudomonas species demonstrated proficiency in producing glucoronic acid, gluconic acid, maleic acid, and citric acid. Furthermore, selected isolates displayed desirable phenotypes that can be inoculated onto groundnut seedlings to assess their efficacy in practical agricultural scenario. These findings underscore the importance of leveraging indigenous microbial resources for sustainable agriculture, offering insights into the development of biotechnological interventions to bolster food security and environmental conservation. This research exemplifies the translational potential of harnessing microbial diversity in agricultural ecosystems, bridging the gap between model plant systems and real-world crop cultivation practices.

Keywords: N2 fixation, Phosphate solubilization, PGPR, Groundnut, Sustainable Agriculture, Real World Crop

Productivity and Profitability of Chickpea Cultivars in Rice Fallows

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A field experiment was carried out during rabi season of three consecutive years of 2017-18, 2018- 19 and 2019-20 at Field Experimental Block, RRTTS, Keonjhar, Odisha to study the effect of heat and thermal unit use of chickpea cultivars under various dates of sowing. The experiment was laid out in a Split plot Design with twelve treatments combinations, four dates of sowing (1st November, 15th November, 30th November and 15th December) kept in main plots, and three varieties of chickpea (JAKI - 9218, JG-14, JG-16) in sub plots with three replications. The results of the experiments revealed that chickpea sown on 15th November registered the maximum mean grain yield of 1040 kg/ha, fetched maximum mean net return of Rs. 26895/- per ha with B:C of 1.89. Growing chickpea variety JAKI 9218 fetched maximum mean net return of Rs. 27850/- per ha with B:C of 1.67. The maximum GDD to reach maturity (2316.3 days) and heliothermal unit was recorded on 1st November while minimum GDD of 1860.5 days was observed on 15th December. Amongmcultivars, JAKI 9218 had higher thermal unit requirement. Photothermal unit from date of emergence to maturity stage accounted higher with 1st November sowing, while lowest PTU were observed with the crop sown on 15th December during both all the years. Variety JAKI 9218 accounted non-significantly higher PTU than JG14 and JG 16 at all the phenological stages of the crop during all the years.

Keywords: Chickpea; sowing dates; climate change; GDD; helio thermal unit; photo thermal unit.

IMPACT OF PULSED ELECTRIC ON TEXTURAL PROPERTIES OF PANEER

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Pulsed electric field (PEF) is a potential pre-treatment technique to improve quality of milk by reducing its microbial load. However, since significant volumes of milk is processed by the dairy industry to dairy products, there is a need to evaluate the quality and acceptability of such products prepared using PEF treated milk. The present study aims at addressing this issue with respect to a popular coagulated product *Paneer*. Milk was treated with high voltage and frequency (55kV & 90 Hz) square waves of pulse width 900 µs for 100s. *Paneer* samples were prepared using milk subjected to three treatment protocols, i.e. conventional heat treatment (CHT), PEF treated milk subjected to conventional heat treatment (PT-CHT) and PEF treated milk (PT). Textural properties, including hardness, cohesiveness, springiness, gumminess, and chewiness, were evaluated using a textural profile analyzer during refrigerated storage. Initial hardness values were highest in T1 and T2 but significantly lower in T3, attributed to higher moisture content and the absence of heat-induced protein interactions in PEF-treated samples. Cohesiveness was higher in T1 and T2, with T3 showing the lowest values. Springiness was significantly higher in T3 initially, decreasing rapidly over storage, indicating a loss of elasticity due to moisture loss and fat solidification. Gumminess, a function of hardness and cohesiveness, was initially lower in T3 and increased during storage for all samples. Chewiness followed a similar trend, with T3 showing lower initial values and increasing over time. Both treatment method and storage period significantly influenced the textural properties of paneer, with PEF treatment alone producing softer, less cohesive, and more elastic paneer initially, but these qualities diminished faster during storage. The study demonstrated the potential of employing PEF with CHT to produce good quality *Paneer*.

Obstructive Urolithiasis (Retention of Urine) in Ruminants: Huge economic loss to farmers

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Urolithiasis is a diseased condition which occurs due to formation of uroliths as a consequence of pathophysiological processes which may be congenital and/or acquired, that results in increased concentration of less soluble crystalloids in urine. Obstructive urolithiasis is monotonously encountered surgical condition in all species of animals but most commonly in cattle, buffalo and sheep. It affects both male and female animals but males are more affected due to long and narrow urethra. Urethral obstruction is caused mainly due to lodgement of calculi in urethral passage. Obstructive urolithiasis is diagnosed on the basis of history, clinical examination, haemato-biochemical findings, urine analysis and ultrasonographic examination. Confirmed cases of obstructive urolithiasis are treated with conventional tube cystostomy and ultrasound guided tube cystostomy depending upon integrity of urinary bladder. Broad-spectrum antibiotics and anti-inflammatory drugs are administered intramuscularly for five consecutive days. Ammonium chloride is recommended per orally at a dose rate of 200-500 mg/kg body weight for 15 days. In ruminants, obstructive urolithiasis is a life-threatening condition that requires immediate attention and can cause potential economic losses.

Keywords: *urolithiasis, ruminants, obstructive, urine*

Agronomic bio-fortification of Zinc in Potato tuber yield

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Potato *(Solanum tuberosum L.)* is an important stable food crop for a huge population across Asian countries including India. Therefore, an attention towards bio-fortification of potato crop is carried out so as to reduce malnutrition of a mega population. In this context a field trial was conducted consecutively for two years under AICRP-Potato at Zonal Agriculture Research Station, Chhindwara during Rabi season. The study was undertaken in Randomized Block Design with five replications with different level of Zinc treatments. Result revealed that foliar application of Zinc sulphate @ 2g/liter at 25 and 50 days after planting gave highest tuber yield (33.42 t ha -1) and highest zinc content in tuber followed by foliar application of Zinc sulphate @ 2g/ liter at 25 days after planting (31.9 t ha -1) t/ha. Zinc plays a significant role in increasing the production as well as the quality of potato tuber. Zinc application in potato either as foliar or as soil-application increases Zn concentration in potato tuber up to 3-4 times which is quite higher than most of the commonly known crops. Finally, Zn-fortified potato could be a potential option for mitigating wide spread Zn-driven malnutrition in the Asian countries.

Keywords: bio-fortification, Potato, Zinc and micronutrient.

Navigating the shift from 'Co 0238' towards new resilient sugarcane varieties

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In recent years, advancements in genetic research and breeding techniques have enabled the development of new, high-performing sugarcane varieties tailored to specific agro-climatic zones and sugar market demands. Sugarcane varietal planning and variety replacement are crucial aspects of optimizing sugarcane production to ensure high yield, sugar recovery and resilience against pests and diseases. As a result, ongoing varietal planning and periodic replacement of poor performing/susceptible varieties is essential to adapt to vulnerable conditions and maintain the productivity. In past decade, sugarcane wonder variety 'Co 0238' has gained popularity among sugarcane growers and sugar mills due to its reliable performance for favorable attributes in production and sugar yield hence, significantly contributed to the prosperity of the farmers and sugar mills in the sub-tropical region of the country. However, during the past couple of years, it has been observed and reported that Co 0238 has become susceptible to red rot disease, consequently area under the cultivation of this variety is likely to declined. As per reports, in the year 2022, area under cultivation of Co 0238 variety has fall from 88% to 54%. Now a day, farmers are being advised to grow newly released varieties viz., Co 0118, CoLk 94184, CoLk 14201, CoLk 15466, and CoLk 16202 having average cane yield potential (t/ha) 78.20, 75, 91.34, 85.97 and 93.22 while sucrose percent is 18.64, 18.5, 18.11, 17.54 and 17.71 respectively. Therefore, in the present scenario these varieties are the better option for the replacement of 'Co 0238' variety without impacting the current yield and sugar recovery. Effective varietal planning, optimal balance between early and midlate varieties and replacement of poor performing or susceptible varieties are the crucial aspects in sugarcane cultivation and production system to enhance the productivity and sugar recovery in the future.

Effect of Biological Soil Amendments on Plant Growth and Soil Microbial Population in Peach Replant Sick Soil

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CITAAS/AB/2024/411

Agriculture is demanding more environmentally safe, sustainable production practices due to the adverse effect of conventional practices on soil biological activity and diversity. Soil rehabilitation and root growth stimulation is also of prime importance in orchards suffering from peach replant disease (PRD). Present study hypothesized that the fumigation, biofumigation, soil microbial inoculants can improve soil microbial activity and feeder root development, thereby having a positive impact on tree growth in newly established orchards, especially PRD sites. Furthermore, the effect of the various treatments on soil microbial community activity was examined, using soil enzyme assays and conventional microbial plate counts. The biofumigaton that performed the best in terms of growth increase were *Brassica* seed meal combination with PGPR. Soil enzyme assays indicated significant changes in soil microbial activity, with fumigated soil showing lower activity. Soils amended with PGPR had higher microbial activity.

Keywords- Peach replant disease, biofumigation, PGPR, plant growth, soil viable microorganism, enzyme activity.

INFLUENCE OF AGRONOMIC PRACTICES ON GROWTH AND YIELD OF GROUNDNUT UNDER GROUNDNUT – REDGRAM INTERCROPPING SYSTEM

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Field experiments were conducted at Agricultural Research Station, Bhavanisagar during 2020-21 to study the effect of agronomic practices on growth and yield of groundnut in groundnut-redgram intercropping system. The experiment consisted of the following treatments *viz*., Factor I (Cropping system): C_1- Sole Ground nut, C_2- Ground nut + Red gram (6:1); Factor II (Irrigation): I_1- Rainfed, I_2 - Irrigated; Factor 3 (Sowing window): S_1- 2nd Fortnight June, S_2 - 1st Fortnight July , S_3 - 2nd Fortnight July. The trial was laid out in a Factorial Randomized Block design with three replications. The results revealed that, the growth parameters viz., plant height, LAI and DMP were not influenced by the cropping system at all the stages. The first sowing window produced significantly higher LAI and dry matter production. At all the crop growth stages, irrigated crop recorded significantly higher plant height, LAI and dry matter production than rainfed crop. Irrigated crop resulted in significantly higher number of pods, whereas hundred kernel weight was not influenced by the irrigation. The Second Fortnight June sowing window produced distinctly more number of pods (22.4 pods/plant) and was on comparable with second Fortnight July sowing. The pod yield of groundnut was not influenced by the cropping system. Irrigated crop recorded significantly higher pod yield (2203 kg/ha) than the rainfed crop (1905 kg/ha). First sowing window of 2nd Fortnight June recorded significantly higher groundnut pod yields (2225 kg/ha) and was on par with second sowing. From this study, it could be concluded that, Groundnut intercropped with redgram at 6 : 1 ratio under irrigated condition sown during 2nd Fortnight June (Ist sowing window) produced higher net income of Rs. 79635 with a benefit cost ratio of 2.47.

Key words: Cropping system, Irrigation, Sowing window, number of pods and pod yield

EFFECT OF NANO UREA APPLICATION ON GROWTH AND YIELD OF FODDER MAIZE

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Field experiments were conducted at Maize Research Station, Vagarai during 2022-23 to study the application of nano urea on growth and green fodder yield fodder maize. The experiment consisted of the following treatments *viz*., T_1 - RDF (30:40:20 Kg NPK/ha at basal + 30 Kg N/ha at 30 DAS), T_2 -30:40:20 Kg NPK/ha at basal + 30 kg RDN/ha through Nano Urea at 30 DAS, T_3 - 30:40:20 Kg NPK/ha at basal + 15kg RDN through Nano Urea at 15 DAS + 15kg, RDN through Nano Urea at 30 DAS, T_4 - 30:40:20 Kg NPK at basal + 10kg RDN through Nano Urea at 10 DAS + 10kg RDN through Nano Urea at 20 DAS +10kg RDN through Nano Urea at 30 DAS, T_5 - N (Control), P and K as RDF at basal. The trial was laid out in randomized Block design with four replications. The results revealed that, application of 30:40:20 Kg NPK at basal + 10kg RDN through Nano Urea in 3 splits at 10,20 and 30 DAS (T_4) recorded significantly higher plant height (257.6 cm) than other treatments. The lowest plant height was observed in T_5 - N (Control), P and K as RDF at Basal (226.5 cm). The same trend was noticed as highest stem girth (16.6 cm) and highest leaf area index (12.67) in T_4. Significantly higher leaf stem ratio (0.48) and chlorophyll index (58.57) were also noticed in the application of 30:40:20 Kg NPK at basal + 10kg RDN through Nano Urea in 3 splits at 10,20 and 30 DAS. Highest greenfodder yield (39.84 t/ha) and dry matter production (10.92 t/ha) were also recorded in the application of 30 kg N as urea at basal and top dressing of 30 kg N through Nano urea in 3 splits at 10,20 and 30 DAS and it was on par with application of 30 kg N as urea at basal and top dressing of 30 kg N through Nano urea in 2 splits at 15 and 30 DAS (39.37 t/ha). The lowest green fodder yield and dry matter production in the application of P and K as RDF at basal with 14.25 t/ha and 3.46 t/ha respectively. From this study, it could be concluded that, application of 30:40:20 Kg NPK at basal + 30kg RDN through Nano Urea at 30 DAS registered highest net return (28310 Rs/ha) and B:C ratio (1.46)

Keywords: Fodder maize, Nano urea, leaf stem ratio, dry matter production and green fodder yield

Trichome density analysis of jassid resistance in upland cotton (*Gossypium hirsutum* L.)

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The field experiments were conducted at department of cotton, CPBG, TNAU, Coimbatore for three consecutive years from 2019-20 to 2020-21 for studying biochemical and morphological factors responsible for resistance against jassids on cotton. Results indicated that based on infestation of jassids, biochemical and morphological traits of cotton, the hybrid CO 17 x RAHC 1040 and GJHV 534 x RAHC 1040 are recommended as resistant against jassid. Correlation studies revealed that trichome density of cotton genotype had negative direct effect (- 0.959) on jassid infestation. Thickness of leaf midrib has positive and direct effect (0.987) on jassid infestation. Thickness of leaf lamina, gossypol content and total phenols showed significant and negative (-0.954, -0.932 and -0.921) correlation with jassid incidence. The peroxidase activity and polyphenol oxidase activity was higher in CO 17 x RAHC 1040 and showed significant positive correlation with jassid incidence (0.955 and 0.927). Nitrogen and phosphorus content showed significant positive (0.854 and 0.986) correlation with jassid incidence.

Keywords: Cotton genotypes, resistance jassid, biochemical traits, morphological traits

Mean Performance of the Parents and Hybrids for Growth and Yield Contributing Traits in Tomato

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The present investigation was carried out to obtain information based on *per se* performances of parents and their combinations for genetic improvement in tomatoes. A set of 18 F_1 hybrids developed as a result of line x tester mating design involving six lines and three testers were evaluated in randomized block design in three replications for the growth and yield characters in tomato. Parents and hybrids differed significantly among themselves for plant height and it ranged from 73.83 cm (LE-56 x Punjab Chhuhara) to 137.43 cm (LE- 65 x Pusa Gaurav) with a mean of 102.38 cm among hybrids. Genotypes differed significantly among themselves for number of primary branches per plant and it ranged from 6.44 (LE-64 x Pant T-3) to 10.23 (EC-1l65749 x Pant T-3) with mean of 8.28 among the hybrids. The highest number of branches was observed in EC-165749 x Pant T-3 (10.23). Average fruit weight varied from 41.36 g (LE-67 x Pusa Gaurav) to 81.55g (LE-64 x Pusa Gaurav) with a mean of 61.72 g among hybrids. Among the hybrids the highest fruit yield per plant was recorded by LE-56 × Pant T-3 (2.93 kg) but was on par with LE-56 × Pusa Gaurav (2.80 kg), LE-64 × Punjab Chhuhara (2.75 kg) and LE-56 × Punjab Chhuhara (2.72 kg), while the lowest fruit yield per plant was recorded with LE-62 × Pusa Gaurav (1.51 kg). The high yielding hybrids be utilized as commercial varieties after necessary multilocation trials.

Evaluation of parents and hybrids of tomato (*Soolanum lycopersicum* L.) for their suitability to prepare value added product (Puree)

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A set of 18 F1 hybrids developed as a result of line x tester mating design involving six lines and three testers were evaluated in completely randomized block design in three replications for their suitability to prepare puree. Ascorbic acid content of the puree was recorded significantly highest in the parent LE-56 (49.40 mg/100 g) followed by Punjab Chhuhara (44.20 mg/100 g), LE-67 (43.28 mg/100 g) and LE-65 (42.85 mg/100 g). Among the hybrids LE-56 × Pusa Gaurav (58.64 mg/100 g) recorded significantly highest ascorbic acid which was on par with LE-56 × Pant T-3 (57.24 mg/100 g) and theses are followed by LE-64 × Punjab Chhuhara (55.36 mg/100 g), LE-56 × Punjab Chhuhara (54.42 mg/100 g) and LE-67 × Pusa Gaurav (52.54 mg/100 g). The highest total carotenoid content of puree was recorded by the parent LE-64 (16.03 mg/100 g g) which was on par with Punjab chhuhara (15.44 mg/100 g) and LE-65 (15.38 mg/100 g). The hybrid LE-56 × Punjab Chhuhara (17.96 mg/100 g) recorded significantly highest total carotenoid content which was on par with LE-64 × Punjab Chhuhara (17.41 mg/100 g) and these are followed by LE-64 × Pusa Gaurav (16.65 mg/100 g), LE-62 × Punjab Chhuhara (16.36 mg/100 g) and LE-56 × Pusa Gaurav (16.08 mg/100 g). The significantly highest lycopene content of puree was recorded by the parent LE-64 (14.50 mg/100 g) followed by LE-65 (13.24 mg/100 g), Punjab Chhuhara (13.20 mg/100 g) and Pant T-3 (13.12 mg/100 g). The hybrid LE-56 x Punjab Chhuhara (16.80 mg/100 g) recorded significantly highest lycopene content followed by LE-64 x Punjab Chhuhara (15.40 mg/100 g), LE-65 x Pusa Gaurav (14.98 mg/100 g), LE-64 x Pusa Gaurav (14.60 mg/100 g) and LE-62 x Punjab Chhuhara (14.54 mg/100 g). The hybrids LE-56 × Pusa Gaurav and LE-56 × Punjab Chhuhara are best suited for processing having high ascorbic acid, total carotenoid content and lycopene content and these hybrids scored maximum for overall acceptability of the products.

Quantification of total elemental composition of soil primary particles in *Alfisol* pedons of Gadag District

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A study on quantification of total elemental composition of soil primary particles in Bailmadhapur micro-watershed of Gadag district, Karnataka was conducted during 2022-23. Horizon-wise soil samples were collected and analysed for major and trace elemental content in sand, silt and clay. Total content of major elements was determined by feeding digested extractant of soil fractions to ICP-OES (inductively coupled plasma optical emission spectroscopy). *Alfisol* pedons 1 and 2 revealed the various patterns in elemental composition across horizons and soil fractions. The study focused on three soil horizons (Ap, Bt1 and Bt2) and three soil fractions (sand, silt and clay) to unravel variations in element concentrations across depths and particle sizes. In the uppermost horizon (Ap) of *Alfisol,* silicon (Si), aluminium (Al) and iron (Fe) dominate the major elements, exhibiting significantly higher concentrations in the sand fraction (110.92, 54.93 and 52.39 g kg^{-1}, respectively). Calcium (Ca), magnesium (Mg), phosphorus (P) and sulphur (S) showed erratic distributions across soil fractions. Trace elements Zn, Pb and Sr demonstrated diverse behaviour (mean concentrations of 97.30, 18.22 and 56.83 mg kg^{-1}) varying among sand, silt and clay fractions. As depth increased into the Bt1 horizon, Si and Al maintained consistent patterns, while Fe concentrations declined. Ca, Mg, P and S decreased in sand content and trace elements exhibited variable behaviour, with Zn and Pb concentrations increasing in the clay fraction. In the Bt2 horizon, major elements Si, Al, Fe, Ca, Mg and K follow consistent trends, while trace elements Zn and Pb show slightly different patterns. The total elemental composition showed an erratic distribution across soil depth.

Investigation of Radon gas concentration and its implications on human health,

in Hawassa town, Ethiopia.

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Radon is a radioactive gas that is created from the decay of Radium. It is a major component of natural background radiation to which human beings are exposed and it exists everywhere in our environment. When Radon gas (Rn-222) is inhaled, its decay products Polonium (^{218}Po), Bismuth (^{214}Bi), and Lead (^{214}Pb) will be attached to the respiratory organs and cause decay. This decay process emits ionizing Alpha radiation, which can damage respiratory organ tissues. In a long time, this damage results in an increase in the risk of lung cancer. For this reason, Radon is known as the leading cause of lung cancer after smoking. Therefore, this is to investigate the radon concentration and associated health impact in randomly selected dwellings and offices, in Hawassa town, Ethiopia. The measurement is conducted in eighteen homes and three offices for three days in each room, from May to July 2024. Using Digital portable radon detector the short-term average radon concentration data is collected and analysed. The measured indoor radon concentration varies from 88.8 Bqm^{-3} to 192.4 Bqm^{-3}, and the mean of these data is 139.89 Bqm^{-3}. The minimum, maximum and mean annual effective dose rates are 2.24 mSvy^{-1}, 4.85 mSvy^{-1} and 3.53 mSvy^{-1} respectively. Excess Lifetime Cancer Risk ranges from a minimum value of 0.8% to a maximum value of 1.6%, with an average value of 1.2%. The collected data is compared with national and international studies and recommendations by different organizations. Most of the values are above the recent recommendation by the World Health Organization (100 Bqm^{-3}). The findings indicate the need for awareness creation, radon-level mitigation, and further study.

A Modern Approach to Agrarian Sustainability through the Use of an Integrated Farming System

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It is difficult for people to earn a living through traditional Indian agriculture because of the very low output, despite the fact that it requires significant inputs in the form of seeds, livestock breeds, fertilizers, pesticides, energy, feed, and labor. Traditional Indian agriculture is primarily focused on manpower, which requires a lot of hard work and energy. Because of the urgent need to consider an integrated farming system, there is a pressing need for an innovative farming system that has maximum productivity and fewer input drives. It recycles natural resources in an effective manner and ensures that nutrient equilibrium is maintained. It also ensures that soil, air, and water are sustainable, and it improves economic profitability and stability. As a result, it helps to preserve the quantity and variety of the living world.

Keywords: Agrarian, Livestock, Integrated farming system, sustainable.

Evaluation of Carnation (*Dianthus caryophyllus* L.) varieties for growth, flowering and vase life under polyhouse

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The present study entitled "Evaluation of Carnation (*Dianthus caryophyllus* L.) varieties for growth, flowering and vase life under polyhouse" was carried out at Agri-Tourism Centre and laboratory experiment in Department of Horticulture, at Chaudhary Charan Singh Haryana Agricultural University, Hisar during the year 2023-2024. The experiment was laid out in Completely Randomised Design and comprised of 10 treatments with three replications. Maximum plant height at harvest (68.07 cm), Length of internodes (10.59 cm), leaf area per plant (2391.97 cm^2) and number of flowers (6.67) were seen in Variety Baltico. However, maximum number of shoots (6.20), number of leaves (169.13), cut stem length (66.33 cm) and stalk length (78.53 cm) were noted in Variety Bizet.Variety Zeppelin showed maximum stalk thickness (6.59 mm), stem thickness (6.69 mm) and fresh cut flower weight (16.89 g) whereas minimum days (133.67) to initiate first bud and first flower harvesting stage (143.33 days) along with best duration of flowering (80.33 days) were marked by Variety Kiro. Maximum flower diameter (7.06 cm) and Vase life (7 days) was evident in Variety Merida and Variety Kloe respectively. Therefore, this can be concluded that all ten treatments showed significant difference among different vegetative, flowering and vase life characters. Varieties Baltico, Bizet, Kiro, and Kloe were found to be most prominent among different cultivars.

Keywords: Carnation, Vase life, Flowering, Polyhouse, Varieties.

Farm mechanization and post-harvest technologies to enhance farm profitability

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Integrating farm mechanization and post-harvest technologies presents a significant opportunity to optimize farm profitability, particularly within horticultural operations. Mechanization, which involves using artificial power-operated devices, and automation, integrating computer and sensor controls, have become essential in modern fruit orchards. These advancements can substantially enhance yields and reduce post-harvest losses, ensuring greater profitability for growers. The shift towards mechanization is driven not only by the need to boost productivity but also by growing labour shortages due to rural migration and the pursuit of improved urban living standards. However, the mechanization of fruit orchards faces several challenges. The diversity in fruit varieties, tree structures, and fruit fragility complicates the development of universally effective machinery. Additionally, the complex physiographic and environmental conditions of orchards, such as uneven terrains and varying weather, further hinder the consistent operation of mechanized systems. High initial costs of specialized equipment and the need for workforce retraining also pose significant economic barriers to widespread adoption. Advances in robotic technology, artificial intelligence, and machine learning promise the development of more efficient and gentle harvesting methods. Customizing machinery for different fruit types and refining cultural practices to align with mechanized systems are critical areas of focus. Precision agriculture technologies, like GPS-guided machinery and drones, are poised to play pivotal roles in optimizing orchard operations. Looking ahead, the integration of emerging technologies, such as electronic noses for detecting fruit ripeness and molecular sensors, is expected to revolutionize orchard management. Merging STEM (Science, Technology, Engineering and Mathematics) disciplines with pomology will be crucial in refining these technologies to meet the specific needs of fruit production. Continued investment in research and development is essential for overcoming the challenges of mechanization and automation, ultimately leading to more sustainable and profitable horticultural practices. Post-harvest technologies are equally vital in enhancing farm profitability by preserving produce quality, reducing losses, and extending shelf life. Innovations in harvesting, automated sorting, and storage methods like cold storage and modified atmosphere packaging are key. By adopting these technologies, farmers can reduce waste, improve product quality, and increase market value, leading to more sustainable and profitable operations.

Keywords: Mechanization, Artificial intelligence, STEM, Automation

A review on filleting machines used in fish processing

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Filleting machinery plays a crucial role in modern fish processing, significantly enhancing efficiency, yield, and safety compared to manual filleting. These machines are designed to automate the removal of bones, fins, skin, and other inedible parts from fish, resulting in high-quality fillets. The primary types of filleting machinery include single-lane, multi-lane, and precision filleting machines. Single-lane machines are used for larger fish and focus on high accuracy, while multi-lane machines process smaller fish at higher speeds to maximize throughput. Precision filleting machines employ advanced vision and sensor technology to optimize cut patterns, adapting to the varying sizes and shapes of fish. Filleting machines typically incorporate a combination of mechanical knives and rotating discs, or water jets in more advanced systems, to make precise cuts. The integration of automated systems, such as computer numerical control (CNC) and robotics, has further improved the accuracy and repeatability of filleting processes. Recent advancements have also focused on improving hygiene and reducing waste through better design and material selection, such as stainless steel and food-grade plastics, to minimize contamination risks. Additionally, innovations in machine learning algorithms allow real-time adjustments during operation, enhancing fillet yield and reducing processing time. Overall, the use of filleting machinery in fish processing is essential for meeting the growing global demand for seafood, ensuring consistent product quality, and maintaining competitive operations in the food industry.

Keywords: Filleting, Fish processing, Automation, Robotics, Fish industry.

Effect of Artificial LED and Natural Light on the Growth of Cucumber Plant (*Cucumis sativus*) in Hydroponic Dutch Bucket System

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Hydroponics is the latest innovation in farming where plants are grown in the absence of soil. In India adoption rate of hydroponics is estimated 13 – 15 % annually. In this context present study was conducted to analyze the morphological characteristics of cucumber plant in Dutch Bucket Hydroponic system. Moreover, comparative evaluation of morphological characteristics of cucumber plants were compared for natural light as well as artificial light emitting diode (LED). The experiment was carried out in the Naturally Ventilated Polyhouse (NVPH) and in the laboratory (as an indoor practice) in the campus of Dadasaheb Mokashi Collage of Agricultural Engineering and Technology Rajmachi, Karad (MH). Cucumber (*Cucumis sativus*) HY shiny variety was grown in natural and artificial light to evaluate different morphological characteristics such as leaf area, plant height and root length. Dutch bucket system of 10 buckets (each having capacity of 11 liters) was installed each in natural and artificial light source. Cucumber plants were grown in both environment for months June- July 2024. Initial seedlings of 15 days were transplanted in both environments. From the present experiment it was observed that, during and at the end of season growth of all the three selected parameters were found more satisfactory in artificial light as compared to natural light. At the end of the experiment average leaf area, average plant height, and average root length was observed approximately 123.15 cm^2, 154 cm, 30.1 cm for artificial light and 56.07 cm^2,110 cm, 25.3 cm for natural light, respectively. Therefore, from this study it was envisaged that overall average leaf area, average plant height and average root length was improved in artificial light by 54%, 28%, and 25%, respectively over natural light.

Keywords: Hydroponics, Dutch Bucket System, Morphological, Natural light, Artificial light (LED).

Impact of Hormonal and Signalling Molecule Treatments on Flower Induction in Pomegranate

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Globally, pomegranate flowering patterns are being impacted by constantly shifting climates. The search for compounds that can improve hermaphrodite blooms, fruit set as well as fruit quality is urgently needed. The current study set out to assess the effects of three different plant growth regulators, two polyamines, and five additional compounds on photosynthesis, flowering ratio, fruit set, and pomegranate fruit quality. Pomegranate plants of the commercial variety Bhagawa were treated with putrescine (44 ppm), spermidine (1.5 ppm), benzyl adenine (6 ppm), ammonium sulphate (5000 ppm), potassium dihydrogen phosphate (5000 ppm), proline (100 ppm), chitosan (500 ppm), ascorbic acid (250 ppm), and paclobutrazol (36 ppm) at full leaf expansion stage twice at an interval of 15 days. The best treatments to considerably increase hermaphrodite flowers were spermidine, potassium dihydrogen phosphate, and NAA; the hermaphrodite to male flower ratio was 0.39, 0.37, and 0.35, respectively, compared to 0.22 in the control treatment. With the exception of spermidine, NAA, and paclobutrazol, all treatments considerably boosted the amount of fruit set; potassium dihydrogen phosphate proved to be the most successful, resulting in 66% of fruit setting as compared to 43% in control plants. Treatments like potassium dihydrogen phosphate and putrescine significantly increased the anthocyanin content and therefore aril color in mature fruits (11% and 10%, respectively), while ammonium sulphate and NAA significantly increased total soluble solids (10% and 6% higher, respectively) in comparison to control. NAA also enhanced total phenols, ascorbic acid, and total antioxidants (3%, 15%, and 7%, respectively). While it is common practice to use NAA in pomegranate production, two ascorbic acid sprays might be added to improve the nutritional value of the fruits. Potassium dihydrogen phosphate applied foliarly twice during the blooming stage may be very beneficial for high-quality pomegranate production since it increases the quantity of hermaphrodite flowers, fruit setting, and fruit color. Overall, use of these chemicals can beneficial to pomegranate farmers to get more remuneration from harvest.

COGNIZANCE OF ICT GADGETS AMONG RURAL STUDENTS: UNRAVELING THE IMPACT OF DEMOGRAPHIC FACTORS

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This study explores the constraints faced by rural students in Haryana in utilizing ICT gadgets, with a focus on categorizing and ranking these challenges. The study was conducted in the Hisar district, the research targeted two government senior secondary schools, one each from the villages of Niyana and Bhiwani Rohilla. A total of 100 students from grades 9 to 12 participated in the study who were willing and interested to participate. The collection of data was done through the developed questionnaire from 1 May, 2022 to 30 May, 2022 by the researcher itself. The level of cognizance of ICT gadgets was measured in terms of cognizance for fifteen ICT gadgets. For the same purpose gadgets inventory was developed by the researcher. Questionnaire also comprises demographic information. The responses of the students were collected on two continuums in 'Yes' and 'No' with weightage of 1 and 0 respectively. The findings of the study indicated that both the school students had cent percent cognizance about computer, smart phones and television. Majority of the students of school-I had a high level of cognizance as compared to School-II students with a medium level of cognizance about the various ICT gadgets. There was significant difference between the mean of both the schools. It was also found that there was significantly positive correlation of age, education, family income, with cognizance of ICT gadgets in School-I and School-II. Also, there was significantly negative correlation of gender and distance from city or town with cognizance of ICT gadgets in School-II.

Incidence of PSB in wheat landrace and cultivars grown under P-starved conditions

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Phosphorus (P) is vital for plant growth and its deficiency limits plant growth and yield. PSB (phosphorus solubilizing bacteria) play a role in addressing phosphorus deficiency in wheat. The present work was done to determine the abundance of PSB in wheat varieties- LC306, HD3086 and PBW725 grown in P amended and P starved soils. Root and shoot samples were drawn at different growth stages- 20-25 days after sowing (DAS), 60 DAS and 90 DAS and at flowering stage. Appropriate dilution of surface sterilized root and shoot tissue was plated on Pikovskaya and NBRIP media following standard microbiological procedures. Mathematically different but statistically insignificant differences were recorded in abundance of PSB. Isolates with appreciable phosphorus solubilization were identified and deposited as General Deposit in CSIR-IMTECH- *Brevibacillus parabrevis* MTCC 13666 and *Brevibacillus parabrevis* MTCC 13667. 16S rRNA data of bacterial strains *Bacillus cereus, Bacillus cereus* and *Bacillus subtilis* is submitted to NCBI with accession number PP794656, PP794657 and PP794658, respectively. The paper will present the quantitative results of P solubilizing ability and also highlight the phylogenetic relation of the isolates. PSB improve P availability and enhance crop yield and support sustainable agriculture.

Genomic Approaches for Enhancing Isoquercitrin Content in Okra (*Abelmoschus esculentus* (L.) Moench)

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Isoquercitrin, a naturally occurring flavonoid glycoside known for its antioxidant, anti-inflammatory, and anti-carcinogenic properties, holds significant therapeutic potential. It is closely related to quercetin but differs in its glycosidic attachment, which can influence its bioavailability and biological activity. Okra (*Abelmoschus esculentus* L. Moench), a widely cultivated vegetable, is a promising source of isoquercitrin. However, the natural variation in isoquercitrin content among okra cultivars is limited, necessitating the development of novel strategies to enhance its concentration. Biotechnological approaches like genome-wide association studies (GWAS) and quantitative trait locus (QTL) mapping helps in identifying genetic loci associated with high isoquercitrin content. Candidate genes involved in flavonoid biosynthesis, such as those encoding flavanol synthase (FLS) and UDP-glucose 3-O-glucosyltransferase (UFGT) can be identified. Analyzing these genes using transcriptomic and metabolomic data helps to validate their role in isoquercitrin biosynthesis. In parallel, CRISPR-Cas9 gene editing can be utilized to enhance the expression of key biosynthetic genes, leading to increased isoquercitrin accumulation. The integration of genomic selection (GS) models allows the prediction of isoquercitrin content in breeding populations, facilitating the development of high-isoquercitrin okra lines. Combining these advanced genomic tools with traditional breeding techniques can significantly enhance the isoquercitrin content in okra contributing to improved human health and expanding the agricultural value of the crop.

Keywords: Isoquercitrin, Genome-wide association study, Gene Editing, Okra

Training Needs Assessment of Tribal Farmers of Nagaland State India.

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Training indicates a planned activity to which a person or group of person are subjected to induce learning which brings about desired behavioural changes that are beneficial to them in their day to day life. Training is a process of acquisition of new skills, attitude and knowledge in the context of improving ones productivity in an organization or enterprise unlike traditional farming practices. In brief, training is an instrument to induce change in the behaviour of individuals for personal, social and organizational effectiveness. An attempt has made to collect the data from 200 respondents based on proportionate random sampling (PPS) technique to know the training needs of farmers and farm women in Tseminyu district of Nagaland. The results of the findings of each major thematic area under training needs on crop production like 'Integrated farming and crop production' (82.50%) were found to be most needed. The thematic area under training needs on plant protection 'biological agents to control pest and diseases' (87.50%) were most needed. The thematic areas under training needs on horticultural crops 'plant propagation' (89.00%) were most needed. The thematic areas under animal husbandry and fishery sectors 'backyard piggery and poultry farming' (86.00%) were most needed. The thematic areas under training needs on home science and women empowerment 'food processing and value addition' (95.00%) were most needed. The thematic areas under farm production and extension education 'IFS for sustainable farm production' (86.00%) were most needed. The thematic areas under vocational training for rural youth 'soap making' (90.00%) were found to be most needed training.

Keyword: Training, Traditional farming, Thematic area, Assessment, Knowledge, Skill and Attitude.

Sustainable Agriculture: Harmonizing Tradition with Modern Innovation

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Organic agriculture is a dynamic and evolving approach to sustainable agriculture, prioritizing natural inputs and ecological processes to grow plants. Recent advancements have focused on enhancing soil health through advanced composting, biochar application, and cover crop integration, all of which boost soil fertility and microbial diversity. Innovations in pest management, such as biopesticides, pheromone traps, and beneficial insect habitats, have significantly reduced dependence on synthetic chemicals while fostering biodiversity. The adoption of precision agriculture tools, including soil sensors and drone technology, has empowered organic horticulturists to optimize water use, monitor crop health, and improve yields. Additionally, new organic fertilizers derived from waste materials and algae-based products have emerged as sustainable alternatives to conventional inputs. These advancements are bolstered by a growing interest in regenerative practices, which aim to restore ecosystems and sequester carbon through techniques like agroforestry and no-till farming. Although challenges such as labor intensity and lower yields compared to conventional methods remain, organic horticulture is expanding, fueled by consumer demand for healthier, environmentally-friendly produce. By integrating traditional knowledge with modern science, organic horticulture has become a key player in the global movement towards sustainable food systems, offering promising solutions for future agricultural resilience. Continued research and innovation are essential for overcoming current limitations and further enhancing the productivity and sustainability of organic agricultural practices.

Keywords: Sustainable agriculture, Biopesticides, No-till farming

Effect of Integrated nutrient management in Chickpea

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A field experiment was conducted during the Rabi season 2022-23 at the adopted village of durg district. The Chick pea crop is called wonder crop, It is a major legume crop recognized as the efficient producer of two scarce nutritional resources i.e. high quality protein (40 to 42 %) Chickpea now has been established also as on the most important oil seed crop in the world, accounting for more than 60 percent of Pulses produced and 30 percent of the total supply of all pulses. Now a day the commercial useof Chick pea by producing pulses Beans etc. is also being made for different items . The fertilizer management decisions and quite specific to the soil and growing conditions. The experimental soil had pH 7.9, electrical conductivity 0.42 d sm-1, organic carbon 0.45%, alkaline kmn04 extractable N 180 kg ha-1, and phosphorus 15.87 kg ha-1, and IN ammonium acetate extractable K 395 kg ha-1. There are two practices were adopted (farmer practices RDF) and improved practices (RDF + Biofertilizer) were applied as also application. Four farmer fields were selected for the treatment. A common pest management practices was adopted for the experiment. The data revealed the significant improvement in yield i.e. 17.0 q/ha, Net return Rs. 14000/- and B:C ratio 1.7 over the former practice yield 15.0q/ha, net return Rs. 11000/- and B:C ratio1.57Present study established the superiority of application of Integrated Nutrient Management Practices Organic and inorganic fertilizer applied in Chick pea crop for sustaining higher productivity, profitability and improvement of soil health.

Keywords: Integrated nutrient management, Economics, Bio fertilizer

Harmonizing Technological Advances and Agroforestry for Environmental Protection: Strategies for Adapting to and Mitigating Climate Change

Dara Hadassah Eunice

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Climate change is no longer a distant concern; it is an immediate crisis that is currently threatening both humanity and the natural environment globally. We are rapidly running out of time to prevent the most severe impacts of global warming. The role of technological innovations and agroforestry in addressing the impacts of climate change is through adaptation and mitigation strategies. Technological advancements such as Precision Agriculture, Remote Sensing, Artificial Intelligence, Internet of Things, Earth Observation, Renewable Energy technologies, Carbon Sequestration and soil health monitoring are crucial in optimizing resource use, enhancing crop yields, and minimizing environmental footprints. Agroforestry, which integrates trees with crops and livestock, provides significant benefits including carbon sequestration, biodiversity enhancement, and microclimate regulation. The intentional integration of trees and shrubs into crop and animal farming systems, offers numerous benefits for environmental conservation, climate change adaptation, and mitigation. Key aspects of agroforestry are: biodiversity enhancement, soil health improvement, water conservation, carbon sequestration, resilience to extreme weather, reduced greenhouse gas emissions, energy efficiency. Agroforestry innovations include: precision agroforestry, smart irrigation systems, carbon sequestration technologies which include biochar, carbon monitoring tools. Synergistic potential of combining technological innovations with agroforestry practices to build resilient agricultural systems. Integration of agroforestry with technological innovation would add the following benefits like enhanced productivity, climate resilience, environmental conservation, economic viability. Key adaptation strategies include the diversification of tree species, efficient water management, and adaptive management of tree-crop-livestock interactions. Mitigation efforts focus on reducing greenhouse gas emissions and improving soil carbon storage through agroforestry practices. Case studies from diverse agroecosystems illustrate successful implementations and highlight the challenges and opportunities for wider adoption. By leveraging the strengths of technological innovations and agroforestry, this paper provides a comprehensive approach to achieving sustainable agricultural development and environmental conservation in the context of climate change.

Keywords: Technological innovations, climate change, carbon sequestration, precision agriculture

Response of *Hedychium spicatum* to Different Growth Hormones Under Laboratory and Polyhouse Condition

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The aim of this study was to investigate the impact of plant growth hormones on the growth of seedlings and to quantify the biomass of the high-value medicinal plant Hedychium spicatum, both above and below ground, in laboratory and polyhouse environments in the temperate region of Bharsar, Uttarakhand. The study consists of ten (10) treatment levels, each consisting of different doses of three (3) growth hormones: T_2 (GA_3 @ 250 ppm), T_3 (GA_3 @ 500 ppm), T_4 (GA_3 @ 750 ppm), T_5 (IAA @ 250 ppm), T_6 (IAA @ 500 ppm), T_7 (IAA @ 750 ppm), T_8 (NAA @ 250 ppm), T_9 (NAA @ 500 ppm), T_{10} (NAA @ 750 ppm), and T_1 as control. It was observed that the administration of GA_3 @ 750 ppm had a substantial effect on the growth of seedling and biomass yield. The experimental findings revealed that the longest shoot length was observed in the laboratory (2.280 cm) under GA_3 @ 750 ppm. In the polyhouse, the shoot length varied throughout different months, with measurements of 4.357 cm, 7.367 cm, and 10.000 cm during April, May, and June, respectively under GA_3 @ 750 ppm. The longest root length was measured in T_4 in both laboratory conditions (2.353 cm) and polyhouse conditions (6.610 cm). In the polyhouse environment, the highest counts of leaves were noticed in T_4 (4.000, 6.220, and 9.110 during April, May, and June respectively). Similarly, the longest leaf length was measured in T_4 (4.020 cm, 6.033 cm, and 9.900 cm in April, May, and June respectively). Under polyhouse conditions, the T_4 treatment exhibited superior fresh shoot biomass (2.980 g) and dry shoot biomass (0.760 g). Further, the fresh root biomass (1.977 g) and dry root biomass (0.843 g) were also seen in T_4. The results demonstrated that it outperformed all other therapies in the trial across several metrics, and these observations were statistically significant. The experiment witnessed a strong positive correlation relation between fresh root and shoot biomass.

Keywords: Plant growth regulators (PGRs) gibberellic acid (GA_3), indole-3-acetic acid (IAA), naphthalene acetic acid (NAA), Polyhouse, Laboratory, *Hedychium spicatum*

Role of technology in improving horticulture

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Hi-tech horticulture combines innovative technologies to improve productivity, sustainability, and profitability in modern agriculture. To maximize growing conditions, this approach uses precision farming techniques like as automated irrigation, climate-controlled greenhouses, and sensor-based monitoring. Geographic Information Systems (GIS), drones, and satellite imaging provide reliable monitoring of crop health, soil conditions, and environmental factors, resulting in real-time data collection and informed decision-making. Hydroponics, aeroponics, and vertical farming innovations maximize space, use less water, and require less chemicals, all of which contribute to more sustainable practices. Pests and diseases are controlled using integrated pest management (IPM) systems and biocontrol agents, which reduce the need for synthetic pesticides. Biotechnology plays an important part in high-tech horticulture, with genetic modification and tissue culture resulting in high-yielding, disease-resistant, and climate-resilient crop varieties. These advancements boost crop quality and extend growing seasons, resulting in a consistent supply of fresh vegetables. Economically, high-tech horticulture reduces production costs by boosting efficiency and minimizing resource waste, resulting in higher profitability. The cultivation of high-quality crops with longer shelf life creates new business prospects. Overall, high-tech horticulture meets the issues of modern horticulture by emphasizing environmental stewardship and food security. The implementation of these cutting-edge practices is transforming the horticultural industry, paving the path for a more sustainable and successful agricultural future.

Keywords: HI-tech, Horticulture

Evaluating the Growth and Impact of Sports Facilities on Student Development in Colleges across Kashmir: Challenges and Opportunities

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The development of sports facilities in educational institutions is critical for fostering holistic student growth, contributing not only to physical well-being but also to mental and social development. This paper evaluates the current state of sports facilities in various colleges across Kashmir, examining their growth over recent years and assessing their impact on student development. Through a mixed-method approach, combining quantitative surveys and qualitative interviews with students, faculty, and administrators, the study highlights the significant role of sports infrastructure in enhancing student engagement, academic performance, and overall well-being. The analysis reveals considerable disparities in the availability and quality of sports facilities among colleges, often influenced by factors such as geographic location, funding, and administrative priorities. Furthermore, the paper explores the challenges faced by these institutions, including budget constraints, inadequate maintenance, and the need for specialised training staff. Despite these obstacles, the findings suggest that targeted investments in sports facilities can yield substantial benefits, not only improving student health but also fostering a sense of community and belonging. The paper concludes with a discussion of potential opportunities for enhancing sports infrastructure in the region, proposing strategic interventions and policy recommendations aimed at overcoming existing challenges. By addressing these issues, colleges in Kashmir can better leverage sports as a tool for student development, ultimately contributing to the broader educational and social objectives of the region.

Keywords: Sports Facilities, Student Development, Kashmir Colleges, Educational Infrastructure

Iron and zinc biofortification potential of endophytic bacterial isolates and their influence on soil nutrient status, enzymatic activity, and yield in three different varieties of soybean

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Endophytic microorganisms within plant tissues offer immense potential to enhance plant growth. This study investigates the efficacy of endophytic microorganisms in promoting soybean growth and biofortification, with a focus on zinc and iron assimilation. The one most promising zinc-solubilizing and siderophore-producing endophytes, PSSI3, were selected for detailed analysis. These strains were assessed for a range of plant growth-promoting traits, including phosphorus and potassium solubilization, nitrogen fixation, HCN, ammonia, EPS production, biofilm formation, indole acetic acid, gibberellic acid synthesis, and biocontrol against fungal pathogens. Strain PSSI3 excelled in solubilizing zinc oxide (8.76±0.17µg/ml) as measured by AAS and showed strong siderophore production (63.06±2.29%). GC-MS analysis identified gluconic acid as the predominant organic acid during zinc solubilization. Morphological, biochemical tests, and 16SrDNA sequencing identified PSSI3 as *Pseudomonas moraviensis*. Pot trials with soybean varieties Pant soybean 26, Pant soybean 25, and Pant soybean 1347 revealed significant enhancements in plant height, dry matter, nodules, pods, seed yield, and harvest index due to bacterial treatments. Additionally, these treatments improved soybean biochemical attributes, such as chlorophyll, carotenoids, nitrate reductase activity, and leghemoglobin content. Soil quality parameters, including pH, EC, organic carbon, NPK levels, and enzymatic activity, also improved under bacterial treatments. Soybeans treated with bacterial isolates exhibited the highest zinc (23.4 mg/gm) and iron (27.62mg/gm) content in grains of all three-soybean variety compared with control (uninoculated). These results underscore the potential of bacterial endophytes to significantly enhance soybean growth and biofortification, contributing to sustainable agricultural productivity and food security.

Impact of Climate Change on Food Security: Strategies for Resilient Food Systems

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The continued change in climate, already evident from increased global temperatures, seriously threatens food security by changing the nutrient profiles of agricultural food systems. High temperatures affect crop physiology and decrease essential crop nutrients like proteins, vitamins, or minerals. For instance, the high temperature might raise plant metabolism, which could lead to the shortening of the growth period and a reduction in nutrient adsorption. Heat stress, further, affects the synthesis of vital compounds like amino acids and antioxidants, hence affecting the nutritional quality of the crops as a whole. Temperature changes in soil microbial activity result in reduced nutrient availability, adding to plant nutrition. This is particularly true for the elevation of temperatures and their harmful effects on cereal crops, which play a substantial role in the contemporary diet. For example, both wheat and rice have shown to exhibit reductions in their protein content under heat stress, reducing their dietary quality. Similarly, the leguminous crops, supplying the dietary plant-based proteins, undergo a reduction in nitrogen fixation under higher temperatures, reducing their nutritional value. All these factors together increase the risk of malnutrition, more so in regions already vulnerable to food security. For this, developing strategies that can enhance the resilience of food systems becomes significant. These may include the development of climate-resilient crop varieties, sustainable agricultural practices, and policies that can ensure food security despite adverse impacts emanating from climate change. These will be necessary in providing assurance that agri-food systems can be resilient while keeping the generation well-nourished with effects from the escalating temperatures.

Keywords: Food security, Malnutrition, Climate-resilient, Agricultural and food systems, Climate change.

Impact of nutrition on IQ level of school children

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Brain development is rapid during early childhood years demonstrating the highest degree of plasticity. The inherent capacity to learn is present but it is modulated by the biological, socioeconomic as well as the psychosocial effects and the timing of these can alter the structure and function of the brain and resultant behavior. During these years due to poverty lack of stimulation or excessive stress brain development is affected. It results in deregulations of the hypothalamic-pituitary-adrenocortical system. The cognitive structure in a child has come about through the interaction between the brain and the environment over the course of development. In the initial stages of the development of neural system in the fetus, the physical characteristics of the brain are determined by genetic factors, but, immediately, the environment starts to influence this structure. After birth, the variety of environmental factors increases, but nutrition continues to be important throughout life.It is now recognized that brain development occurs over a much longer portion of the life-span than originally thought. The mechanism in which nutrition can affect brain development is that there are at least three important ways in which diet may affect the neurochemistry. First, the ingestion of food affects the availability of the precursors required for the synthesis of neurotransmitters. Second, food serves as the source of vitamins and minerals that are essential co-factors for the enzymes that synthesize. Third, dietary fats alter the composition of the nerve cell membrane and myelin sheath and that, in turn, influences neuronal function. Malnutrition alters brain development and intelligence by interfering with the overall health as well as with the child's energy level, and rate of motor development and growth. It is also found that iodine deficiency during pregnancy resulted in neuropsychological damage to progeny leading to lower IQ. A study on school children to see the effect of iodine intake of school children on their brain development was carried out which showed that there is positive and significant correlation between iodine intake and IQ. Positive correlation was also found between mother education and IQ of these children.

Keywords: Nutrition, IQ, Iodine, thyroid, mothers' education, poverty.

Innovative Solutions in Precision Farming: Exploring the Latest Software and Mobile Apps

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The combination of software and mobile applications has led to a considerable advance in precision farming, an innovative technique that aims to optimize agricultural processes. A thorough analysis of the most recent cutting-edge mobile apps and software used in precision farming is presented in this abstract. Starting with an overview of precision farming's core principles and goals, the paper highlights the need for cutting-edge technical solutions to modern agriculture's problems, including resource optimization, environmental sustainability. and productivity development. A thorough examination of software tools and mobile applications created especially for precision farming is then offered. Numerous features, such as data gathering, analysis, decision support systems, and remote monitoring, are included in these solutions. Additionally, the incorporation of cutting-edge technology is examined, emphasizing how they might enhance precision agriculture methods. Examples of these technologies include artificial intelligence, the Internet of Things (loT), and geographic information systems (GIS). Additionally, the review evaluates how these mobile apps and software are used and adopted at various agricultural operation scales, ranging from small-scale farms to major commercial organizations. Important variables affecting acceptance rates and implementation difficulties are covered, along with possible solutions for removing obstacles and optimizing advantages. The summary ends by providing some insights into potential future study areas and technology developments that could influence the software and mobile application ecosystem for precision farming. To further innovate and develop customized solutions for sustainable and effective agricultural production systems, emphasis is placed on the significance of interdisciplinary collaboration between the disciplines of agriculture, engineering, and computer science.

Keyword: Precision farming, Internet of things, Software, Applications

Integrating Remote Sensing and GIS for Crop Acreage Estimation of Rabi Season in Middle Gujarat, India

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Accurate and precise information about crop type, crop stage, and crop acreage is essential for the sustainable utilization of available water resources. This study focuses on estimating Rabi season crops in the Panchmahal district of Gujarat state, India. The generation of spectral profiles and crop acreage estimation involved classifying Sentinel-2 satellite images using unsupervised classification with ISODATA clustering techniques. The satellite image of the study area was classified into 52 classes and overlaid with a ground truth point shapefile on the classified image. NDVI-based signatures from twelve dates during the Rabi season of 2020-2021 were derived from Sentinel-2 data. This NDVI dataset was used to classify the major crops in the study area: maize, wheat, castor, chilli, cotton, pigeon pea, sorghum, and tobacco. The total growing areas for these crops were estimated as follows: 34,472.59 ha for maize, 16,517.09 ha for wheat, 2,186.92 ha for castor, 250.59 ha for chilli, 8,005.56 ha for cotton, 1,130.93 ha for pigeon pea, 1,719.38 ha for sorghum, and 1,468.52 ha for tobacco. The overall accuracy and kappa coefficient for crop acreage estimation were found to be 90.71% and 0.78%, respectively. The results of this acreage estimation will help understand the cropping pattern and its interaction with spatial and temporal variability, aiding in the present and future estimation of crop water requirements and the proper availability of resources in this selected region.

Keywords: Sentinel-2, ISODATA unsupervised classification; kappa coefficient; cropping pattern; accuracy assessment.

MORPHOLOGICAL AND BIOCHEMICAL CHARACTERIZATION OF ELITE GENOTYPES OF HATKORA (*Citrus macroptera* Mont.) from Mizoram

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Crop improvement can be achieved genetically, by developing resistant types, by devising improvement agronomic practices, by adapting to diverse environments and by correcting soil nutrient levels. Use of available genetic resources can be a major part of any crop improvement programme. The success of a breeding program depends on development of improved genotypes through assessment of genetic variability. The present investigation was conducted to study the genetic variability among elite Hatkora accessions from Mizoram with respect to their biochemical constituents, bioactive compounds and antioxidant activity. The observations on polymorphic qualitative characters revealed that there is considerable variations in terms of leaf lamina shape, leaf lamina margin, leaf apex shape, petiole wing shape, fruit shape, fruit apex shape, fruit base shape, seed shape and colour. Significant differences were observed among fruit quantitative characters i.*e* fruit weight, fruit volume, fruit length, fruit diameter, rind thickness, juice volume, juice percentage and number of seeds per fruit. The effect of different geographical locations of the districts was also found to be significant for fruit length, fruit weight and juice percentage.

Keywords: Hatkora, morphological, biochemical, Mizoram

In Vitro Examination of Phytoextracts and Fungicides for Effective Management of *Neopestalotiopsis eucalypticola* in Sapota

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Sapota (*Achras sapota* L.) belongs to the family Sapotaceae. Sapota (Sapodilla, Chikoo) is a tropical fruit known for its sweet flavor and nutritional benefits. Sapota is one of the major Fruit crop grown in India. Its significance in the agricultural landscape is undeniable, acting as a cornerstone in sustaining the country's orchards and economy. Using the Poisoned Food Technique, the effectiveness of seven Phytoextracts was examined at 10% and 20% concentrations. While resistance was observed at a 10% concentration, *Zingiber officinale* (60.92%) exhibited the highest mycelial growth inhibition while *Ocimum sanctum* and *Mentha peperita* (7.59%) displayed least efficacy, at 20% Conversely, *Allium sativum* (73.15%) showed maximum inhibition while *Azadiractin indica* (9.63%) showed least inhibition. While resistance was observed at a 10% concentration, *Zingiber officinale* (60.92%) exhibited the highest mycelial growth inhibition while *Ocimum sanctum* and *Mentha peperita* (7.59%) displayed least efficacy, at 20% Conversely, *Allium sativum* (73.15%) showed maximum inhibition while *Azadiractin indica* (9.63%) showed least inhibition. Systemic, non-systemic, and combined fungicides were also examined at different concentrations using the Poisoned Food Technique. Notably, Thiophanate methyl 70% WP proved effective at both 500 ppm and 1000 ppm concentrations, inhibiting mycelial growth by 92.78% and 93.33%, respectively. Among non-systemic fungicides, Copper oxychloride 50% WP demonstrated substantial inhibition (89.63% and 89.67% at 1500 ppm and 2000 ppm, respectively). Metalaxyl M 4% + Mancozeb 64% WP emerged as a promising combined fungicide, inhibiting mycelial growth by 89.44% and 92.33% at 1500 ppm and 2000 ppm, respectively. Conversely, Hexaconazole 4% + Zineb 68% WP exhibited lower efficacy (77.78% and 82.22% at 1500 ppm and 2000 ppm, respectively). These findings underscore the potential of specific Phytoextracts and Fungicides for effective management of *Neopestalotiopsis eucalypticola* in Sapota cultivation, offering practical insights for sustainable disease management strategies in the agricultural sector.

Keywords: Sapota, *Neopestalotiopsis eucalypticola*, Phytoextracts, Fungicides, Poisoned Food Technique, *In vitro*, Disease Management.

SELECTION INDICES IN GROUNDNUT (*Arachis hypogaea* L.)

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Groundnut (*Arachis hypogaea* L.) is one of the most economic oilseed crops of the world and major oilseed legume crop in India, which meets about 30 per cent of the edible oil requirements in the country. Yield in crops is a quantitative trait and has a complex genetic control mechanism and hence, direct selection is not much effective on it. Since the economic part of groundnut known as pod is developed under the soil, the prediction of its performance based on aerial morphological characters is almost difficult (Weiss, 2000). The most desirable approach to improve characteristics such as pod yield is simultaneous selection based on related traits (Bos and Caligari, 2007). This can be done using selection index, which is multiple regressions of genotypic values on phenotypic values of several traits (Falconer, 1989). The use of selection index is superior in improving complex traits (Hazel and Lush, 1942). The better way of exploiting genetic correlations with several traits having high heritability is to construct an index which combines information on all the characters associated with yield. This suggests the use of selection index, which gives proper weight to each of the two or more characters to be considered. 70 diverse genotypes of groundnut were evaluated in a RBD design with 3 replications for the study of selection indices. Thirty-one selection indices involving pod yield per plant (X1) and four yield components *viz.,* number of mature pods per plant (X2), sound mature kernels (X3), 100 pod weight (X4) and harvest index (X5) were identified and considered for the construction of selection indices. Among the single character indices, 100 pod weight exhibited higher genetic advance and relative efficiency over straight selection for pod yield per plant. The index based on five characters *viz.,* pod yield per plant, number of mature pods per plant, sound mature kernel, 100 pod weight and harvest index recorded the highest genetic advance as well as relative efficiency and selection efficiency. These characters could be advantageously exploited in the groundnut breeding programmes.

Synergistic Effects of Jeevamrut and Vermiwash on Organic Wheat Production Through Bio-Fertigation

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This study investigated the interplay between lifestyle factors and genetic regulation in autoimmune diseases, focusing on the role of human T-cell metabolic and proliferative control through C-REL gene transcription. This study combined CRISPR-Cas9 manipulation of C-REL in human T-cells with a longitudinal cohort of 100 adults (autoimmune patients and controls), investigating metabolic and proliferation dynamics via flow cytometry and assays. It assessed lifestyle impacts through surveys and medical records, ensuring ethical compliance and informed consent. Analysis integrated genetic markers, lifestyle data, and disease outcomes using SPSS.In a comparative study involving 50 individuals with autoimmune disorders and 50 healthy controls, those with autoimmune conditions displayed higher BMIs, smoking prevalence (30% vs. 22%), and alcohol consumption (6.1 units vs. 4.9 units). Initial inflammatory markers including TNF-alpha, IL-6, IL-8, IFN-alpha, IFN-beta, and CRP were markedly elevated in autoimmune cases but showed a reduction over a three-year period. Elevated inflammatory markers correlated with increased disease susceptibility (HR 1.32-1.50), whereas regular physical exercise demonstrated a protective effect (HR 0.82) according to regression analysis. This study highlights lifestyle factors' substantial influence on autoimmune disease risk and progression, correlating with diet, physical activity, smoking, alcohol intake, and stress levels. While advocating for comprehensive lifestyle adjustments to manage autoimmune risks, caution is warranted in attributing causation given study constraints. Future research should prioritize longitudinal, interventional studies with diverse demographics and objective measures to better grasp molecular pathways and refine targeted prevention and treatment strategies. Keywords: Autoimmune diseases, C-REL gene transcription, CRISPR-Cas9 manipulation, Genetic regulation, Lifestyle factors, T-cell metabolism.

The Potential of Smart Textiles in Modern Applications

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Smart textiles, also known as e-textiles or electronic textiles, are an exciting development in the textile business, combining revolutionary technology with traditional fabric materials. The research study investigates smart textiles' varied applications and increasing trends, showing their potential in a variety of industries, including healthcare, sports, fashion, and military applications. The study begins by defining smart textiles and categorizing them into three types: passive smart textiles, which provide basic functionality like temperature regulation; active smart textiles, which are capable of responding to environmental stimuli; and ultra-smart textiles, which incorporate advanced technology such as embedded sensors and communication devices. The report also looks into the technological advances that have aided the development of smart textiles, such as conductive fibers, flexible electronics, and nanotechnology. The healthcare industry is given special attention, with smart textiles used to monitor vital signs, distribute medication, and provide real-time feedback on physical activity, all of which improve patient outcomes and quality of life. Smart textiles are redefining performance monitoring in sports, enabling athletes to optimize their training regimens using data-driven insights. Furthermore, the study looks at the industry's problems, such as durability, washability, and production costs, which prevent widespread adoption. Ethical considerations regarding data privacy and the environmental impact of these technologies are also discussed. In conclusion, this paper posits that as technology continues to advance, smart textiles will increasingly play a pivotal role in enhancing everyday life, making significant strides in functionality and user experience. By addressing the current limitations and harnessing their full potential, smart textiles are set to become invaluable assets in the fabric of modern society.

Keywords – Smart Textile, E-Textile

Characterization of rice landraces for low P tolerance in acidic soil of NEH Region

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Soil acidity is one of the major constraints for crop production in NEH Region. A set of 80 rice landraces were screened for the presence of *PSTOL1* gene using seven *Pup1-linked* markers. Based molecular screening, the genotypes were grouped into six clusters in which 26 were *Pup1* positive, 25 were partially favourable, and 25 were utterly devoid of *Pup1*. Based on population structure analysis the entire 80 genotypes were grouped into 4 sub-population (peak ΔK at K=4). Principal coordinate analysis (PCoA) extracted three principal coordinates with 91.34% of total variation. AMOVA revealed 75% of variation in among populations and 25 % in within populations. High F_{ST} value (0.792) and low gene flow (Nm) (0.066) indicated strong genetic differentiation based on *Pup1* locus. Field validation under three graded P-levels showed significant genetic variations for *Pup1* locus and P-use efficiency. The qualitative and quantitative traits exhibited significant differences in G x P interactions. The study identified eight genotypes *as* highly efficient to low P. The identified *Pup1* positive genotypes will of immense help as potential donors for breeding programme. Low P-tolerant detected in some *Pup1* negative landraces implies the possibility of a novel gene source for low P-tolerance in rice.

Keywords: Rice, Phosphorus, Pup1, marker, landraces

Beneficial effects of live mulches in fruit orchards

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Prime objective of living mulch in orchards is water conservation and erosion control, secondarily weed suppression and soil temperature modification. Live mulches have a greater suppressive effect on weeds than crop residues. Legumes like green gram (moong bean), black gram (urad dal), chickpeas, cowpeas and pigeon peas are good options to improve soil fertility. Recent studies put emphasis on the constructive effect of live mulch on fruit crops in terms of yield, quality and disorders. In tropics, legumes are used to control nematodes. Winter mulch avoid ground from freezing and offers warmth thus protects the small plants from freezing injury. Whereas live mulch system with *Zea mays* reduce nitrate leaching. Aloe vera and ashwagandha are drought-tolerant and can grow well in the space between pomegranate trees. A low growing spreading groundcover, creeping Thyme(*Thymus serpyllum*) releases fragrant oils and attracts pollinators thus increase fruit set. Forage Crops like Lucerne (alfalfa) and Napier grass most effective in controlling soil erosion besides used as fodder crops. *Stylosanthes hemata,* the most drought resistant permanent vegetation cover have been used as most compatible species in Ber to improve fertility and moisture status of the soil. Mulching ensure that the soil remains consistently moist, which is crucial for preventing fruit cracking. In Pomegranate, *Vicia villosa*, *Festuca arundinacea* , Peppermint , Alfalfa , Cowpea improve soil conditions, aid better water infiltration and reduce temperature fluctuations that lead to fruit cracking. Combinations of clover and ryegrass mix and legume and mustard mix and *Medicago sativa,* help in Nitrogen fixing and improve soil fertility and which reduced the risk of aril browning. Live mulch such as Buckwheat, Calendula, Mustard, Thyme, Barley, White clover provide cooling effect by reduces soil temperature, hence reduce heat stress on fruit protect from Scald.

In Custard apple cultivation, apart from reducing environmental stress, the mulching creates a stable nutrient-rich environment that supports complete pollination and healthy seed development. The study found that sod-culture with Darbh (*Eragrostis cynosuroides L.*) can lower the soil surface temperature by 20.28°C and reduce the occurrence of spongy tissue by 100%.Nevertheless, choosing compatible mulch species is utmost important for specific results in fruit orchards. Drawbacks of the live mulching is that mulch species compete with main crop for nutrients and water, this may leads to reduce yields of main crop.

Keywords: live mulch, weeds, disorders, clover sp.

Maternal Nutrition on Hatchability

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The nutritional health of parent birds plays a critical role in ensuring that eggs receive a well-balanced and sufficient supply of nutrients necessary for the embryo's normal development. This nutrient supply is derived directly from the mother's diet and metabolic processes. According to BIS (2007), an ideal breeder feed should contain 16% crude protein (CP), 2800 Kcal/kg of metabolizable energy (ME), 3.5% calcium, and 0.7% phosphorus. It has been long recognized that genetic differences in how birds absorb, metabolize, and deposit nutrients can influence the effects of these nutrients on embryo viability. If the egg contains nutrients that are insufficient, excessive, or imbalanced, the embryo's chances of survival can be compromised. As nutritional imbalances worsen, the adverse effects on the embryo tend to become more severe and manifest earlier in its development. The specific signs of nutritional stress in embryos typically vary based on the severity of the maternal nutritional deficiency. Energy is the primary limiting nutrient in breeder diets. However, feeding breeders a low-energy but high-protein diet has been associated with reduced hatchability rates. The inclusion of palmitic acid, oleic acid, or linoleic acid in the diet has been shown to improve hatchability and reduce late-stage embryonic mortality. Conversely, deficiencies in vitamins such as A, B1, B2, B3, B5, E, and K can lead to reduced hatchability. Additionally, minerals like calcium, zinc, manganese, chloride ions, selenium, and potassium are vital, as their deficiency can decrease hatchability. On the other hand, an excess of certain nutrients, including vitamin B12, calcium, phosphorus, iron, iodine, and bromine, can also negatively impact hatchability. Furthermore, factors like diseases, parasitic infections, toxins, poisons, or certain drugs can contribute to nutritional or pseudo-nutritional issues, further affecting hatchability.

MaxEnt modeling for predicting impacts of climate change on the suitable habitat of *Morus indica* in Tamil Nadu, India

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This study assesses the habitat suitability of *Morus indica* tree species under current and future climate scenarios (2050s, 2070s, and 2090s). Habitat suitability was classified into non-suitable (< 0.3), medium (0.3-0.5), and high (> 0.5) categories. Under current conditions, medium suitability areas cover the largest extent (17,445.44 sq.km), followed by non-suitable (5,045.22 sq.km) and high suitability (3,463.806 sq.km) areas. Future projections indicate substantial alterations: by the 2050s, non-suitable areas increase by 36.75%, with medium and high suitability areas decreasing by 7.54% and 15.54%, respectively. This trend intensifies by the 2070s and 2090s, with non-suitable areas expanding dramatically and high suitability areas declining by up to 65%, suggesting habitat fragmentation and decreased species viability. Key predictors of habitat suitability include Bio 4 (Temperature Seasonality), Bio 12 (Annual Precipitation), Bio 2 (Mean Diurnal Temperature Range), and Bio 18 (Precipitation of the Warmest Quarter). The study highlights the urgent need for conservation efforts to mitigate the adverse impacts of climate change on *Morus indica* habitats.

Keywords: *Morus indica*, Habitat suitability, Climate change, Bioclimatic variables, Conservation.

Markov Chain Approach for Wet and Dry Spell Analysis for Keonjhar district of Odisha

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The success or failure of the crops is highly related with the occurrences of dry spells. Sequence of dry and wet periods along with onset and withdrawal of rainy season is necessary for successful agricultural crop planning and soil and water conservation measures. In this study, weekly rainfall values have been calculated from daily rainfall data of 31 years (1989 to 2019) of Keonjhar district and were used for estimation of initial, conditional probabilities and consecutive dry and wet spell analysis based on Markov chain probability model. 20 mm or more rainfall in a week is considered as wet week otherwise dry & used as threshold value. This study found that Mean annual rainfall of district is 1353 mm, with an average of 67 rainy days . The initial probability of occurrence of wet spell was <10 %during SMW 1- 12, 16-41 % during SMW 13-20, >70 % during SMW 24- 41, and then afterwards suddenly decreased <40% during SMW 42-52. On the contrary, the initial probability of occurrence of dry spell was found to be very high (>60%) during SMW 1-20 and 41-52, whereas from 21-40 it is relatively very less. The conditional probability of a wet spell followed by another wet spell,P(w/w) was very high (>70%) during SMW 21-38.Therefore, depending on moisture availability rice nursery bed preparation can be started by 22nd SMW and harvesting operation can be completed by 38th-42nd week by selecting medium to long duration varieties. The amount of rainfall in the months of April and May is considered as pre-monsoon showers, helps in seed bed preparation. Since winter season gets about 7% of total rainfall, rabi(toria/vegetables) crops can be planned after 44th week with assured irrigation.Rice-Sesamum, Rice-Horsegram/Greengram/Blackgram, Maize-Toria, Maize-cowpea, Rice-onion, Rice- Mustard etc. are advised for this district. Water harvesting systems can be constructed, to store excess water during rainy season.

Keywords-SMW (Standard Meteorological Week), Wet spell, Dry spell.

Assessing Sorghum Cultivation in India: Trends in Area, Production, and Productivity

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India has seen a significant boom in the consumption of millets recently, especially since the National Year of Millets (2018) and the International Year of Millets (2023) were recognized. With over 40% of the world's total millets produced, India is the world's top producer. However, sorghum plays an important role in feeding people because it contributes significantly to the fight against hunger and food insecurity. The secondary data used in this study was sourced from the Indian government's Ministry of Agriculture and Farmers Welfare. Time Series Data of sorghum were analyzed for 7 sub-period decade wise, Period I (1951-60), Period II (1961-70), Period III(1971-80),Period IV(1981-90),Period V(1991-2000),Period VI(2001-10),Period VII(2011-20) and for overall period(1951-2020) for India. The trend was calculated using Compound Annual Growth Rate (CAGR) and Instability of area, production and productivity was computed by using Cuddy Della Vella Index (CDVIAcross all periods, Periods IV, V, VI, VII, and the overall period exhibited a negative but highly significant growth rate. For production, Periods I and III demonstrated a significantly positive growth rate, while Period VII and the overall period showed a negative but significant growth rate. Except for Period V and the overall period, productivity of sorghum showed a positive and significant growth rate in Periods I, III, VI, and the overall period. The area, production, and productivity of sorghum displayed low instability throughout all periods. From this, we can conclude that area and production showed decreasing trend but productivity of sorghum showed increasing trend throughout the study period. There is need to increase the area under cultivation to fulfilling the demand of consumers.

Keywords: Millet consumption, Growth rate, Instability, CDVI, Trend analysis

Phytoremediation of heavy metal contaminated soils

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Heavy metals being non-biodegradable and non-thermo degradable keep on accumulating in the environment and reach toxic levels in the soil due to long-term exposure of wastewater.Excessive concentrations of heavy metals *viz.,* Cr, Cd, As, Ni, Se, and Pb have been found in soils of agricultural land near cities and industrial areas around the world **.** Recuperation of heavy metal-contaminated soil ecosystems, affected by rapid and injudicious industrialization, intensive agricultural practices, faulty mining activities and waste disposals has become a great challenge for mankind **.** Heavy metals can have carcinogenic effects on humans, and animals and negative effect on soil microorganisms & crop plants. Since heavy metals are non biodegradable, they accumulate in the environment and subsequently contaminate the food chain. This contamination poses a risk to environmental and human health. Thus, remediation of heavy metal pollution deserves due attention. Different physical and chemical methods used for this purpose suffer from serious limitations like high cost, intensive labor, alteration of soil properties, and disturbance of soil native micro flora. In contrast, phytoremediation is a better solution to the problem. Phytoremediation is the use of plants to reduce the concentrations or toxic effects of contaminants in the environment. It is a relatively recent technology and is perceived as cost-effective, efficient, novel, eco-friendly, and solar-driven technology. **Arora *et al.* (2016)** has reported in their case study that, inoculation of Switchgrass with *Azospirillium* and AM fungi has enhanced absorption of Pb and Cd. They also reported that final harvest biomass was suitable for bio energy purpose. In conclusion, phytoremediation offers a promising solution for removing heavy metals from contaminated soil, utilizing the natural abilities of plants to absorb and accumulate these pollutants and enhance crop performance and production.

Keywords: Phytoremediation, Heavy metals, Contaminants, Biodegradable, Cost-effective.

Nanotechnology for Sustainable Aquaculture

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Aquaculture, a rapidly growing food industry, is crucial for meeting the global demand for animal protein. However, challenges such as disease, pollution, environmental degradation, and inefficient feed use hinder its growth. Abiotic stresses like pollution, water shortages, and climate change also hinder its expansion. To address these issues, new science and technology paths have been established, with the development of innovative nanotools showing great potential to enhance aquaculture. On the other hand, it appears that the main obstacles to addressing sustainability are heightened vulnerability to disease, the advent of novel pathogens, and the limited effectiveness of traditional practices. Nanotechnology has proven to be a valuable tool in fish nutrition, biotechnology, genetics, reproduction, disease, and environmental quality. It has accelerated fish development through nanoelement-laced feed, eliminated contaminants in aquatic systems, and transformed research on fish genetics through the use of genetically modified methods and nanobiotechnology. The use of nanotechnology has significantly impacted fish health, immune system, and reproduction. Nanosensors, DNA nanovaccines, nanoinspired genes, and medication delivery systems have transformed fish health and reproduction. In order to maximise treatment outcomes and reduce negative effects on the environment, nanoparticles are effective carriers for supplying fish with medicinal drugs, vaccinations, and immune stimulants. As a result, scientists are concentrating more on finding the best possible dose and delivery systems as well as how nanoparticles interact with fish immune systems. Nanoparticles can be injected intravenously, given to water for treatment, or delivered through fish meal to improve growth, reproduction, and other characteristics. Fish become more attractive, stronger, and healthier by adding nanomaterials to their diet, which also effectively prevents disease. The benefits of nanotechnology are worth pursuing and research and development on nanotechnology offers distinctive opportunities to advance, sustainable and reinvent traditional aquaculture methods.

Keywords: Aquaculture, Nanotechnology, Sustainability

Evaluation of Herbicide Droplet Distribution with Unmanned Aerial Vehicles versus Knapsack Sprayers in Transplanted Rice (*Oryza sativa* L.)

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In rice cultivation, herbicide application is traditionally performed using manual knapsack sprayers. Recent advancements in aerial spraying technology, specifically unmanned aerial vehicles (UAVs), offer a promising alternative. The study conducted at Agricultural research station, Bhavanisagar during '*Summer*' season compared the droplet deposition characteristics between UAVs and conventional knapsack sprayers (KS) for herbicide application. Using a pre-emergence (PE) application of pyrazosulfuron ethyl (10%WP) at 25 g a.i./ha at 3 days after transplanting (DAT) and a post-emergence (PoE) application of bis-pyribac Sodium (10%SC) at 25 g a.i./ha at 25 DAT, three UAV spray volumes (15 L/ha, 20 L/ha, and 25 L/ha) were evaluated against a knapsack sprayer applying at 500 L/ha. Results indicated that the KS (500 L/ha) provided superior droplet coverage rate, droplet size ($Dv_{0.5}$), number of spray deposits/cm^2, and spray uniformity compared to UAV spray volumes. Among the UAV volumes, 25 L/ha yielded the best droplet coverage rate, spray uniformity, and number of spray deposits/cm^2. Thus, the UAV at 25 L/ha achieved optimal droplet characteristics for herbicide application. Given its lower volume, the UAV application at 25 L/ha proves to be more energy-efficient, cost-effective, and labor-saving compared to the conventional knapsack sprayer.

Keywords: UAV, Spray volume, Herbicide, Knapsack sprayer.

Impact of Calcium Nitrate and Magnesium Sulfate on Growth Parameters in Potato Cultivation (*Solanum tuberosum* L.)

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Foliar application of calcium nitrate and magnesium sulfate significantly influenced the vegetative growth parameters of potato crop. The treatment ($Ca(NO_3)2$ @ 1% + $MgSO_4$ @ 1%) led to the highest plant height at 43.65 cm, the maximum number of leaves per plant at 44.85, and the highest dry matter content in tubers at 20.35%. Meanwhile, the treatment ($Ca(NO3)_2$ @ 2% + $MgSO_4$ @ 2%) excelled in other growth parameters, including the largest leaf area per plant at 147.13 cm^2, the highest fresh shoot weight per plant at 189.72 g, and the maximum dry shoot weight per plant at 32.90 g, demonstrating its potential to enhance overall plant growth. Among the varieties studied, Kufri Jyoti generally outperformed Kufri Chandramukhi in most growth parameters, although Kufri Chandramukhi showed superior results in leaf area (160.21 cm^2) and dry matter content (22.50%). The interaction between treatments and varieties further confirmed that the combination of calcium nitrate and magnesium sulfate optimize growth, with Kufri Jyoti showing the best overall response when treated with Calcium and Magnesium Fertilization.

Keywords: Potato, Growth**,** Calcium Nitrate**,** Magnesium Sulfate.

Gender inclusive Approaches for sustainable Development

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Gender inclusive extension strategies are addressing the unique problems that men and women in agriculture face, gender-inclusive extension services also acknowledge the significant contributions that women have made to the industry. Gender equality is essential for overall success in agriculture, as women make up around 43% of the labour force in this sector. Informational gaps, budgetary constraints, and sociocultural barriers all hinder women's participation. In order to empower women, increase food security, and foster sustainable rural development based on principles like equality, justice, and participatory methods, gender-inclusive extension programs personalize training and support services. Peer support networks, flexible training schedules, hands-on learning methods, and inclusive technology are some strategies for getting beyond obstacles. Implementing participatory ways to evaluate women's needs ensures that programs are designed successfully. Removing barriers requires community organizing, policy enhance knowledge sharing and accessibility. services that are inclusive of all genders increase agricultural output, reduce gender disparities, give women leadership roles, and support sustainable agriculture by tackling the demands of the social, economic and environmental problems.

Keywords: Gender gap, Gender building, Extension services
Women, Sustainable Agriculture, Inclusive Strategies, Limited Resources, Strategies
in the field of agriculture.

Screening Drought-Tolerant Sorghum Genotypes Using Polyethylene Glycol Under In Vitro Conditions

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Rainfed agriculture, dependent solely on natural rainfall, exposes sorghum genotypes to risks from irregular and insufficient precipitation. To explore an alternative to field experiments for assessing moisture stress, this study induced stress using polyethylene glycol (PEG) under in vitro conditions. Water stress impacts nearly every developmental stage of the plant, with pronounced damage during critical growth stages such as germination, shoot length, and root length. The primary aim of this study was to screen drought-tolerant sorghum genotypes using PEG. Sixty sorghum genotypes were evaluated for tolerance during germination and early seedling growth in the Crop Physiology Department at the University of Agricultural Sciences, Dharwad. Significant variations were observed at the germination stage, where water stress delayed and inhibited seed germination across all genotypes. Exposure to osmotic stress drastically reduced the germination percentage from 77% to 59% as PEG levels increased from 0% to 1%. Seedling length and vigor index also progressively declined with increasing PEG levels, while the highest values for both parameters were recorded under control conditions (0% PEG).PEG, a hydrophilic polymer, negatively affects germination and seedling length by reducing the availability of free water to germinating seeds, decreasing water uptake, and subsequent germination. Among the genotypes, SVD-1272 (88%) and SPV-486 (84%) exhibited the highest germination percentages at 1% PEG, while M148-138 (12%) and ICSV-16006 (16%) recorded the lowest. PEG also disrupts cellular processes involved in seedling growth and development, affecting cell elongation and overall seedling length. Notably, the BJV-44 cultivar showed no significant differences in shoot length at each water potential level, indicating a lower negative impact of water stress on this genotype (24.19 cm at control, 23.78 cm under 0.5% PEG, and 19.68 cm under 1% PEG). Moreover,PEG significantly reduced the vigor index of germinating seeds, reflecting seed quality by considering both germination percentage and seedling growth. Osmotic-sensitive sorghum genotypes exhibited a lower vigor index, while tolerant genotypes showed less variation in germination ability under different osmotic stress levels. The ICSR-15001 genotype showed a low percentage reduction in vigor index II compared to other genotypes, while SPV-2217 recorded the highest percentage reduction. Consequently, the combined effects of delayed germination and inhibited seedling growth due to PEG lead to a reduced vigor index, indicating decreased seed quality and overall seedling performance.

Keywords: rainfed agriculture, polyethylene glycol, osmotic stress, drought tolerance, sorghum genotypes and germination.

Cryogenic grinding of Spices

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Spices are integral to the culinary traditions of India, renowned not only for their unique flavours and aromas but also for their health benefits. Preserving these qualities during processing is essential to maintaining their worth. Cryogenic grinding is an innovative technique that helps retain the essential properties of spices. By cooling the spices to extremely low temperatures using liquid nitrogen or carbon dioxide, this process makes them brittle, allowing for fine grinding without the loss of essential oils and flavours.

Cryogenic grinding proved highly effective in preserving volatiles in cumin genotypes, significantly enhancing the recovery rate. In contrast, traditional grinding at room temperature caused a substantial loss of volatile oils, with cumin genotypes experiencing an 18-19% reduction. Remarkably, cryogenic grinding increased the oleoresin content in the RZ 209 genotype of cumin by 28.28%. In coriander samples, this method also resulted in significantly higher oleoresin content, with volatile oil levels ranging from 0.14% in genotype RCr 436 to 0.39% in genotype Sindhu, and oleoresin content from 13.80% in genotype ACr 1 to 19.58% in genotype Sindhu. Additionally, coriander powder ground at -50°C retained higher levels of total flavonoids, phenols, and antioxidants. Cryogenic grinding of Byadagi chilli preserved more capsaicin content compared to other milling methods. For ginger, grinding at -70°C yielded the highest amount of oleoresin, while normal grinding temperatures produced the lowest. Overall, the yield of oleoresin consistently increased as the grinding temperature decreased.

Cryogenic grinding provides an advanced approach to spice processing, effectively preserving their essential oils, flavours, and nutritional properties. This technology has great potential for the spice industry, enhancing both domestic consumption and international exports by producing high-quality, finely ground spices. To make this technology viable for large-scale production, further research and government support are necessary. If the cost of liquid nitrogen remains manageable, cryogenic grinding could be economically feasible. Embracing this method could elevate product standards and unlock new markets for Indian spices.

APPLICATION OF ARTIFICIAL INTELLIGENCE AND SENSOR TECHNOLOGIES IN SUSTAINABLE LIVESTOCK FARMING

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Artificial intelligence will assist livestock farms in collecting and analyzing data in order to precisely forecast customer behavior, such as purchasing habits, leading trends and so on. Farms will be able to automate procedures, cut key expenses and enhance the quality of livestock products such as milk with increasing investment. The purpose of this article is to highlight an innovative application of the Internet of Things (IoT) in modern livestock farming, namely animal enumeration and identification for exact traceability. Technological advances in recognizing behavioral patterns in shy feeder' cows, as well as real-time weight monitoring, improve the accuracy of long-haul animal transportation. These advances provide advantages such as enhanced animal welfare standards, decreased supply chain inefficiencies and increased operational productivity, as well as expanded market access and worldwide competitiveness. Individual animal customization, economic analysis, data security, privacy, technical flexibility, training, stakeholder participation and sustainability issues are some of the problems that these technologies present. These abstract are intertwined with some ethical concerns about animal welfare, smart farming and environmental consequences. Artificial intelligence and machine learning, along with other sophisticated technologies, have had a substantial influence across a variety of sectors. Agriculture and animal rearing are not immune to this favorable influence. With the use of artificial intelligence in agriculture, the day is not far away when drones directly bring personalized milk to your home with the protein, milk fat, and solids-not-fat (SNF) composition that you prefer. Modern dairy farms incorporate robotic systems to provide immunizations, machine milking and feed assessment based on individual animal performance. From farm to fork, AI examines the animal origin food quality traceability technique. AI assists in fully mechanized animal husbandry, from animal birth to production of food output. The future of AI in the animal industry is uncertain, but the benefits and rising demand for AI in other sectors will secure its future in the animal sector as well.

Keywords: Artificial Intelligence (AI), Sensor Technology, Internet of Things (IoT), Machine Learning, Animal Husbandry.

Investigation Of Rice Straw Management Practices and Nitrogen Levels on Wheat [Triticum aestivum (L.) on Productivity of Wheat.

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Wheat *[Triticum aestivum (L.)]* is one of the most important staple food crops of the world as well as India. It is cultivated under diverse growing conditions of soil and climate. In India, it is the second most important food crop after rice. It is an excellent health-building food containing approximately 78% carbohydrates, 12% protein, 2% fat, and minerals each, and a considerable amount of vitamins. The field experiment was carried out in *Rabi* season of 2022-23 at the , Lovely Professional University, Punjab encompassing sixteen distinct treatments. Four treatments are apply with in Main Plot and four in Sub Plot, through Split Plot design and replicatated is three time.

Ripening pattern of on-tree and off-tree mango

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This study aimed to assess differences in the rate of ripening for mangoes fruit retained on the tree or harvested, at various points during maturation. The mangoes(on-tree) were freshly harvested, every 3 days from the date of start (120 days after flowering) for the next 58 days, from an orchard inside IARI, and were tested for ripening indices like internal/ external color, firmness, TSS, respiration rate, and density. The mango was Pusa Manohari, a variety released by ICAR-IARI. The mangoes were harvested on the 6th, 16th, 22nd, and 42nd day (from the date of start) and were stored in ambient without any treatment (off-tree_control). The quality characteristics of the off-tree were assessed with storage duration. On-tree mangoes showed almost no change in TSS, While TSS increased from 7 to 17 Brix and 9 to 19 Brix for off-tree mangoes, respectively. After 18 days of storage, the firmness of on-tree mangoes showed a decrease of 36.44 N (from 100.53 to 64.09 N), while off-tree mangoes rapidly decreased in firmness from 73.93 to 21.78 N. The respiration rate for on-tree mangoes remained largely unchanged (~173 mg co_2 kg^{-1} hr^{-1}), however, it increased from 175 to 419 mg co_2 kg^{-1} hr^{-1} in off-tree mangoes. There were no significant differences in density between on-tree mangoes, off-tree, and treated fruits. Regarding the internal color of mango pulp which was measured by L*, a*, b*, the value L* decreased at the slowest rate in on-tree mangoes, as compared to off-tree mangoes. The values of a* and b* increased at the lowest rate in on-tree mangoes, while the rate of increase was comparatively higher in off-tree mangoes. There was almost no change in the L* external peel color of on-tree mangoes and off-tree mangoes. The a*external peel color of on-tree mangoes increased slowly, but in off-tree mangoes, it increased from -15.68 to -6.97. Similar trends were observed in the external color of mangoes. The mangoes left on the tree took a longer time to ripen as compared to when they were harvested and stored in ambient.

Keywords: on-tree, off-tree, Mangoes, Ripening, Maturity

Character association analysis studies in oat accession (*Avena sativa* (L.)) under different locations of Chhattisgarh

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32 germplasm with different species of oat accession selected from 294 germplasm lines maintained at IGKVV in *rabi* 2019. Experiment was conducted during *rabi* 2021 in four different environments of Chhattisgarh. In each environment each genotype was sown in a two-row plot in randomised block design with two replications. Observations of five randomly plants of each genotype in each replication were recorded on ten different characters *viz.,* days to 50% flowering, plant height (cm), leaf length (cm), leaf width (cm), number of tillers per plant, green fodder yield (gm), leaf dry weight per plant (gm), stem dry weight per plant (gm), leaf stem ratio, dry matter weight (gm), days to maturity and plant population. Analysis of variance revealed that significant differences existed among genotypes for all the characters in all four environments. Over all the environments, green fodder yield per plant was significantly and positively correlated to the plant height, leaf length, leaf dry weight, leaf stem ratio. leaf dry weight per plant and leaf stem ratio not only had direct effect but also positively and significantly associated with green fodder yield per plant in all the four environments.

Advances in Remote Sensing Technologies and Their Agricultural Applications

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Application of Remote Sensing has made a significant impact to monitor, manage and analyze the agricultural land. These technologies that entail obtaining information on the state of the surface of the Earth without necessarily having to physically touch it has evolved rapidly in the last couple of years and holds promises in aspects such as precision farming, crop observation, and ecosystem stewardship. This chapter aims at discussing the new insights in the field of RS technologies with emphases on their revolutions in agriculture. Advances made in satellite imaging together with improved high resolution sensors have made it possible to acquire accurate information on the spatial distribution of crops and their health status, qualities of the soil, and water supply. Techniques like multispectral and hyperspectral imaging let for recognition of minor changes in the plant's physiological conditions that are not noticeable by the naked eye allowing for the early recognition of stress factors which include nutrient deficiencies, pests, and diseases. Also, recent developments such as remote sensing coupled with GIS and analytical methods have opened avenues in precision agriculture. Daily by using information schemes, farmers are able to schedule irrigation, apply fertilizer in the right places, and manage crop more effectively hence increasing yields and coming up with better solutions that conserve the environment. Another major innovation is ' drones ', which are synonyms to Unmanned Aerial Vehicles (UAVs) and are convenient and relatively inexpensive tools for imaging and monitoring the status of agricultural fields in real time. The chapter also addresses future possibilities of the increasingly developing technologies like LiDAR and radar remote sensing for higher advancement of the agriculture applications which focuses on topography mapping, biomass assessment and changes in structural characteristics of crops.

Keywords- Remote Sensing, Drones, Unmanned Aerial Vehicles, LiDAR

Phage therapy: An alternative to antibiotic

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Aquaculture, the fastest-growing food industry, faces threats from multi-drug resistant bacteria due to its reliance on antibiotics for prophylactic and therapeutic purposes. The development of new antibiotics has stalled, making finding sustainable solutions a pressing issue. Bacteriophages, due to their specific host range, ability to treat farmed species and the environment, limited ecological impact, and abundance, represent a promising sustainable solution to control pathogenic aquaculture bacteria. Therapeutic bacteriophages, or phages, are a promising alternative to antibiotics for managing bacterial infections in various organisms, including cultured fish. Their natural immunogenicity modulates immune responses and promotes specific bacterial clearance mechanisms. Phages act directly only on targeted bacteria which allows to fight aquaculture bacterial pathogens and reduce the spread of food-borne diseases in humans. However, to achieve standardized treatments and avoid side effects, improvements in understanding their biology and genomes are needed. Phages have therapeutic potential due to their production of lytic enzymes. Currently, functional use of phages against bacterial pathogens in cultured fish is in its infancy. Considering these factors, bacteriophage-based research prospects in aquaculture could include exploring phages in aquaculture systems and developing bacteriophage-based vaccines against fish diseases. This could potentially be used as bacterial control strategies they might represent for managing aquaculture-related bacterial diseases.

Keywords: Aquaculture, Bacteriophage, Diseases, therapeutics

Formulation of maize cheese analogue with low fat and high protein content

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Cheese may also be manufactured with a variety of corn extracts, such as fresh maize corn extract, in addition to cow's milk. Papain can be employed as a coagulant in the formation of cheese. The benefits of high-carotene and low-fat cheese made from maize corn extract are in evident. Maltodextrin works to boost volume and total solids for a higher yield. The current study's first objective was to create a cheese analogue from maize corn extract with more, protein, and good sensory qualities by optimizing the formula composition between lime extract, papain, and maltodextrin. Second objective was to investigate the physicochemical and sensory characteristics of the cheese analogue using the optimal formula. And the third objective was to compare formulated maize cheese with cow's milk cheese. The response was approach with three factors such as lime extract, papain, and maltodextrin which was used in the experimental design. The maize extract cheese and the additions of papain (0.020%), lime extract (1.98%), and maltodextrin (17%). This cheese of maize corn extract was 18.7% yield, pH of 6.3, 70.3% water content, 11.5% protein content, 5.67 mg/g total carotene, 1.32% fat and cholesterol 0.02 mg/g. The Panellists favoured the corn cheese analogue, which possesses the same sensory qualities as milk cheese such as a soft feel, uniform spreading ability, and a typical yellowish-white appearance. In comparison to cow's milk was 4.3% protein, fat content of 6.1%, total carotene of 5.32 mg/g, and cholesterol of 0.19 mg/g. The maize corn may be utilized as a low-fat cheese substitutes which would be used for health purposes.

Work load of women involved in fuel load carrying activity

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The present study, was conducted in Dharwad and Kalaghatagi taluka of Dharwad district during the year 2021-22, explores the physiological workload of women involved in load-carrying activities, focusing on fuel wood collection. A sample of 250 women who regularly involved in fuel wood collection and carrying activity were selected from ten villages. The exploratory and experimental research was used designs. The socio-economic status of respondents was assessed using the Agarwal et al. (2005) scale, revealing that a significant majority (89.6%) belonged to the poor socio-economic class, with a smaller proportion in the lower middle (7.6%) and very poor/below poverty line (2.8%) categories. The study identified various health issues associated with fuel wood carrying. The most prevalent problems were backache (87%), neck muscle strain (75.22%), visibility issues (54.88%), headache (52%), and head burning (36%), with a notable 10% of respondents experiencing miscarriages. These issues varied across talukas but consistently highlighted the physical strain faced by these women. Analysis of the fuel wood carrying activity indicated that most women (66.66%) carried 24-26 kg of fuel wood per trip, covering an average distance of 4 km, and spending approximately 3.66 hours per trip. The physiological workload, evaluated based on energy expenditure and heart rate, classified the traditional method as very heavy for 70% of respondents and heavy for the remaining 30%. In contrast, an improved method resulted in 76.66% of respondents experiencing heavy workload and 23.33% in the moderately heavy category. This study underscores the significant physical burden placed on rural women due to fuel wood collection, necessitating interventions to alleviate their workload and improve their overall health and well-being.

Keywords: Women, Work load, Fuel wood, and Drudgery.

POLLINATION BIOLOGY OF BOTTLE GOURD

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In summer and kharif seasons, bee activity starts at 0530 and 0830 hr and stops at 1000 and 1200 hr. For the collection of nectar, pollen and both nectar and pollen, *Apis dorsata* spent 19.9, 111.583, 210.85 and 23.25, 111 and 168.7 seconds/flower and *Apis cerana* spent 17.2, 91.7 and 160.55 and 19.25, 98.4 and 171.85 seconds/flower. In the summer season, *Apis cerana* has the more foraging rate of 5.55 flowers/ minute followed by *Apis dorsata*, *Halictus* sp, *Apis mellifera*, and *Lasioglossum* sp. with 4.9, 2.95, 2.5 and 1.25 flowers/ minute and in kharif season, *Apis mellifera* has the highest foraging rate of 3.9 flowers/ minute followed by *Apis cerana*, *Lasioglossum* sp, *Apis dorsata*, *Apis florea*, *Campsomeriella collaris* with 2.8, 2.5, 2.35, 2.1, 1.65 flowers/minute. During the summer season, Among the major floral visitors of the bottle gourd, *Aulacophora* sp. carried the highest mean pollen grains of 1680 followed by *Apis mellifera*, *Apis dorsata*, *Apis cerana*, *Lasioglossum* sp., *Halictus* sp., *Haptonchus* sp. and *Nesidiocoris tenuis* which carries 1660, 880, 520, 480, 320, 72 and 72 loose pollen grains on their body and *Apis mellifera* deposited a greater number of pollen grains (22.8 pollens/visit) followed by *Lasioglossum albescens*, *Apis cerana*, *Apis dorsata*, *Halictus* sp., *Aulacophora* sp., and *Haptonchus* sp. deposited 18.9, 16.4, 15.9, 11.8, 8.8, and 3.3 pollen grains during their first visit. *Apis mellifera* has the highest pollination efficiency index of 82887.12 followed by *Aulacophora* sp., *Apis dorsata*, *Apis cerana*, *Haptonchus* sp., *Lasioglossum albescens*, *Halictus* sp. and *Nesidiocoris tenuis* with respective pollination efficiency index of 35629.44, 27984, 15606.24, 10987, 11521.44, 4720 and 790.77.

IN VITRO SCREENING OF ANTI-FUNGAL ACTIVITY OF *HIBISCUS SUBDORFFIA* STEM IN ACETONE EXTRACT

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The present research paper deals with antifungal activity in *Hibiscus subdorffia* stem extract. The extract was carried out by Soxhlets apparatus using acetone as solvent. The antifungal activity was measured by well diffusion method; using test fungi such as *Aspergillus flavus*, *Aspergillus niger*, *Cladosporium fulvum, Fusarium oxysporum*, *Colletotrichum sp, Botrytis cinerea* and *Penicillium sp.* The acetone stem extract of *Hibiscus subdorffia* shows a greater zone of inhibition against *Colletotrichum sp* (1.73cm) followed by *Fusarium oxysporum* (1.36cm), *Cladosporium fulvum* (1.28cm), *Botrytis cinerea* (1.16cm), *Penicillium sp* (0.91cm), *Aspergillus niger* (0.86cm) suggests that acetone extract of *Hibiscus subdorffia* possess a good amount of anti-fungal compounds whereas a least zone of inhibition was recorded in *Aspergillus flavus* (0.8cm).

Keywords*: Aspergillus flavus, Aspergillus niger, Cladosporium fulvum, Fusarium oxysporum*, *Penicillium sp, Botrytis cinerea, Colletotrichum sp*, *Hibiscus subdorffia*, Soxhlets apparatus.

Organic Cultivation of Watermelon using a mix of Modern and Traditional cropping methods.

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This paper aims to illustrate the feasibility and advantages of sustainable agricultural practices by providing a thorough analysis of an organic watermelon cultivation project. The project was carried out on a 28m x 36.6m (0.25 acre) plot. In the research work modern methods like Tunnel farming, Drip irrigation, better seed selection and traditional methods such as organic soil amendments, and land preparation practices were merged with an aim of obtaining improving crop yield and quality. The use of humic acid, biofertilizers, and organic fertilizers like Jeevamrut was stressed as a means of preserving soil health. Natural remedies like Dashparni Ark and Neem Ark were employed to control pests and diseases. The findings emphasize the sustainability of organic farming from an economic and produce quality standpoint.

Keywords: Organic Farming, Sustainable Agriculture, Economic Viability, Environmental Sustainability

Effect of different level of pruning's on growth and yield of high-density guava cv. Shweta.

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Crop regulation is the most critical factor in guava (*Psidium guajava L.*) production. In the past, crop regulation has been accomplished through deblossoming, flower thinning, foliar NAA treatment, and irrigation withholding. Pruning has recently developed as a commercial and alternative way for managing the guava crop. Pruning on bearing trees includes forming new shoots, preventing branch overpopulation, removing crossing branches, unhealthy branches, water sprouts, and root suckers. This study was conducted for winter season crop at Advanced centre for horticulture research (ACHR), SKUAST-J, Udheywalla, Jammu during the year of 2022-2023. The pruning done at different levels i.e. 20 percent, 30 percent, 40 percent, 50 percent, 60 percent, 70 percent, 80 percent and control (no pruning) on 3 years-old plants spaced at 3 × 3 metres. The vegetative parameters and yield were analyzed to determine the effect of pruning intensity on fruit size and yield of guava. The result was revealed that the maximum fruit length (8.42 cm), fruit width (8.00 cm), fruit weight (201 gm) and fruit yield (27.40 kg) was recorded with 50% pruning and minimum in control. In general, the 50% pruning intensity level was found beneficial for enhancing fruit size and yield in guava crop.

Keywords: Guava, pruning intensity, yield.

Studies on stem rot of Indian mustard (*Brassica juncea* (L.) Czernj. Cosson) incited by *Sclerotinia sclerotiorum* (Lib.) De Bary."

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Sclerotinia sclerotiorum (Lib) De Bary, the causal fungus of Sclerotinia stem rots in Mustard. It is a necrotrophic pathogen with worldwide distribution known to infect over 400 species of plants. This disease locally called Polio disease in northern region of Madhya Pradesh. Symptoms appear on root, on or stem pith inside as elongated water soaked spots. Small white bodies appears on stem which later on covered by the cottony mycelial growth, converted white to black colour as hardened sclerotia developed that is serving as source of primary inoculum for the next season. Earlier, Sclerotinia stem rot considered as a minor problem in India but it has become a widespread, destructive and serious problem not only India but throughout the world most mustard growing areas. *S. sclerotiorum* having specific characters *viz.*, Soil borne nature, survives up to 5 years, polyphagous nature approx. 400 plant species, Compact resting sclerotia, Ascospores discharged from apothecial @ optimum 5 -10^{0}C, sclerotia limited 1 to 2 cm in soil. Source of genetic resistance is limited because no proven source of resistance against disease till date. Keeping inview the importance of the disease a well-planned block wise field survey of major mustard growing districts *viz.,* Morena, Bhind, Gwalior, Sheopur and Datia were carried out during January-March 2015. The disease is emerging as a serious threat to mustard cultivation. While, the surveyed districts taken all blocks from three villages and from each village taken five field randomly selected. Surveyed village of blocks heavy disease incidence recorded in Morena (11.52%), Bhind (13.48%) and Gwalior (6.33%) were identified as hot spots but in Sheopur (2.81%) and Datia (5.00%) were recorded fewer incidences as compare to highly incidence districts. Mean incidence of Sclerotinia stem rot ranged from 1.5-16.50 per cent recorded in northern Madhya Pradesh. It is concluded that surveyed highly incidence of this disease alarming situation at farmers' fields has occurred. At present study of field surveys indicated that *Sclerotinia* stem rot has set its foot as a key position among mustard disease in Northern region of Madhya Pradesh. Sclerotinia stem rot incidence was increasing gradually year after year and emerging as a serious threat to mustard crop. The disease appears regularly become mild to severe forms in remains different Rapeseed-Mustard growing areas of Madhya Pradesh. The farmers were discouraged for cultivation of mustard. The low incidence of Sclerotinia stem rot disease was adopting (Mustard + Wheat) cropping pattern adopted, where the sandy loam alluvial soil, while, where, adopting (Mustard + Pea), (Mustard + Chickpea) and mono crop (only mustard) grown areas were found high incidence of this disease and soil was light black to black cottony soil with less drainage facility. This disease most found in early sowing farmers' field but there was not found in late shown fields. Hence, these above points may help to make strong strategies for managing this disease with compatible integrated disease management practices.

The impact of seed hydropriming, plant spacing, and integrated nutrient management (INM) on the growth of summer green gram crop, including biomass production, yield, and nutrient uptake.

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Pulses are an essential component of the vegetarian diet in the Indian sub-continent because they are a rich source of protein and effectively combat malnutrition at a low cost. Hence, it is imperative to enhance the production and productivity of pulses, not only to combat protein malnutrition but also to fulfill the substantial demand of 1.5 billion Indians by 2040. The study conducted at Bundelkhand University Jhansi in India during the summers of 2021 and 2022 aimed to evaluate the effects of seed hydropriming, plant spacing, and integrated nitrogen management practices (INM) on the production of seeds and biomass, as well as the uptake of nutrients by the summer green gram crop. This value decreased in descending order to 41.70%, 40.61%, 38.80%, and 37.79% due to treatments N4, N3, N1, and N2, respectively. The application of treatment P1 led to an uptake of 30.59 kg/ha of nitrogen, 5.10 kg/ha of phosphorus, and 16.59 kg/ha of potassium. This uptake significantly increased in treatment P2. The application of N5 nutrient management, which consisted of 50% recommended dose of fertilizer (RDF) through chemical fertilizer and 50% RDF through Vermicompost, led to a significant increase in nutrient absorption. Specifically, the treatment resulted in the absorption of 41.44 kg/ha of nitrogen (N), 7.31 kg/ha of phosphorus (P), and 21.01 kg/ha of potassium (K). Treatment N4 caused the extraction of 39.49 kg/ha of nitrogen (N), 6.90 kg/ha of phosphorus (P), and 21.01 kg/ha of potassium (K) from the soil. The study determined that the combination of seed hydropriming, a crop geometry of 30x10 cm row x plant spacing, and the use of 50% of the recommended dose of N, P, K nutrients through organic sources (FYM and/or vermicompost) resulted in the highest plant vigor, nutrient absorption from the soil, yield attributing characters, nutrient uptake, dry matter production, and seed yield for green gram crop. These practices are recommended for widespread adoption by farmers.

Addition of nutraceuticals in diet of broilers for improved production

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Poultry is one of the fastest growing sectors in Indian Agriculture. Chicken meat has culminated into one of the cheapest sources of good quality protein and is the second most widely consumed meat in the world. Antibiotic growth promoters (AGP) have been used in broilers to increase live weight and feed efficiency, but their use has been prohibited in many countries due to the presence of antibiotic residues in poultry products, antimicrobial resistance in the population and environmental pollution. So, researchers and animal nutritionists have found an alternative to AGP in the form of "Nutraceuticals". The words "nutrition" and "pharmaceutical" were first joined in 1989 by Dr. Stephen De Felice, defining nutraceutical as a food or a component of a food that has the potential to prevent or treat disease. The global nutraceutical market was estimated at USD 291.33 billion in 2022, and it is expected to increase at a compound annual growth rate (CAGR) of 9.4% between 2023 and 2030 (Grand View Research 2023). Nutraceuticals can be added to poultry feed in the form of minerals, amino acids, probiotics, prebiotics, vegetables, fruits, spices, herbs, enzymes, phytochemicals and bioactive peptides. Utilization of nutraceuticals in broiler feed may boost productivity because of their immunomodulatory properties, enhance feed conversion efficiency, improve the quality of poultry products (e.g., eggs, meat) enriched with biologically active compounds like PUFA (polyunsaturated fatty acids), antioxidants, antimicrobials, vitamins and organ protective elements, reduce the negative environmental effects of animal waste and increase disease resistance. This emerging trend emphasizes the increasing importance of nutraceuticals in modern poultry feeding. As a result, there is a considerable demand for organic compounds that promote the dissemination of high-quality poultry products to markets.

Study on preparation and organoleptic evaluation of aloe vera ready to serve functional drink

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Aloe vera gel has been used in pharma and cosmetic industry as well as in the food industry, mainly as a resource of functional ingredients, especially used for the preparation of healthy food drinks and other beverages. The present study was carried out to standardize the protocol for preparation of aloe RTS beverage and its storability. Significant differences were observed with respect to physico-chemical parameters between the treatments. The chemical constituents, viz., total soluble solids, reducing sugars, total sugars, sugar: acid ratio and pH were found to increase marginally from 9.94 to 11.76oB, 1.36 to 1.50 per cent, 6.29 to 7.02 per cent, 16.89 to 32.94 and 3.38 to 5.59 respectively, whereas titratable acidity, ascorbic acid, non-reducing sugars and polysaccharide content decreased from 0.39 to 0.23 per cent, 112.49 to 103.30 mg per 100 ml, 5.76 to 5.00 per cent and 16.49 to 16.33 mg per 100 ml respectively, during the storage period of six months. The mean organoleptic scores decreased significantly from an initial value of 4.08 to 3.50 for colour and appearance, 3.68 to 2.72 for taste and aroma, 3.78 to 2.95 for mouthfeel and 3.69 to 2.72 for overall acceptability with the advancement of storage period. The results of organoleptic evaluation particularly indicated that the treatment with aloe juice 10 per cent + TSS 15°B (T10) and aloe juice 20 per cent + TSS 15°B (T12) found superior in their acceptability than other treatments for all the four organoleptic parameters throughout the study. There was marginal increase in microbial load (TBC) of aloe RTS beverage during storage, but it did not cause any spoilage even up to six months of storage.

Keywords: Aloe Vera, Beverages, Functional drink, Organoleptic, Ready to serve.

Dissecting genetic variation for agro-morphological traits under elevated temperature in CO2-temperature gradient chamber and validation of markers linked to heat tolerance in rice

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Global warming has resulted into increase in temperature affecting crop yield and sustainability. In order to utilize the diversity present in rice germplasm, 1100 rice genotypes of the NE region were assessed for high yield stability under variable temperature regimes in the CO2-temperature gradient chamber under ambient and elevated temperature. A set of selected lines were evaluated extensively and marker-trait associations with SSR markers associated with heat stress tolerance were estimated. As compared to ambient temperature, lower mean value was recorded for the agro-morphological traits at elevated temperature whereas, PCV, GCV, heritability, and GAM have shown rising inclination towards elevated temperature. Based on the F_{ST} value (6.42%), the genotypes belonging to Meghalaya and Tripura were significantly different from the genotypes other than those in the north-eastern Indian region. Based on model based clustering, 86 genotypes depicted more than 80% genetic purity to their respective ancestry, whereas seven genotypes, namely, Sojkyrleh, RCPL 1-123, RCPL 1-136, RCPL 1-74, RCPL 1-188, Sialkathi, and Bapnah, had less than 80% genetic purity and were considered admixtures. Two markers, RM 234 and RM 7364, were found to be significantly associated with yield per plant under elevated temperature conditions as per GLM and MLM approach. Genotypes namely, TRC-2016-291, TRC-2007-1, TRC-2016-426, Daya, Badjhania, TRC-2016-624, TRC-2016-33, Nania, TRC-2016-51, Aati Ghal and TRC-2016-153 were selected as high yielding under elevated temperature conditions.

Keywords: CTGC, genetic diversity, heat stress, marker-trait association, rice

Effect of farming systems on biology and ecology of cabbage aphid, *Bravicoryne brassicae*

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Zero Budget natural Farming (ZBNF) has proven advantageous on the conventional farming (CF) in terms of less input use, less disturbance to environment and greater yield. A study conducted to figure out the efficacy of ZBNF over CF in terms of incidence of *Brevicoryne brassicae* in cauliflower revealed less incidence of aphid in ZBNF than CF. A continuous monitoring over the aphid population was done and data obtained was used to construct life table with parameters such as age stage specific survival rate, age stage specific fecundity, age specific survival rate and age specific fecundity. The mean values of above parameter were analysed by using TWOSEX-MS Chart Program. The result showed that the mean fecundity of adult female aphid is 24 and 20.47 in ZBNF and CF respectively. Furthermore, the other parameters such as Gross reproductive rate (GRR), Net reproductive rate (R_0), True intrinsic rate of increase (r), Finite rate of natural increase (λ) were also found to be higher in ZBNF than CF. This increase in fecundity in adult female could be attributed to improved biology of the aphid as it was feeding on nutritionally stronger host enriched by jeevamrit and Ghanjeevamrit incorporated in ZBNF. However, the total lifespan of adult females was reported to be lower in ZBNF, spanning 20 days, compared to CF, which extended to 21 days. Likewise, the instar longevity (I, II, III, and IV), female adult longevity, and adult pre-oviposition period (APOP) were all shorter in ZBNF compared to CF. This compressed life cycle of aphids in ZBNF had significant implications for their biology and fecundity, directly contributing to the reduced occurrence of this species in ZBNF compared to CF.

Keywords: Zero Budget natural Farming, conventional farming, Life table, longevity, fecundity

Growth and Yield of Kalmegh (*Andrographis paniculate*; Nees) under Litchi based Agroforestry system

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Agroforestry is defined as a sustainable land management system which increases the overall yield of the land, combines the production of crops including tree crops and forest plants or animals simultaneously or sequentially, on the same unit of land and including management practices that are compatible with the cultural practices of the local population (King and Chandler, 1978). In Agroforestry, Tree- crop components of agroforestry systems interact in terms of responses such as changes in soil fertility, microclimate changes and resource availability (nutrient, light, water) and utilization (Rao et al. 1998). Andrographis paniculata is commonly known as Kalmegh. It is also known as 'King of Bitters' belonging to family Acanthaceae, an annual herb is one of the important medicinal plant used as antipyretic. It is highly demanded by pharmaceuticals industry for preparing various ayurvedic preparations. Andrographis paniculata is reported to contain 1.5-2.5% andrographolide (a bitter principle) as the main active constituent in leaves. The investigation revealed that the Andrographis paniculate grown under Litchi chinensis, reported higher growth and yield as compared to open field condition. Moreover, the correlation between growth and yield were positive correlated at 1 per cent and 5 per cent level of significance. The correlation relationship between dry weight of shoot and total dry weight of plants revealed that they were highly positively correlated at 1 per cent level of significance. It is the reason, Andrographis paniculata is recommended for intercropping under Litchi chinensis for assured income and sustainable development in changing climatic scenario. Keywords – Agroforestry, Andrographis paniculate, Sustainable development, Litchi chinensis

Comparative Analysis of Growth and Yield in *Heteropneustes fossilis* (Bloch, 1794) and *Lactuca sativa* within Different Aquaponics Systems

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Aquaponics integrates hydroponics (growing plants in water) and aquaculture (cultivating aquatic organisms) into a sustainable farming method. In the face of the current global overpopulation crisis, this technique presents a viable and efficient solution for sustainable food production. Lettuce (*Lactuca sativa*) and Asian stinging catfish or Singhi (*Heteropneustes fossilis*) were selected for this study due to their high nutritional value, strong market demand, and ability to thrive in aquaponic systems. In this study, three different culture setups (E1, E2, and E3) were designated as treatments, with all setups utilizing fish tanks of 165.65 liters (5.85 ft^3) volume and E2 and E3 incorporating Nutrient Film Technique (NFT) systems with 40 liters (1.39 ft^3) of water holding capacity, conducted over 45 days experiment. E1 was prepared for the monoculture of Singhi (without plant integration) with a stocking rate of 50 NOS. While E2 and E3 systems were randomly assigned for 50 and 40 individuals of Singhi integrating 80 NOS of lettuce individually. In both E2 and E3, a constant water circulation rate of 200 L/h was maintained. Regular monitoring of water quality parameters, including DO, temperature, salinity, pH, and ammonia, showed no significant variations ($p>0.05$) among the three treatments. The specific growth rate (SGR) of Singhi at 1.79% in E3 was significantly higher than E1 (1.64%) and E2 (1.74%). while the survival rates were 84%, 90% and 92.5% for E1, E2 and E3 respectively. *Lettuce* production yielded 5.72 kg/m^2 in E2 and 4.92 kg/m^2 in E3, with E2 achieving the highest yield among the systems. The specific growth rate (SGR) of Singhi was found to be highest in E3. Both E2 and E3 systems demonstrated superior productivity compared to the conventional tank monoculture method used in E1.

Keywords: *Aquaponics, Heteropneustes fossilis, Lactuca sativa, growth, production*

Innovative approach for enhancing the Farmer's income

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Fruit peel, a hitherto underutilized by-product of fruit processing, holds immense potential to augment farmer income. Fruit peel, a by-product of fruit processing, is often discarded as waste. However, it has the potential to generate additional income for farmers through various value-added products. This paper explores the potential of fruit peel to increase farmer income and identifies opportunities for its utilization. Fruit processing generates significant amounts of peel waste, which can be a financial burden for farmers. However, fruit peel is rich in nutrients, fiber, and antioxidants, making it a valuable resource. This study explores the economic viability of fruit peel utilization and its impact on farmer livelihoods. A mixed-methods approach was employed, combining surveys, interviews, and experiments to investigate the production, processing, and marketing of fruit peel products. Results indicate that fruit peel can be transformed into high-value products such as essential oils, animal feed, and organic fertilizers, yielding a significant increase in farmer income. Market analysis reveals a growing demand for natural and organic products, providing a lucrative opportunity for farmers to tap into the fruit peel market. However, challenges such as lack of awareness, inadequate infrastructure, and market fluctuations need to be addressed to fully realize the potential of fruit peel utilization. This research provides a comprehensive framework for farmers, policymakers, and industry stakeholders to harness the economic potential of fruit peel and improve farmer livelihoods. By promoting fruit peel utilization, we can reduce waste, increase farmer income, and contribute to a more sustainable food system.

Keywords: Fruit peel, Farmer income, Value-added products, Essential oils, Animal feed, Organic fertilizers.

AGROECOLOGY AND BIODIVERSITY CONSERVATION IN ORGANIC FARMING SYSTEM

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The term "Agro ecology and Biodiversity Conservation in Organic Farming refers to a value-based and potentially eco-friendly way to maintain the environment. Agro ecology plays a crucial role in enhancing biodiversity conservation in the organic farming system. Agro ecology, as an approach to farming, emphasizes the interconnectedness of ecological processes and agricultural practices. Agro ecology applies ecological principles to agricultural systems, focusing on enhancing ecosystem functions and promoting biodiversity. It is a unique production and management system that promotes enhanced agro-system health. Natural beauty is balanced while increasing the self-life of agriculture. It helps protect agriculture and maintain the academic discipline that studies ecological processes applied to the agricultural production system. Securely enhancing soil health, particularly managing organic matter while promoting welfare biodiversity, is the goal of organic farming. Conserving natural resources and the environment, increasing biodiversity, and promoting sustainable development that enhance biodiversity conservation while ensuring food security and economic viability. Reduce toxic residues; therefore, free chemical pollution is reduced. Organic farming has proven to have a positive influence on biodiversity. Organic farming is an agricultural production system that avoids or largely excludes the use of synthetically compound fertilizer, pesticides, growth regulators, and livestock feed additives. This abstract explores the synergies between agro ecology and biodiversity conservation within the organic farming system. Biodiversity improves soil fertility, resilience to climate change, and overall ecosystem stability which are aspects of biological pest control to maintain soil productivity. This abstract examines the synergy between agro ecological approaches and biodiversity conservation in organic farming, highlighting their mutual benefits and the potential for these integrated practices to advance sustainable agriculture and environmental stewardship.

Keywords: Agro ecology, biodiversity and organic farming system.

Digital Agriculture: Transforming Developing Countries and Advancing Sustainability in India

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Digital agriculture is transforming the farming process, offering substantial benefits to developing countries by addressing rural poverty and hunger. Driven by advancements such as indoor vertical farming, automation, livestock technology, precision agriculture, Artificial Intelligence (AI), and blockchain, this revolution integrates digital technology across machinery, agronomy, and communication. Mobile devices enhance efficiency and accessibility, while AI, the Internet of Things (IoT), and mobile solutions are pivotal in these advancements. Digital agriculture improves communication, monitoring, and decision-making, leading to time and cost savings, increased productivity and profitability, and better risk management. In India, agriculture is a critical sector, contributing 20.2% to the GDP and supporting half the population. However, small and marginal holdings dominate, and farmers face challenges in earning adequate returns. With the projected demand for food grains to rise to 345 million tonnes by 2030, digital precision agriculture technology is essential. The Indian government has launched the Digital Agriculture Mission 2021-2025 to support initiatives based on AI, blockchain, remote sensing, GIS technology, and the use of robots and drones. This mission, involving collaborations with major companies, aims to make farming more profitable and sustainable, ensuring safe, nutritious, and affordable food for all.

Keywords: Digital Agriculture, Developing Countries, Indoor Vertical Farming, Automation, Livestock Technology, Precision Agriculture, Artificial Intelligence (AI)

Biomass partitioning, economics and yield performance of Groundnut as influenced by phosphorus levels and genotypes

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Groundnut (*Arachis hypogaea* L.) is an important oilseed crop containing about 38-50% oil and 25-30 % dietary protein. India ranks first in area, while in production it ranks second after China with a share of 25.4 % global area and 19.7 % global production of groundnut with an average productivity of 1220 kg/ha which is even lower than that of the world (1579 kg/ha). The major factors limiting the productivity of groundnut in India may be improper selection of varieties without considering soil and climatic conditions of area, flawed fertilizer application, environmental factors and improper water managementThe experiment was laid out in split plot design, replicated thrice with five main plot treatments consisting of phosphorus levels (0,30,40,50 and 60 kg/ha) and three sub plot treatments as genotypes (MH 4, HNG 10 and GNH 804). After one year field experimental study, it was recorded that yield, yield attributes and biomass partitioning to different plant parts was significantly influenced by phosphorus levels and genotypes. Irrespective to phosphorus levels and genotypes, dry weight of different plant parts except root was increased upto maturity, while percent contribution of all plant parts except nuts had declined from 60 DAS upto maturity. Significantly higher dry weight accumulation in different plant parts was recorded with 60 kgP_2O_5/ha phosphorus level at all stages of observation. At 90 DAS and harvest stage maximum dry weight of different plant parts except leaf was recorded with GNH 80. Among phosphorus levels, 60 kgP_2O_5/ha recorded significantly higher pod yield (3481 kg/ha) which has increased to the tune of 2.0 - 92.6 percent over phosphorus levels varying from 50-0 kg P_2O_5/ha, respectively and proved most economical with B:C (1.15). Among genotypes, GNH 804 followed by HNG 10 produced significantly higher pod yield than MH 4. Significantly higher yield with 60 kgP_2O_5/ha phosphorus level and genotype GNH 804 might be due to significantly higher number yield attributes and dry matter accumulation in different plant parts. So, it is concluded that to obtain higher yield and economic returns of groundnut, genotype GNH 804 be fertilized with 60 kg P_2O_5/ha.

Key words: Dry matter accumulation**,** Genotypes, Groundnut, Phosphorus levels and Yield

DESIGN AND FABRICATION OF A BANANA BUNCH HARVESTER

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India, being the largest producer of bananas globally, accounts for over 25% of the world's total banana production. However, the traditional methods of harvesting bananas are labour-intensive, posing significant challenges for small-scale farmers. The conventional method of harvesting bananas involves manual cutting and handling of the fruit, which leads to worker fatigue, fruit damage, and musculoskeletal problems. The process requires a team of two workers, a cutter and a supporter, to carefully cut the banana bunch from the plant. This labour-intensive process not only affects the workers' health but also leads to a significant amount of fruit damage, resulting in substantial economic losses. To address these challenges, our project aims to design and develop a manual banana harvester that is efficient, cost-effective, and suitable for various banana varieties, including Cavendish, Nendran, and Plantain. The harvester is designed to reduce labour strain, minimize fruit damage, and improve worker well-being, while promoting efficient and cost-effective harvesting. The manual banana harvester consists of a stainless steel gripper and cutter mechanism with a 360° rotating telescopic design. The harvester is lightweight, weighing only 5.5 kg, making it easy to transport and store. The benefits of the manual banana harvester are numerous. Firstly, it reduces labour strain and fatigue, allowing workers to harvest bananas for extended periods without discomfort. Secondly, it minimizes fruit damage, resulting in higher- quality produce and increased economic returns for farmers. Furthermore, the manual banana harvester is cost-effective, with an estimated cost of 9.7 K, making it an affordable solution for small-scale farmers. Our project aims to revolutionize the banana harvesting process by providing a efficient, cost-effective, and sustainable solution. By developing the manual banana harvester, we aim to benefit small-scale farmers, enhance productivity, and contribute to the sustainability of banana production.

Keywords: banana harvesting, manual harvester, sustainable agriculture, crop management, ergonomical design.

Data Capturing to Project Management: Knowledge about ICT based research life cycle

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ICT has been very helpful in developing nations to improve researchers' knowledge and understanding, which makes it easier for innovations to reach farmers and makes it possible for researchers to directly communicate information to farmers who don't have the opportunity to attend agricultural extension meetings or services. The study was carried to determine the knowledge of ICT based research life cycle among the research faculties of CCS Haryana Agricultural University, Hisar in 2023. All the colleges of university were selected for collection of data. Data were collected personally from 120 research faculties including scientists from cotton section (5), oilseeds section (7) and wheat & barley section (7). The findings of the study revealed that majority of the scientists were males, aged between 37-47 years, PhD with NET qualification and job experience of 6-10 years. Majority of respondents (88.3%) had knowledge of applications *viz.* remote sensing, geophysical survey and speech recognition under data capturing. For data structuring and enhancement cent per cent of the respondents had knowledge about coding followed by animation (65.0%) and image enhancement (46.6%). Regarding data analysis cent per cent of the research faculty had knowledge of applications for descriptive statistics followed by collating (90.0%) and content analysis (65.0%). Cent per cent of the respondents had knowledge about data protection and system security planning followed by the knowledge of back up (96.6%) for strategy and project management. Majority of the respondents faced eye problems due to continuous working (WMS 2.55) followed by limited availability of training programs tailored to the specific needs (WMS 2.44) as the major constraints.

Keywords: Information and Communication Technologies (ICTs), Knowledge, Research

ASSOCIATION OF SELECTED CHARACTERISTICS WITH ENTREPRENEURIAL BEHAVIOUR OF MANGO GROWERS

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Odisha is the 7th largest Mango producing state in India & occupies 60.00 % of total fruit cultivated areas of the state. ODOP (One District One Product) Programme is an initiative by Government of India which is seen as a transformational step forward towards realizing true potential of a district, fuel economic growth, employment generation & rural entrepreneurship. The Mango, being a commercial fruit crop, production & income of the farmers can only be increased through entrepreneurship for which entrepreneurial behaviour act as a crucial factor. Hence, it is important to study the entrepreneurial behaviour of Mango growersFrom each district two blocks were selected purposively on the basis of maximum area & production of Mango and from each block clusters of villages were selected randomly. 45 numbers of respondents were selected randomly from each cluster of villages totalling to 180 respondents for the study. Collected data were classified, tabulated and analysed through statistical tools like Index, frequency, percentage, mean, standard deviation, correlation & multiple regression. It was found that out of the 18 selected characteristics 13 variables i.e. age, self-education, Mango farm experience, social participation, land holding, cultivable land, land under Mango, annual income, income from Mango, consolidated information seeking behaviour, consolidated marketing behaviour, consolidated knowledge and consolidated adoption were found influencing the entrepreneurial behaviour and other 5 variables i.e. family education, family size, Mango tree per acer, Mango yield index, consolidated constraints were found having no association with entrepreneurial behaviour. These 13 variables had significant & strong correlation with entrepreneurial behaviour. R Square was found to explain 63.00 percent of variation in the dependent variable i.e. consolidated entrepreneurial behaviour was explained by the selected independent variable i.e. age, self-education, family education, family size, Mango farm experience, social participation, land holding, cultivable land, land under Mango, annual income, income from Mango, Mango tree per acer, Mango yield index ,consolidated information seeking behaviour, consolidated marketing behaviour, consolidated knowledge, consolidated adoption & consolidated constraints.

Keywords: Entrepreneurial behaviour, selected characteristics, Mango growers, association, significan

Innovative Approach for Enhancing the Farmer's Income

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Fruit peel, a hitherto underutilized by-product of fruit processing, holds immense potential to augment farmer income. Fruit peel, a by-product of fruit processing, is often discarded as waste. Fruit peel is rich in nutrients, fiber, and antioxidants, making it a valuable resource. Fruit peel can be transformed into high-value products such as essential oils, animal feed and organic fertilizers, yielding a significant increase in farmer income. It has the potential to generate additional income for farmers through various value added products. Fruit peel utilization can reduce post-harvest losses by 15-20% and contribute to sustainable agriculture practices. It needs to study the economic viability of fruit peel utilization, impact on farmer livelihoods and opportunities for its utilization. Fruit processing generates significant amounts of peel waste, which can be a financial burden for farmers. Previous study indicated that market analysis reveals a growing demand for natural and organic products, providing a lucrative opportunity for farmers to tap into the fruit peel market. However, challenges such as lack of awareness and inadequate knowledge need to be addressed to fully realize the potential of fruit peel utilization.This paper explores a comprehensive framework for farmers, policymakers, and industry stakeholders to harness the economic potential of fruit peel and improve farmer livelihoods. By promoting fruit peel utilization, we can reduce waste, increase farmer income, and contribute to a more sustainable food system.

KEYWORDS: Fruit peel, Farmer income, Value-added products, Post-harvest losses, Agricultural waste management

Nutrient Management in a Changing Climate: Strategies for Resilient Horticultural Systems

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As the impacts of climate change intensify, horticultural crop production faces significant challenges in maintaining soil fertility and crop productivity. This study investigates climate-adaptive nutrient management strategies to enhance soil health and horticultural crop resilience in a changing climate. The research employs a multidisciplinary approach, combining field experiments, soil analysis, and climate modelling to develop effective nutrient management practices. Climate-driven changes in soil moisture and temperature alter nutrient availability and uptake, necessitating adaptive fertilizer application timing and rates. Soil organic matter and microbial activity play critical roles in maintaining soil fertility and crop productivity under climate stress. Diversified farming systems and agroecological practices enhance soil health, biodiversity, and ecosystem services, contributing to climate resilience. Precision agriculture and digital tools enable data-driven nutrient management, optimizing fertilizer use and minimizing environmental impacts. The study demonstrates that climate-adaptive nutrient management can improve soil carbon sequestration and mitigate climate change, enhance crop yields and quality under climate stress, reduce fertilizer waste and environmental pollution, and support sustainable agricultural development and food security. This research provides valuable insights for farmers, policymakers, and industry stakeholders seeking to develop climate-resilient horticultural production systems. By adopting climate-adaptive nutrient management strategies, the agricultural sector can reduce its vulnerability to climate change, ensuring a more sustainable and food-secure future. The findings of this study can inform the development of climate-smart agricultural practices, contributing to a more resilient and sustainable food system.

Key words: Organic farming, issue, export etc.

Nutritional and Therapeutic potential of Vitamin-C Rich Super food: Persimmon

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Fruits and vegetables are vital for healthy diets and there is broad consent that a diverse diet containing a range of (plant foods and their associated nutrients, phytonutrients and fibre) that is required for health and wellbeing. Fruits possess various medicinal and aesthetic values. Persimmon is a berry fruit sometimes known as the “apple of the Orient” is quiet delicious, high-quality fruit with great export potential. It is mostly cultivated in Asian countries and widely consumed as a table fruit. The bright yellow colour of the fruit is quiet appealing, soft texture and pleasant aroma attract most of the consumers. Its nutritional composition includes health promoting nutrients such as minerals, vitamins, anti-oxidants that are vital for optimum health. The fruits are good source of Vitamin C, low in calories and fats but rich source of dietary fibre. The tannic and Gallic acids in persimmons along with the other flavonoids and antioxidants, may reduce high blood pressure, inflammation and high cholesterol. Eating persimmons may help boost immunity as they are rich in ascorbic acid (vitamin C.) A single persimmon offers enough vitamin C required for a day. Persimmon is also rich in vitamin A, other carotenoids and antioxidants. These may help enhance the function of the optic nerve and protect eyes from cataracts and age-related macular degeneration (AMD causes vision loss). Consuming persimmons regularly may also decrease the risk of adverse ailments like glaucoma, night blindness, and other diseases. Persimmon contains vitamin B6 that helps to regulate the breakdown of proteins, fats and carbohydrates that offers optimal metabolism and energy levels. Phytonutrients in a ripe persimmon, like tannins and polyphenols, have antimicrobial features that may help reduce stomach infections and fibres present in persimmon helps to balance gut microbial flora for the smooth functioning of the intestines. Hence it is the powerhouse of all nutrients.

Keywords: Persimmon, Vitamin-C, Bioactive compounds, Phytonutrients, Anti-microbial

Plant Growth Promoting Rhizobacteria as Big Impact: How Can Change the Future of Sustainable Agriculture under Changing Climatic Conditions

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Agrochemicals have become an inevitable part of agriculture in the current scenario despite their manifold benefits, agrochemicals pose a serious threat to agriculture itself and do not account as sustainable. Continued uses of agro-chemicals have resulted in the development of pesticide resistant pests. Another drawback of pesticides owing to the nature of their intermediate compounds is that they are hard to degrade, thus degradation by microbial agents can help contain the toxicity. Hence, we must focus on the improvement of alternative methods to boost agriculture that are sustainable and effective. Bacteria that colonize the rhizosphere and plant roots, and enhance plant growth by any mechanism are referred to as Plant Growth Promoting Rhizobacteria (PGPR). PGPR can exhibit a variety of characteristics that are responsible for influencing plant growth. PGPR works by various direct and indirect mechanisms which include utilizing tryptophane for the production of Phytohormones, antagonism against phytopathogens by the production of siderophores, BNF, nutrient acquisition by phosphate and zinc solubilization. Along with all the benefits that PGPR have to offer the best one has to be sustainability as rhizobacteria do not pose any threat to the quality of soil and do not interfere negatively with other life forms. Rhizobacteria-based bio-fertilizers hold significant promise for sustainable agriculture, as academic research indicates their potential to enhance soil fertility, improve crop yields, and reduce the need for chemical fertilizers. These biofertilizers can promote plant growth through nitrogen fixation, phosphate solubilization, and the production of plant growth-promoting hormones. With increasing concerns about environmental degradation and the demand for organic farming practices, rhizobacteria-based solutions are poised to play a crucial role in the future of agriculture. Ongoing research aims to optimize these biofertilizers for diverse crops and environmental conditions, paving the way for their broader adoption and integration into farming systems worldwide.

Keywords: IAA, PGPR, Pesticide, Bio-fertilizers, Sustainable Agriculture, Climate Change

Isolation method standardisation and characterization of native finger millet Starch

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Finger millet, known for its exceptional nutritional profile, remains underutilized due to challenges in processing and limited research focus. This study aimed to standardise the isolation process of finger millet starch based on yield and colour attributes, crucial for its industrial applications. Finger millet grains were cleaned, and processed using both dry and wet milling methods, with steeping solutions of distilled water, 0.25% NaOH, and 0.5% Na2SO4. The starch was isolated through centrifugation and subsequently dried. The yield and color (L*, a*, b* values) of the starch were evaluated to find the better isolation process. Results revealed that the wet milling method with 0.25% NaOH steeping solution produced the highest starch yield of 55.05 ± 1.32% and the highest L* value of 89.85, indicating superior lightness and purity. The alkali-assisted method facilitated effective dehulling and bleaching, contributing to better starch characteristics. In contrast, the distilled water steeping solution resulted in the lowest yield and colour values. The study involved a comparative analysis of finger millet starch obtained using different steeping solutions and isolation methods. The starch isolation using the wet milling method with NaOH steeping emerged as the most effective approach. This refined protocol offers a standardized method for obtaining high-quality finger millet starch, enhancing its potential for use in various food and industrial applications. The native starch obtained was characterised for various properties like water absorption capacity, oil absorption capacity, swelling power and solubility. Rheological analysis demonstrated the pseudoplastic nature of the starch gel by various model fitting. This detailed analysis provides valuable insights into the structural and functional properties and the findings underscore the significance of the isolation process in determining the yield and quality of starch, providing valuable insights for future research and industrial practices.

Harnessing Climate-Smart Agriculture to enhance Crop Yields and Farm Income in Odisha

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Climate change, characterized by increasing temperature and variability in rainfall, poses severe risks to agriculture and food security in Odisha, India. The state's semi-arid districts—Balangir, Kendrapara, and Mayurbhanj—are particularly vulnerable to these climate-induced challenges. Climate-smart agricultural (CSA) practices, including crop rotation, integrated soil management, and efficient water use, are essential for farmers to adapt to these changes while also contributing to a reduction in greenhouse gas (GHG) emissions. This paper evaluates the impact of CSA practices on agricultural yield and farm income in these vulnerable districts. Utilizing primary survey data collected from 284 households during the 2022–2023 agricultural cycle, the study employs a multi-stage stratified sampling approach alongside a structured questionnaire to capture comprehensive data on CSA adoption and its effects. To analyze the impact of CSA practices on productivity and income, Propensity Score Matching and the Two-Stage Least Squares method were employed. The study underscores the critical role of CSA in supporting sustainable agricultural growth and economic resilience amidst climatic uncertainties. The results suggest that small and marginal farmers in Odisha area highly susceptible to environmental stresses, can achieve substantial gains in productivity and income by embracing CSA technologies. Consequently, it is imperative for policymakers to promote and expand the adoption of CSA practices through robust extension services and support programs. By scaling up CSA adoption, the agricultural sector can better withstand climate challenges and contribute to enhanced food security and economic stability in the region.

Keywords: Climate smart agriculture, crop yield, farm income, CSA practices

Genome editing technology, a sustainable approach for crop improvement and disease management against biotic stress

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Crop productivity is significantly threatened by undesirable changes in various environmental factors. Global warming has created favourable environment for introduction of new pests and pathogens in new geographical areas. Among these pathogens, plant viruses pose a substantial risk to global food security causing more than 40% damage by reducing the quality and quantity in many economically important crops. Viruses with limited genome size and a few proteins can survive in the diverse environment by generating mutants through genetic rearrangements. Compatible host-virus interactions are a prerequisite for successful infection, multiplication and local/systemic movement that involves different host cellular factors. Targeting of these host susceptibility factors present a very effective strategy against plant viruses by disrupting their replication, translation and spread. Advanced genome editing tools like clustered regularly interspaced short palindromic repeat (CRISPR) and its associated protein (cas9) have emerged as fast and time saver technology over conventional breeding for crop improvement. This approach has been effectively utilized for targeted knockout of eukaryotic translation initiation factor (eIF4E) in cucumber and exhibited broad virus resistance against cucumber vein yellowing virus (CVYV), zucchini yellow mosaic virus (ZYMV) and papaya ring spot mosaic virus-W (PRSMV-W). Similarly, resistance against potato virus Y (PVY) has been reported in tomato upon targeted disruption of eIF4E1. One more study has shown that knockout of tobamovirus multiplication 1a (TOM1a) and TOM3 gene in tomato displayed resistance to tobacco brown rugose fruit virus (ToBRFV). These studies demonstrate that genome editing offers an environment friendly and sustainable approach for management of plant viruses.

Pretreatment Methodologies to Enhance Agricultural Waste Biodegradation and Effective Energy Recovery Through Anaerobic Digestion (AD).

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Agricultural wastes such as wheat straw, rice straw, corn stover and others, are mainly composed of complex lignocellulosic structure that hinders with their biodegradation and thus becomes rate-limiting during the hydrolysis step of anaerobic digestion (AD) process. Pretreatment of agro-waste could enhance breakdown of this complex lignocellulosic network, thereby accelerating downstream AD process. The pretreatment methods could be physical (mechanical, thermal, sonication), chemical (acid, alkali, organic solvent and oxidative) and biological (enzymatic, bacterial, fungal). Physical method improves the degradability of polymeric units but is highly energy intensive and in some cases might lead to the formation of recalcitrant compounds, i.e., furan derivatives from cellulose. Strong chemical pretreatments with acid/alkali although enhances bio-degradability as high as 89% but might lead to loss of cellulose and lignin content up to 60% and 70%, respectively. Use of ionic liquids (salts in liquid form at or near room temperature) is emerging as a highly effective chemical pretreatment that are renewable, recoverable, difficult to oxidize, and bio-based salts. In biological pretreatment, bacterial pretreatment is superior to fungal and algal pretreatments. Advanced technologies like FTIR, SEM, XRD, and TGA-DTG can validate the efficiency of the pretreatment method, by evaluating the modifications in lignocellulosic biomass with respect to their functional groups, mass loss, crystal feature, surface topography, and morphology. AD aids in stabilizing the end product or digestate, reduces odour as well as produces renewable source of energy in the form of Methane, which is a commercial important bioenergy resource. Thus, AD in conjugation to varied pretreatment technologies is a beneficial and sustainable strategy for conversion of waste to wealth.

Keywords: Agro-waste, pretreatment, anaerobic digestion, renewable energy, methane.

Genetic Diversity for Morpho-Physiological and Quality traits in Biofortified Bread Wheat

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Wheat is the widely cultivated cereal crop, serving as a staple food for over 1/3rd of the global population, and is the main source of nutrients and protein. To meet the increasing demand for food and nutritional security, developing high-yielding varieties with improved nutritional quality is crucial. Understanding genetic associations and variability among genotypes is essential for breeders to develop improved crop varieties with high grain yield and better quality. This study aimed to assess genetic variability in 64 biofortified bread wheat genotypes, including four checks, for 14 morpho-physiological and 12 quality traits during the *Rabi* 2022-23High heritability coupled with high genetic advance was observed for spike weight, biological yield/plot, harvest index, grain yield/plot, wet gluten, dry gluten, total gluten, zinc content, inorganic phosphate, sedimentation value and phenolic content, indicating the presence of additive gene action and therefore, direct selection will be effective for genetic improvement. There was significant positive correlation among yield and other traits, *viz*., plant height, number of tillers per meter, number of spikelets / spike, spike length, spike weight, peduncle length, 1000 grain weight, grain weight / main spike, number of grains / spike, biological yield / plot, harvest index and hectoliter weight, which indicate that selection for these traits will be effective to improve grain yield. The study revealed promising genetic diversity in wheat genotypes for the traits under consideration, highlighting the potential for improving grain yield along with quality traits through selection and/or recombination breeding. The selection based on the traits like number of tillers/meter, biological yield/plot, harvest index, spike length, number of grains/spike, peduncle length, 1000 grain weight and hectolitre weight will be effective to improve wheat yield, and quality traits like phytic acid, iron content, zinc content, inorganic phosphate, sedimentation value and phenolic content can also be improved simultaneously.

Keywords: Genetic Variability, Heritability, Genetic advance, Correlati

Integrating Nutrient Management Strategies to combat climate change: A Study on Rice-Wheat Production Systems in Haryana

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Presently, Global agrifood system emits one-third of all emissions and its food demand is estimated to surge to feed a projected global population of 9.7 billion people by 2050. A sustainable agrifood system is one that delivers food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generation is not compromised.+ In this scenario, Agriculture is the second largest contributor of greenhouse gas emissions in India. To mitigate these emissions, crop scientists have been working on new ways to make farming more nutrient- and energy-efficient. States with intensive crop production systems like Haryana and Punjab, care must be taken to ensure that the availability of nutrients is not limiting grain yield. Henceforth the farmers of Haryana and Punjab should encourage different nutrient management strategies to cope up with theses irratic changes of climate. Thus, careful attention is required with soil management and macro and micro-nutrient supply. Nevertheless, Residue burning is still a widely prevalent practice among farmers of Haryana and Punjab. It destroys soil organic matter, affects the air quality and adds to greenhouse gas emissions. In the rice–wheat production areas of Haryana and Punjab, many farmers have now adopted zero tillage of wheat with retention of preceding crop residues which projected a positive grain yield using balanced nutrient management strategies. Hence the Study concludes identifying various conservative agricultural practices specifically zero-tillage in Haryana and Punjab also extending the awareness among farmers which can rapidly upsurge the benefits of residue recycling in no-till-which means direct sowing of seeds through the residues without tilling the land.

Keywords: GHG Emissions, No-till, Conservative Agriculture Practices, Balanced nutrient management

Effect of long-term Phosphorus fertilization and farmyard manure on soil organic carbon and soil physical properties under maize-wheat crop rotation

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The long-term impact of phosphorus (P) application on soil physical properties and soil organic carbon (SOC) is vital for sustainable land management and maximizing crop productivity. This study evaluates how inorganic P fertilizer alone and with farmyard manure (FYM) affects soil properties and crop yields in maize-wheat systems across soils with varying Olsen-P levels. Conducted in 2023 on soils with different Olsen-P statuses, the experiment included treatments: P0 (control), P30, P60, P90, P120, P30+FYM, and P60+FYM. Results indicated that in high Olsen-P status soils, increasing P rates from 30 to 120 kg P_2O_5 ha^{-1} decreased cumulative infiltration (CI) by 0.97% to 3.9%. In contrast, in medium Olsen-P status soils, CI increased by 1.2% to 24.9% with similar P treatments. Bulk density (BD) increased by up to 10% with P120 in high Olsen-P soils but decreased by up to 6.7% in soils with medium Olsen-P. The addition of FYM improved CI, mean weight diameter (MWD) of soil aggregates, and soil organic carbon (SOC), while reducing BD in both P status soils. Positive correlations were found between infiltration rate and aggregate MWD with SOC levels. Optimal P rates, especially with FYM, enhanced soil physical properties and crop yields. These findings underscore the importance of tailoring P application strategies to soil Olsen-P levels for sustainable maize-wheat cropping.

"Growth and Reproductive Fitness of Fall Army Worm *Spodoptera frugiperda* (J.E. Smith) Lepidoptera: Noctuidae on Artificial Diet"

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The fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae), is an invasive and polyphagous pest found worldwide that poses a severe risk to grain production safety. An invasive and significant pest of maize, Spodoptera frugiperda (J.E. Smith) was recently brought to South India in 2018. Two strains are known to exist: the maize strain and the rice strain. Although many diets have been attempted worldwide, none of them used rice and Maize flour as a natural host component. Continuous mass rearing of this invasive pest throughout the year required an artificial diet because natural food was not easily available for all seasons and farmers sprayed any insecticide in maize crop fields caused much damage to mass-reared fall armyworms contamination, Infection, and insecticide may kill all of the larvae and mass-reared cultured disturb. The development of larvae revealed a substantial variation in the diets concerning the criteria of reproductive fitness.

The findings showed that the combination of maize and rice flour with a chickpea flour-based diet, compared with the combination of maize leaf as control with an Artificial diet, was the one in which *Spodopetra frugiperda* experienced the best growth, development, and food utilization and best reproductive fitness. The net reproductive rate, gross reproductive rate, intrinsic rate of rise, finite rate of growth, mean generation time, and population doubling time were all significantly impacted by the evaluated diets. The combination diet based on maize & rice and chickpea flour had the highest values of these parameters, and it was succeeded by a diet based on maize flour with chickpea flour and common in rice flour powder. According to the findings, a Diet consisting of a combination of chickpea flour and rice flour was the best suitable for growth, and reproductive fitness and for mass raising of *Spodoptera frugiperda* in a laboratory.

Keywords: Growth, Reproductive Fitness, Mass rearing, *Spodoptera frugiperda,* Artificial diet, Fall army Worm

Growth regulator treated half corms enhance corm and cormel production in gladiolus (*Gladiolus hybridus* Hort.)

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The experiment was conducted to determine the effect of half corm soaked in growth regulators on corm and cormel production in gladiolus cultivar 'Punjab Glance'. The highest survival percentage (97.64 and 94.76%) was obtained with potassium nitrate at 1 and 1.5%, whereas benzyl adenine was most inefficient in survival of plants. Corm and cormel production was most enhanced in potassium nitrate at 1% treatment *viz.* corm yield (33.68 and 32.69 per m^2), cormels yield (360.73 and 322.38 per m^2), corm weight (24.59 and 19.38 g per plant) and corm size (3.55 and 3.62 cm per plant). Potassium nitrate yielded 70-80% flowering grade corms (3-4 cm), whereas 10-15% were non-flowering grade corms (2-3 cm). Considering corm and cormel yield, half corm soaked in potassium nitrate at 1% for 24 hours was found to be more profitable.

Farmers' Perspectives on Climate Change, Low Carbon Agriculture, and Carbon Management in Bishnupur District of Manipur: A Comparative Study

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This comparative study examines the knowledge, attitudes, and practices of farmers regarding climate change, low-carbon farming, and carbon credits in the Bishnupur district of Manipur, India. A survey of 200 farmers from the blocks of Thinungei, Kwaksiphai, Sendra, and Kumbi in Bishnupur district of Manipur was conducted using a questionnaire. The questionnaire prepared for the interview is composed of four parts: socio-demographic information, behavioural information, sustainable farming practices, and agronomic information. Farmers were divided into adopters and non-adopters of low carbon farming practices. The study reveals significant differences in their understanding of climate change, perceptions of low carbon farming, and engagement with carbon credit initiatives. Adopters demonstrate higher knowledge and more positive attitudes towards climate-resilient agriculture, while non-adopters face barriers such as limited access to information and resources. The study highlights the need for targeted interventions to enhance farmers' knowledge, attitudes, and practices regarding climate change mitigation and adaptation strategies, ultimately supporting the resilience of agricultural systems and the well-being of farming communities in Manipur.

Keywords: Climate Change, Low Carbon Farming, Carbon Credits, Farmers' Knowledge, Attitudes, Practices.

Green Gold: Sustainable Income Generation through Innovative Uses of Banana Pseudostem

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The current study focuses on the different creative uses of banana pseudostem for consistent revenue generation in rural areas. Banana pseudostems from several genotypes (ABB, AAB, BB) were evaluated for tensile strength, with banana genotypes AAB being the strongest at 768MPa, BB genotypes at 500-600MPa, and ABB at 450-480MPa. Banana fibers from the AAB and BB genotypes were used to make saris and shawls, whereas fibers from the ABB genotype were utilized to make purses and decorative items. The liquid extract of banana pseudostems obtained following fiber extraction was employed as a liquid bio-fertilizer (N-0.5%, P-0.17%, and K-0.18%). Instead of paddy straw, dried wastes from banana yarn production are employed as a substrate for growing mushroom (oysters) where maximum mycelium growth was found in 8 days after inoculation and harvesting within 22-30 days (DAI). By establishing value chains centered around banana pseudostem, rural areas can foster local industries, reduce unemployment, and mitigate the migration of rural populations to urban centers. This paradigm shift from waste to wealth exemplifies a sustainable model for rural development, creating resilient and self-sufficient communities that contribute to the broader goals of sustainable development and environmental stewardship.

Keywords: Sustainable, banana fiber, tensile, pseudostems, biofertilizer

Association of short tandem repeat polymorphs with average daily gain in Vrindavani cows

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Short tandem repeats are a class of genetic markers abundantly distributed in the genome. STR polymorphism results from differences among individuals in the number of repeats of a DNA sequence comprising of 2-6 nucleotide base pairs. These are widely used for association studies based on linkage disequilibrium. The present study was conducted to explore polymorphism and association of a pair of STRs viz. BMS2503 and BMS2389 which are nearest to and flanking a quantitative trait locus (QTL) controlling average daily gain (ADG) in Vrindavani cows. Both the STRs were found to be polymorphic. On analysis of phenotypic data collected from 95 cows the least square mean value for average daily gain was found to be 383.34 ± 4.75 gm. However, least square analysis of variance did not reveal any significant effect of genotypes at BMS2503 and BMS2389 and the haplotypes at the two STRs on ADG. Similar studies with different STRs in the vicinity of the same and other QTLs governing ADG should be undertaken to identify polymorphisms associated with genetic determinants of ADG in Vrindavani cattle population. With a growing emphasis on sustainable livestock practices, it has become increasingly important to include non-production traits in the selection process alongside traditional dairy characteristics.

A field study on supplementation of mineral licks for grazing sheep

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A study was conducted to evaluate the impact of mineral licks supplementation on sheep production performance in Warangal district. The study was carried out for 90 days in two continuous years. A total of 200 animals were selected randomly from five locations from adopted villages (Nallabelly, Ontimamidipally, Jayaram Tanda, Singaram, and Mahbubnagar). During 90 days, the treatment group was supplemented with mineral lick (Molasses coated mineral brick) by hanging in the sheds, while in the control group animals were natural grazing without supplementation. Analysis of the data revealed that the mineral lick-supplemented animals gained body weight of 18 kg and came to sexual maturity at 35 th week while the control-group animals the body weight was 15 kg and attained sexual maturity at 38th week. Economic indicators such as body weight, health status, and the age of sexual maturity were significant in the treatment group. These findings suggest that supplementation of mineral lick has enhanced the performance of sheep.

Key Words: Mineral lick; Body weight; Sexual maturity

Combining Ability and Gene Action Studies in Pigeonpea (*Cajanus cajan* (L.) Millsp.): Identifying Superior Genotypes for Crop Improvement

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Pigeonpea (*Cajanus cajan* (L.) Millsp.) is the sixth important pulse crop in the world and second important pulse crop in India after chickpea. A total of 24 pigeonpea crosses were developed by crossing six lines with four testers in Line × Tester fashion during *Kharif* 2022-23 at Pulses Research Station, Junagadh Agricultural University, Junagadh and were evaluated for twelve traits in Randomized Block Design with three replications during *Kharif* 2023-24 to estimate combining ability and gene action. The estimates of σ^2gca were lower than the corresponding σ^2sca for all the characters studied indicating the predominance of non-additive gene action. Among the parents, the line GJP 1915 was found to be good general combiner for seed yield per plant and its yield contributing characters like plant height, number of primary branches per plant and pod length. The tester GJP 1820 was good general combiner for seed yield per plant and its component traits like plant height, number of primary branches per plant, number of secondary branches per plant, number of pods per plant and 100-seed weight. Two crosses BDN 2013-41 × UPAS 120 and GJP 1915 × BLACKTUR had registered significant and positive sca effect for seed yield per plant. Hence, these crosses could be exploited in heterosis breeding for improvement of high yielding genotypes. It is suggested that the selection of parents for further breeding programme should be based on gca effect and due consideration should be given to mean value of the cross combination while selecting crosses for specific combining ability effect.

Assessing Farmers' Perception of Agricultural Input Dealer Services: A SERVPERF Model Analysis

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Agricultural input dealers are very important among several other actors of private extension system in the country in providing agro advisory services. Being a localite information source, they have utmost credibility among the farming community than outside extension agents and thus can aid in effective transfer of technologies. To make use of this potential, National Institute of Agricultural Extension and Management (MANAGE) is offering a Diploma in Agricultural Extension Services for Input Dealers (DAESI) to turn them into para extension professionals through training and capacity building. The study was carried out during 2020 to assess the perception of the farmers towards the services provided by agricultural input dealers using SERVPERF model. Two districts namely Nagar Kurnool and Wanaparthy from Telangana state were included in the study covering a random sample of 120 farmers. Results revealed that that majority (60.00%) of the farmers had a medium level of perception followed by high (28.33%) and low (11.67%) level of perception respectively. Dimension wise results as per SERVPERF model depicted that perception of the farmers was satisfactory towards the tangibility, reliability, responsiveness and assurance dimensions with their recorded mean values of more than 3. However, there was a slight dissatisfaction observed towards empathy dimension that recorded a mean value of 2.89.

Keywords*:* Input dealers, Agro advisory services, Credibility, Perception, SERVPERF model

Morphological characterization in Pigeonpea [*Cajanus cajan* (L.) Millsp] germplasm of chhattisgarh using DUS descriptors

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In this study 100 germplasm and 4 checks CGA2, CGA1, RJLN and ASHA were evaluated and morphological characterization are carried out by visual observation on the basis of DUS characterization, which was conducted in Augmented Randomized Complete Block Design with 4 blocks during kharif 2020-2021 at College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh. The observation are recorded on five randomly selected plants in each genotype for the following 15 qualitative traits and out of 15 characters, Flower pattern of streaks on petal shows (57) sparse, (32) medium, (14) dense type of genotypes, Pod constriction (92) slight and (12) prominent type of genotypes, Plant branching pattern show (15) germplasm are erect, (74) germplasm are Semi-spreading and (15) genotypes are spreading, Stem colour (90) are green and (14) are purple, Pod colour (20) green with brown streak, (80) green with purple streak and (4) purple, leaf shape (82) are oblong and (22) are narrowly oblong, Colour of flower base of petal light yellow (57), orange yellow (23), red (4) and yellow (20) genotypes, Plant growth habit shows (74) Determinate and (30) are indeterminants type of genotypes, seed colour (46) are brown, (39) are dark brown, (6) are grey and (3) genotypes are purple, seed colour pattern (99) are uniform and (5) genotypes are mottled. Seed shape (94) genotypes are oval, (43) are globular and (10) genotypes are elongated. The qualitative characters showed wide variation and the potential germplasm may be utilized for further breeding programes.

Review on Microencapsulated antimicrobials for textiles

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Increasing global competition in textiles has created many challenges for textile researchers. Novel finishes of high added value for apparel fabrics are also greatly appreciated by the most demanding consumer market. Antimicrobial textiles with improved functionality find a variety of applications such as health and hygiene products, especially the garments worn close to the skin and in the area of medical applications. Textile materials are good carriers of various types of microorganisms and can cause health related problems to the wearer. In order to protect from the wearer from such infection the textile fabrics can be finished with antimicrobial agents. There are several studies in literature in which natural materials have been used to give antimicrobial finishing to the textile materials. One of the major limitations in the natural materials based antimicrobial finishing is the non durability of the finish since they cannot form any bond with the textile materials. Microencapsulation of natural materials is one of the methods used to increase the durability of the antimicrobial finishing on the textile material. There are many problems associated with microorganism's growth on textiles. Research to develop antimicrobial textiles using different technologies like Microencapsulation, Nano technology etc has taken a big leap. This review presents the critical analysis of the microbes and their mechanism of adherence on textiles their effect and various aspects of producing antimicrobial textiles.

Keywords: Antimicrobial, Textiles, Microencapsulation, Microorganisms, Finishes, Nano technology.

Bio-efficacy and cost effectiveness of biorationals against mustard aphid, *Lipaphis erysimi* Kalt.

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The current investigation entitled "Bio-efficacy and cost effectiveness of biorationals against mustard aphid, *Lipaphis erysimi* Kalt" was carried out during the *Rabi*, 2020–2021 at the Agronomy Farm, S. K. N. College of Agriculture, Jobner, for controlling aphid infestations in mustard crops through two rounds of spraying. Treatments included *Metarhizium anisopliae*, *Beauveria bassiana*, *Verticillium lecanii*, Azadirachtin, NSKE (5.0%), neem oil (1.0%), karanj oil (1.0%), karanj seed extract (5.0%), and a standard check involving alternate spray of dimethoate (0.03%)/malathion (0.05%). Results indicated that the most effective first spray treatments were standard check dimethoate, followed by Azadirachtin, NSKE, neem oil, *M. anisopliae*, *V. lecanii*, *B. bassiana*, karanj seed extract, and karanj oil. For the second spray, the most effective treatments were malathion, Azadirachtin, NSKE, neem oil, *M. anisopliae*, *V. lecanii*, *B. bassiana*, karanj seed extract, and karanj oil. Plots treated with dimethoate/malathion showed zero avoidable loss and the lowest loss in karanj oil-treated plots. Similarly, these treatments exhibited the highest yield increase and net profit, with dimethoate/malathion having the highest benefit-cost ratio (15.09) compared to other treatments, notably karanj seed extract (1.87).

Bio-efficacy of botanicals against tea mosquito bug infesting cashewnut

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An experiment was conducted at Regional Fruit Research Station, Vengurla, Maharashtra to study the bio-efficacy of botanicals for the management of tea mosquito bug infesting cashew nut in the year 2022-23. The experiment was laid in RBD with eleven treatments and three replicate. Results revealed that the data recorded on cumulative incidence of TMB revealed that at 7 DAS the treatment T_9 (Lambda cyhalothrin 0.6 ml/l) noticed 0.23 TMB incidence and was found to be significantly superior over the rest of the treatments. Among the different botanical treatments, the treatment T_6 Satvin (*Alstonia scholaris*) bark extract 5% was found to be the most effective (0.36) for management of TMB, but it was at par with all other treatments except T_{11} (Untreated control). At fifteen days after spraying, treatment T_9 (standard check) noticed 0.25 TMB incidence and found to be significantly superior over the rest of the treatments. Among the different botanical treatments, the treatment T_6 Satvin bark extract 5% was found to be the most effective (0.44) for management of TMB, but it was at par with all other treatments except T_{11} (Untreated control). The maximum yield (9.00 kg/tree) was recorded in treatment T_9 (Standard check) which was significantly superior to all other treatments. Among the different botanicals, treatment Satvin bark extract 5% recorded maximum yield (5.35 kg/tree) but was at par with all other treatments.

Keywords: Botanicals, Tea mosquito bug, Cashew nut, Organic management, Bio-efficacy.

A Study on the Effectiveness of Soybean in Reducing Malnutrition among the Children of Harda District

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Malnutrition is widely recognized as a major health problem in developing countries. Growing children in particular are most vulnerable to its consequences. Cases with mild-to-moderate malnutrition are likely to remain unrecognized because clinical criteria for their diagnosis are imprecise and are difficult to interpret accurately. Malnutrition is the condition that results from eating a diet in which certain nutrients are lacking, either available in excess or in the wrong proportions. It is present in the form of under-nutrition, which is caused by a diet lacking adequate calories and protein. Malnutrition has great impact on children's physical and mental growth and it is the major cause of mortality in infants. Cases of Malnutrition have also been reported in Madhya Pradesh where it is considered much higher than the national average. According to National Family Health Survey-III, malnutrition in Madhya Pradesh has increased from 54% to 60%. The state also tops the list of states in infant mortality rate (IMR). Objective: To reduce Malnutrition among the children of poor population, especially those of scheduled caste and scheduled tribe communities who do not have easy access to the diet rich in nutrients. To promote the use of Soybean in human diet and thus, to emphasise for bringing more area under cultivation of Soybean as it is also a cash crop. To encourage the masses for using Soybean by products like Soy flour, Soy Paneer (Tofu), Soy milk etc. The study has been conducted on 50 children of tribal families from village Sultanpur of Harda district and Soybean products have been given to the malnourished children under normal diet and the regular observation have been taken monthly similarly other 50 children without Soybean in their diet would also be taken for comparative studies. For assessing the progress due to Soybean consumption, individual's weight, height and physical appearance have been taken. The observations were taken on 50 Malnourished Children of Tribal Village Sultanpur for a period of 36 months from 2018 to 2021 to evaluate the Impact of Soybean Products on Malnourished Children. After conducting this study around 65 to 75 percent of Malnutrition were reduced in the children. The weight of per child has been increased up to 210 to 250 gm. per month and the BMI was raised from 14.70% to 15.41%.

Keywords: Soybean, Malnutrition, Malnourished Children, Tribal, Protein

Evaluation of Compatibility and Bio-Efficacy of Selected Agrochemicals against Leafhopper, *Empoasca kerri* (Pruthi, 1940) (Hemiptera: Cicadellidae) in Soybean

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Now a days there is a demand for tank mixing of different agrochemicals in order to manage both insect pests and diseases simultaneously. Lack of knowledge regarding compatibility of agrochemicals can result in emergence of resistance in insects, reduced effectiveness of the chemicals and potential for phytotoxicity. To address these issues, a laboratory and field experiment was conducted at Agricultural Research Station (UAS, Dharwad), Sankeshwar, Karnataka, India during *Kharif*, 2022-23 to assess compatibility and bio-efficacy of selective insecticides (Diafenthiuron 50% WP @ 1.25 g L^{-1}, Dinotefuran 20% SG @ 1 g L^{-1}, Thiamethoxam 25% WG @ 0.3 g L^{-1} and Spiromesifen 22.9% SC @ 1 ml L^{-1}), fungicides (Propiconazole 25% EC @ 1 ml L^{-1} and Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.5 g L^{-1}) and water-soluble fertilizer (19:19:19, N:P:K @ 5 g L^{-1}) mixtures at their recommended doses with fifteen treatments and three replications in soybean. Out of different treatments Diafenthiuron 50% WP + Propiconazole 25% EC + 19:19:19, Dinotefuran 20% SG + Propiconazole 25% EC + 19:19:19 and Diafenthiuron 50% WP + Tebuconazole 50% + Trifloxystrobin 25% WG + 19:19:19 recorded 2 ml L^{-1}, 1 ml L^{-1} and 2 ml L^{-1} of sedimentation, respectively which was less than the limits of 2 ml 100 mL^{-1} as specified by Indian Standard Institute, 1973. The pH of all the test solutions were in range of 6.44 to 8.36 there wasn't much difference in the pH hence, treatments were found compatible both physically and chemically. Among different treatments tested in field Thiamethoxam 25% WG alone (3.15 leafhoppers/3 leaves) and its combination treatments *viz*., Thiamethoxam 25% WG + Propiconazole 25% EC + 19:19:19 (3.37 leafhoppers/3 leaves) and Thiamethoxam 25% WG + Tebuconazole 50% + Trifloxystrobin 25% WG + 19:19:19 (3.60 leafhoppers/3 leaves) found effective in managing leafhoppers population.

Keywords: Compatibility, foaming, phytotoxicity, sedimentation, soybean

Salicylic acid mediated alleviation of zinc toxicity in Mungbean seeds by modulating physio-biochemical and histological mechanisms

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Zinc is an inherent micro-element found in soil within terrestrial ecosystems and is essential for plant development due to its critical role in various metabolic processes. Nonetheless, excessive concentrations of zinc in soils can lead to detrimental changes in plants, affecting their physiology and biochemistry, and ultimately causing diminished growth and productivity. However, salicylic acid acid is known to have a beneficial role in alleviating zinc toxicity in plants. The present study explores the role of salicylic acid (SA) in reducing the harmful effects of zinc excess on mungbean seeds during germination. A laboratory experiment was conducted on mungbean seeds of genotype SML 1827. Seeds were subjected to zinc stress (10 mM and 20 mM zinc sulphate) and seed priming was done using salicylic acid (SA) (0.25mM and 0.5mM). Results indicated that various biochemical parameters like malondialdehyde and electrolyte leakage were increased under zinc stress but decreased with SA priming. The results of the Pearson correlation analysis showed relationships between the different qualities, shedding light on their interdependencies and the need for further thorough investigation to validate and understand their mechanisms. This study suggests that SA priming could be a practical approach to mitigate zinc-induced early oxidative damage in crops, promoting sustainable agriculture and crop management in areas with high soil zinc concentrations.

Keywords: Zinc, Salicylic acid, Seed priming, Phytotoxicity, anatomy.

Management of cashew apple and nut borer with bio-pesticides

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Field experiment was done at the Regional Fruit Research Station, Vengurla, Maharashtra with an aim to find out effective bio-pesticides against the cashew apple and nut borer with good yield. The next best treatment T8 soapnut aqueous extract @ 2% recorded 5.63 per cent incidence of ANB and at par with the treatments T1 Azadirachtin 10,000 ppm @ 3ml/l, T7 Dashaparni Arka @ 8ml/lit, T6 VIMIL @ 15ml/lit and T5 AMIL @ 15ml/lit were noticed incidence of ANB 5.71, 7.59, 7.68 and 7.82, respectively. Whereas the treatment T3 *Beauveria bassiana* @ 5g/l at par with T2 *Metarrhizium anisopliae* @ 5g/l and T4 *M. anisopliae* (2.5g/l) + *B. bassiana* (2.5g/l) which recorded the ANB incidence 9.19, 9.28 and 9.42 per cent, respectively.

The data on cumulative mean incidence of ANB after second spraying it is evident that the treatment T9 (λ cyhalothrin 5 EC @ 0.6 ml/lit) was found to be significant superior rest of the treatments with the least incidence of ANB (0.47%). The next best treatment T8 soapnut aqueous extract @ 2% at par with the treatments T1 Azadirachtin 10,000 ppm @ 3ml/l and recorded 1.76 and 1.91 per cent incidence of ANB. Whereas, the next best treatment T7 Dashaparni Arka @ 8ml/lit at par with treatments T6 VIMIL @ 15ml/lit and T5 AMIL @ 15ml/lit were noticed incidence of ANB 4.43, 4.78 and 4.88, respectively. The treatment T3 *Beauveria bassiana* @ 5g/l at par with T2 *Metarrhizium anisopliae* @ 5g/l and T4 *M. anisopliae* (2.5g/l) + *B. bassiana* (2.5g/l) which recorded the ANB incidence 6.91, 7.02 and 7.14 per cent, respectively.

Keywords: Cashew apple and nut borer, Bio-pesticides, Management.

Visual Colorimetric Reverse Transcriptase - LAMP assay for Detection of Tilapia Lake Virus (TiLV)

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Tilapia, the second most cultivated freshwater fish worldwide and a crucial source of dietary protein, faces a significant threat from the emerging Tilapia Lake Virus (TiLV). A colorimetric Loop-Mediated Isothermal Amplification (LAMP) assay was developed for the rapid detection of TiLV. The assay was evaluated at different annealing temperatures (60°C, 63°C, 65°C) and reaction times (30, 40, 50 minutes), with 65°C and 50 minutes yielding the most intense and reliable results, confirmed by a ladder-like pattern in agarose gel electrophoresis. This colorimetric LAMP assay demonstrated high sensitivity, detecting TiLV RNA down to 1 picogram, and achieved 100% diagnostic sensitivity and specificity. Visual detection, using Hydroxy naphthol Blue and Calcein, produced clear colour changes observable under indoor light. This optimized colorimetric LAMP assay offers a sensitive, specific, and cost-effective visual detection tool for TiLV, suitable for field-level diagnostics. Rapid LAMP-based detection aids in the effective management of TiLV, supporting the sustainability of global tilapia aquaculture.

CHARACTERIZATION OF STRIPE RUST RESISTANCE IN *Triticum aestivum* L.

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Stripe rust, caused by *Puccinia striiformis* f. sp. *tritici* (*Pst*), is a significant global threat to wheat. During the 2019-20 and 2020-21 growing seasons, 67 wheat germplasm lines were evaluated at the seedling stage against various stripe rust pathotypes (46S119, 110S119, 238S119, and a mixture) under controlled conditions. The seedling reaction tests revealed that 28 lines exhibited resistance to all tested *Pst* pathotypes, attributed to major resistance genes such as *Yr5, Yr10, Yr15, Yr24*, and *Yr26*, either individually or in combination. These lines were further evaluated in the field across two locations, Ludhiana and Gurdaspur, over two years. Based on the area under the disease progress curve (AUDPC), the lines were categorized into clusters, with 28 lines classified as highly resistant (AUDPC 0-100). Lines with AUDPC values of 100-200 displayed partial resistance, likely due to the presence of adult plant resistance (APR) genes such as *Yr70, Yr17, Yr40, Yr36, and Yr47*. Biochemical analysis revealed that activity of defensive enzymes (PAL,TAL) along with the activity of antioxidant enzymes (Peroxidases, Polyphenol oxidases) were upregulated in the genotypes PBW725, BWL1789, BWL6990 with concomitant decrease in H2O2 and MDA content suggesting that these enzymes (defensive and antioxidant) plays an important role in imparting resistance in cultivars against stripe rust pathogen. Moreover the activity of PR proteins like glucanases and chitinases behaved differently in different genotypes with a maximum increase recorded under inoculated condition in PBW725 indicating there active participation in disease resistance. Histopathological studies were conducted for two lines namely PBW725 and PBW343 from 12 to 120 h time period, where the spore germination occurs similarly in both line at 12 and 24 h post infection (pi). Further in PBW 343, a susceptible line, forms appressoria that enter stomata and forming sub-stomatal vesicle and finally colonized the tissue with developed haustoria. In PBW 725 (resistant line) where the germ tube was aborted at earlier stages and no further colonization was observed.

Challenges and Strategies for Adopting Integrated Farming Systems by Farmers

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Integrated Farming Systems (IFS) is an agricultural practice that combines different farming activities, such as crop cultivation, livestock rearing, aquaculture, and agroforestry, on a single farm. Integrated Farming Systems (IFS) offer potential benefits but come with significant challenges for farmers. The adoption of Integrated Farming Systems (IFS) by farmers is influenced by several key constraints and requires targeted interventions for successful implementation. Farmers faced many challenges in adopting integrated farming systems were Lack of capital/ finance to start and maintain more than one enterprise, High cost of production, Natural calamities and climate changes, Lack of awareness about existence of scientific IFS models and Lack of training on integrated farming system. And for this kind of suggestions might be Provide access to affordable credit and subsidies to ease initial investment challenges, Offer training and extension services to equip farmers with the skills needed to manage diverse IFS activities effectively, Improve market linkages and infrastructure to reduce post-harvest losses and enhance profitability, Promote water-saving technologies and sustainable resource management practices to mitigate environmental challenges and Advocate for policies that support IFS adoption, including land consolidation and incentives for sustainable practices.

Keywords: Challenges, Strategies, Integrated Farming System

Challenges and opportunities in organic farming

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Organic farming practices include, intercropping, mulching, integrating crop residues with livestock manures, and forbidding the use of synthetic inputs in agriculture. Among farmers, organic agriculture might be a wise decision if they are concerned about maintaining the ecological balance in the long run. In contrast, agrochemicals are made from fuel, which is depleting and not renewable. Compared to typical farming, organic farming minimizes production costs up to 25% and yields higher profits. Furthermore, the application of organic farming results in a 50% reduction in erosion, which raises productivity to five times in five years. Organic farming in low-land areas provide habitat for a variety of wildlife, improving the ecosystem as a whole and improving groundwater, both of which are advantageous to agricultural methods. Government in all over the world are putting regulations in place to promote the adoption of organic agriculture as they realize more and more of its benefits. This includes payment to farmers, financing for research and assistance with the establishment of organic infrastructure. Organic farming may be able to meet population need and give rural residents greater employment opportunities. When starting organic farming, farmers must overcome numerous obstacles. Some of the most ones are high cost of organic inputs, the requirement for certification, the lack of a market for organic products, and the low yield and low pricing. Another issue is that, when it comes to organic farming, socioeconomic limits pose the greatest hurdle, followed by technological, infrastructure, and environmental issues. One of the major problem is that the widespread use of chemicals and pesticides to control weeds and insect pests resulted in the evolution of weed and pest species.

Keywords: productivity, organic, ecological, profit and agriculture.

Challenges and Opportunities in Organic Farming

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Organic farming has attracted considerable attention from those who see it as a panacea to those who see it as ideological nonsense. A more humble responsibility for the organic movement may be to serve as role model for a farming system in which values other than financial are cultivated. Organic farming asks how we ought to relate to each other and our natural environment. The values of the organic movement are not esoteric, but are based on observation and common sense: treat livestock well, use resources sparingly, use the least harmful method, nature is inherently valuable and so on. Food security depends upon personal relationships of integrity and trust among farmers, farm workers, suppliers, consumers and others up and down the agricultural supply chain, and integrity and trust have been fundamental to organic agriculture's success. There are many other role models across the spectrum of agricultural systems, such as conservation tillage, permaculture and traditional farming systems, but organic farming has emerged as one of the best known alternative farming systems developed in response to the shortcomings of mainstream agriculture. Many of the key benefits and opportunities for organic agriculture are suitable areas for the organic movement to show leadership and innovation, including assurance and auditing procedures, rural and regional development and low cost agricultural systems relying on biological and ecological processes. The yields in organic agriculture may be equivalent to or better than conventional agriculture, although often they are not, simply because of inadequate plant available nutrients, weed infestation, non-cash phases in the crop rotations or inexperienced management. Yield performance is very location and management specific and many underlying drivers (e.g. soil carbon, weed seed banks) of yield have long responses times. Although organic agriculture causes less pesticide contamination in food, people and the environment, it is premature to claim that organic agriculture is completely environmentally sustainable. In particular, some soil nutrients have negative budgets in certain organic cropping systems, causing a depletion of soil reserves of that nutrient.

Keywords- Organic farming, agriculture, environmentally, permaculture

Capacity Building of Rural Youth through Agri Business Activities

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India is a nation where a significant portion of the population lives in rural areas, with a substantial demographic of rural youth who possess essential entrepreneurial skills. Agribusiness refers to the sector that integrates farming with associated commercial activities, encompassing all processes involved in bringing agricultural products to market, including production, processing, and distribution. The term "agribusiness" is relatively recent and represents the convergence of agriculture with business principles. Capacity-building was defined as the activities that increase an individual's ability for growth, development or accomplishment by building the potential of individuals to respond to the needs one serve. Capacity -building included four aspects viz. potential, willingness, aspiration and economic motivation for the purpose of the study. Therefore, keeping all this in mind the present study was undertaken with the objective to explore the capacity building of rural youth towards Agribusiness Activities. The study was conducted in four districts of Haryana state where Agri Business Centers were located. Thus from Bhiwani, Jind, Hisar, and Kurukshetra districts a sample of 240 rural youth from 16 villages formed the sample of the study. Capacity-building was defined as the activities that increase an individual's ability for growth, development or accomplishment by building the potential of individuals to respond to the needs one serve. Capacity -building included six aspects viz. abilities, capabilities, potential, willingness, aspiration and motivation for the purpose of the study. It was found that Around 60.00 per cent of the respondents had high level of potential and willingness for agribusiness activities, 56.66 per cent respondents had medium level of aspiration and less than half of respondents hadmedium level of economic motivation for agribusiness activities.

Applications of Bioinformatics in Plant and Agriculture

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Bioinformatics, which combines biology, computer science, and information technology, substantially advances modern plant and agricultural sciences. This field's uses in agriculture include increasing agricultural productivity, expanding plant breeding, and encouraging environmentally friendly techniques. Genomics is a key application field, where high-throughput sequencing and genome-wide association studies (GWAS) discover genes associated with attributes such as yield, disease resistance, and stress tolerance. Bioinformatics tools evaluate large genomic databases, accelerating the development of genetically modified crops. In plant breeding, bioinformatics aids marker-assisted selection (MAS) and genomic selection (GS). By combining genetic markers and phenotypic data, bioinformatics predicts breeding results and selects superior genotypes, lowering the time and cost of traditional breeding procedures. Bioinformatics also contributes to the understanding of plant-pathogen interactions. Comparative genomics and transcriptomics reveal the molecular processes of disease resistance and susceptibility, which is critical for creating disease management methods and resistant crop varieties. In addition, bioinformatics analyses environmental and ecological data to better understand the effects of climate change on crops, find stress-responsive genes, and design climate-resilient crops. It also helps to manage and conserve plant genetic resources, which promotes biodiversity and sustainability. In conclusion, bioinformatics applications in plant and agricultural sciences are extensive and transformational. Bioinformatics advances plant biology understanding, improves crop breeding, and promotes sustainable agriculture, all of which contribute to global food security and agricultural output.

Keywords: Bioinformatics, plant, Agriculture

Importance of biofortification of wheat to meet food security throughout the world

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Biofortification of wheat is a critical strategy to address global food security and combat micronutrient deficiencies, particularly in developing nations. As wheat is a staple crop consumed by billions, its enhancement with essential nutrients such as iron, zinc, and vitamins can significantly improve public health and nutritional status. Malnutrition is a major problem in developing countries including India. According to the Indian Council of Agricultural Research, the global scenario is 2.37 billion people do not have access to adequate food, 768 million people are undernourished and 118 million more people faced hunger in 2020 in comparison to 2019. The human body requires a sufficient amount of macronutrients and micronutrients. Iron is required for the proper functioning of muscle and brain tissues. Iron deficiency causes brain damage and anemia which affects 42% of children under five and 40% of pregnant women globally. Zinc serves as a cofactor in as many as 300 enzymes required in humans. It is required for the regulation of synthesis and degradation of nucleic acids, proteins, lipids and carbohydrates. Zinc deficiency leads to retardation in growth, loss of appetite, impaired immune function and increased susceptibility to infections. Biofortification, through breeding and genetic modification, offers a sustainable and cost-effective solution by enriching wheat with vital nutrients at the source. Moreover, biofortified wheat varieties maintain nutritional quality, agronomic performance and increasing yield. The collaboration of national research institutions with CIMMYT and HarvestPlus program focused on biofortification; various wheat varieties with enhanced iron and zinc content have been released in countries like Pakistan, India, and Bangladesh. These varieties such as WB-02 (40 ppm), HPBW-01 (40 ppm) and HI 8759 (41.1 ppm) for iron biofortification, Zinc-enriched wheat varieties like HPBW-01 (40.6 ppm), DBW 332 (40.6 ppm), HI 8777 (40.3ppm), PBW 771 (41.4 ppm), WB-02 (42 ppm), and PBW Zinc2 (48.5ppm) released in India under the HarvestPlus program.

Keywords: Biofortification, Micronutrients, Malnutrition and HarvestPlus.

Analysis of Biochemical Changes in Genotypes of Pea Against *Erysiphe polygoni* DC Causing Powdery Mildew

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Pea (*Pisum sativum* L) is a valuable crop all over the world, is also known as "Matar". It belongs to family *Leguminosae* and sub family *Papilionaceae*. It's affected by various Fungal, Bacterial and Viral diseases. Powdery mildew of pea is one of the major diseases of pea incited by *Erysiphe polygoni* DC. Major symptoms of powdery mildew disease are the presence of white floury patches appeared on the leaves as well as stems, tendrils, pods and in the severe condition its cover whole plant parts except root region and finally plant become older and later stage of the crop whole plant become comparatively greyish brown and the infected parts convey dull appearance. In extreme condition infected pods and leaves fall down from the plant. An experiment was conducted at farm of SKNCOA, Jobner during *Rabi* season 2021. Plants respond to external stimuli by altering metabolic pathways, resulting in a cascade of different interrelated changes in biochemical processes. The incidence of powdery mildew in pea induces change in phenol, peroxidase and reducing sugar. Powdery mildew resistant and susceptible pea genotypes respond differentially to these traits. Powdery mildew resistant genotypes had comparatively less concentration of reducing sugar and high concentration of phenol and peroxidase before and after infection. All the traits being significantly correlated with disease severity can be an important component of an effective powdery mildew screening procedure in pea.

Keywords:- Phenol, Peroxidase, Reducing Sugar, Powdery Mildew

Diversity and Use of Indigenous Herbs and Vegetables in West Tripura District

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West Tripura, a region in Northeast India, is home to a rich diversity of indigenous herbs and vegetables, which have been an integral part of the tribal culture and cuisine for centuries. Tribal communities have traditionally practiced organic farming methods, using natural and sustainable techniques to cultivate herbs and vegetables. This study aims to document and assess the diversity of locally available organically grown indigenous herbs and vegetables in West Tripura district. Through a combination of field surveys, market analysis, and stakeholder interviews 30 indigenous herb and vegetables species were identified, many of which possess unique nutritional and medicinal properties. These findings reveal that these indigenous species not only serve as a source of nutrition and but also as a critical component of the local economy, particularly for small and marginal farmers. However, challenges such as habitat loss, lack of documentation, and limited market access threaten the sustainability of these resources. This study highlights the importance of conserving and promoting indigenous vegetable and herbs of West Tripura, and provides insights for policymakers, researchers, and entrepreneurs to harness their economic potential while ensuring environmental sustainability and social equity.

Key words: West Tripura; organic farming; indigenous herbs and vegetables; nutritional impact; sustainable agriculture

Effect of Plant Growth Regulators on Economics and Harvest Index of Garlic (*Allium sativum* L.) under Terai region of West Bengal

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Garlic (Allium sativum L.) most widely farmed bulbous crop in the world and the second most widely cultivated Allium species after onion. Through the application of chemical fertilizers environmental pollution through nitrate poisoning and exterminating soil micro-flora thereby, alternatives to those problem the growth regulators play important role in economic production and cost management of garlic by employing methodology of Randomized Block Design comprising of three replications with ten treatments. The present experiment conducted on various kinds of growth regulators (Gibberellic acid (GA3) @ 50 ppm, GA3@ 100ppm, GA3@ 150 ppm, Naphthalene acetic acid (NAA) @ 50 ppm, NAA@ 100 ppm, NAA@ 200ppm, Kinetin@ 10 ppm, Kinetin@ 20 ppm, Kinetin@ 40 ppm and Control (Distilled water) at the instructional and research farm of the Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, India, during the autumn and winter seasons for two consecutive years. The result obtained that the foliar application of GA3@50 ppm generated maximum net returns (812753 Rs/ ha.) and benefit cost ratio (4.44) over other treatments. The control plots treated with distilled water was produced qualitatively inferior bulbs and generated lowest net returns (461946Rs/ha.) and benefit cost ratio (2.62). Interestingly the highest harvest index obtained under the Knetin@20 ppm (71.53) and lowest HI obtained under treatment of GA3 @100 ppm. (62.59). Based on the current experimental results, it may be concluded that foliar application of GA3 @ 50 ppm proved the best over other plant growth regulators.

Keywords*: Economics; garlic; GA3, NAA; kinetin; returns*

CAN WETLAND WEEDS SERVE THE PURPOSE OF FEED SHORTAGE?

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India faces a significant feed shortage, particularly in the livestock sector, with a deficit of about 11% in green fodder, 23% in dry fodder, and 28% in concentrates. This scarcity has serious implications for livestock particularly in regions like the Himalayan foothills, where traditional feed sources are often inadequate and more than 40 per cent deficits have been observed, owing to a lengthy winter season. On the other side, wetland ecosystems, often challenged by the proliferation of aquatic weeds, present a unique opportunity to address feed shortages. Studies have explored the use of aquatic macrophytes like water hyacinth, water lettuce, duckweeds, and water spinach for biogas production, and as fodder for various livestock, including cattle, sheep, pigs, poultry, and aquatic animals, further emphasizing their potential as sustainable feed alternatives. The research necessitates the use of primary and secondary data including various tools, including focus group discussions (FGD), key informant interviews (KII), and personal interviews, with data analysis using SPSS and PowerBi. The preliminary analysis reflected that out of 29 wetlands in Jammu and Kashmir, Wular, Hokersar, Dal are the major Ramsar Sites in Kashmir valley supporting the growth of aquatic vegetation. The littoral zones of these wetlands are occupied by *Typha angustata*, *Phragmites communis*, *Nelumbo nucifera, Nymphaea alba, Nymphoides peltata* and *Trapa natans* which are extensively used for fodder, food and medicinal purpose. Also, several migratory birds like White-bellied Heron, Pink-headed Duck, Baer's Pochard and animal species, such as cattle, sheep, equines, ducks, swans etc depend on these aquatic weeds for sustenance. The findings are expected to help in devising alternative feeding solutions that enhance the income levels of farmers by tapping into underutilized resourcesHowever, further research and extension efforts are needed to optimize the nutritional value and ensure the safe and effective use of these weeds, paving the way for a more sustainable and self-reliant livestock sector.

Keywords: Wetlands, Weeds, Fodder, Extension, Livestoc

Population Structure and Association Mapping for yield attributing traits in fieldpea (*Pisum sativum* L.) genotypes

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The inadequacy in the genomic studies and presence of narrow genetic base in Indian fieldpea genotypes provides a mean for stagnancy in the yield. In this research study, 150 fieldpea genotypes were screened using 174 simple sequence repeat (SSR) markers to assess genetic diversity among genotypes, population structure and detecting genomic regions associated with different yield traits. Out of 174 SSRs, 116 polymorphic markers yielded a total of 420 alleles. The PIC values of SSRs studied ranged from 0.30 (AA 8) to 0.84 (PSAA 219) with an average of 0.56. The most discriminative and informative SSRs were PSAA 219 (0.84), PSAB 23 (0.82) and PSAD 270 (0.81). Population structure revealed three subpopulations at a maximum likelihood value of delta K=3 with low genetic differentiation as evident by presence of high admixture. Reasons for such results suggesting that the studied genotypes may have common ancestral history at some level exhibiting limited gene flow and diversity. The estimate of the average degree of linkage disequilibrium (LD) present at the genome level in 150 fieldpea genotypes revealed presence of significant LD blocks. Association analysis revealed that twenty-four marker-trait associations were found significant for seven traits *viz*., anthocyanin at grain filling, normalized difference vegetation index at grain filling, number of pods plant^{-1}, plant height, relative water content at flowering, hundred seed weight and seed yield plant^{-1} by GLM (Q) method and seven marker-trait associations were found significant for six traits *viz*., chlorophyll at flowering as well as at grain filling stage, flavonoids at flowering, normalized difference vegetation index at grain filling, harvest index and number of pods plant^{-1} by MLM (Q+K) method. Therefore, after QTL validation these SSR markers can be further used for marker assisted selection to improve breeding efficiency in term of time and cost.

Keywords: Genetic diversity, population structure, association mapping

Assessment of *per se* performance of Gomphrena (*Gomphrena globosa* L.) genotypes for productivity and quality traits

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An experiment was conducted with an objective to evaluate Gomphrena genotypes for growth, flowering, yield and quality traits at College of Horticulture, Bagalkot in a randomized block design with three replications during 2022. Observations were recorded on each genotype for both qualitative and quantitative traits. The results revealed that, maximum (65.80cm) plant height, plant spread in N-S (56.13cm) and E-W direction (53.5cm), stem girth (11.31mm), days from bud to bloom (8days), duration of flowering (67 days), number of flowers per plant (279.53), individual flower weight (3.19g) and yield per plant (763.57g) was observed in genotype AGS-4. More number (9.27) of primary branches were noticed in AGS-7, secondary branches (28.40) in AGS-10, maximum leaves (564.47) count in AGS-5. The genotype AGS-9 took minimum (9days) number of days to bud initiation, while AGS-8 took least number (31.67days) of days to 50 percent flowering. The quality traits like stalk length (22.61cm) and inflorescence length (4.74cm) were best in genotype AGS-1. The highest shelf life and display life (7 days) was observed in genotype AGS-3 and AGS-6. Based on the qualitative results, genotype AGS-8, 9 and 10 exhibited upright growth habit and remaining other genotypes belonged to spreading type. RHS colour chart grouped all genotypes into four major flower colour groups i.e, pink, white, purple and red flower colour, leaf blade as reddish purple group, genotype AGS-1, 2, 4, 5 8 and 9 belonged to short acuminate blade shape, whereas other genotypes showed acute leaf blade shape.

Keywords: AGS-genotype, flower yield, Gomphrena, growth parameters

Effect of *Spodoptera frugiperda* on biochemical response of wild maize, inbred lines and teosinte derived lines

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Maize is a global cereal of high nutritional value whose production is largely affected by biotic and abiotic stresses. Among biotic stresses, *Spodoptera frugiperda,* commonly known as fall armyworm (FAW) has appeared to be the most devastating pest that invaded India and caused a havoc in maize fields. Studies suggested that wild progenitors of plants show more tolerance to environmental stresses. This investigation was undertaken to compare the biochemical response of teosinte, the wild maize, inbred lines and teosinte derived lines against FAW infestation. Seeds of thirteen genotypes were sown in the experimental fields in randomized block design (RBD) with three replicates. Fall armyworm larvae were released on the whorls of 25 days old plants at the rate of 15 larvae per plant. Leaves were collected from the plants at 5, 10 and 15 days after infestation for biochemical evaluation. A significant increase in SOD activity was observed in the leaves of LM 13 (1942) x teosinte at all the growth stages. Increased $OH^{\cdot}$ scavenging activity was observed in all the infested genotypes. An increase in DPPH radical scavenging activity was observed in the infested leaves of CM 139 (1969) x teosinte. NO radical scavenging activity was significantly increased in the leaves of teosinte, LM 13, CM 139, CM 139 (1968) x teosinte and LM 24 (1971) x teosinte that might prevent these genotypes from oxidative damage. There was also a significant increase in total phenols in the leaves LM 24 and CM 139 (1969) x teosinte that helped them in providing defence against insect-attack. It may thus be concluded that the teosinte derived lines attained tolerance to FAW infestation by inducing reactive species scavenging pathways.

Artificial Intelligence: The Catalyst for a New Era in Indian Agriculture

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Agriculture is the backbone of the Indian economy, introduction of Artificial Intelligence (AI) into this field is revolutionizing the way farming is done. By enhancing productivity, cutting costs and optimizing resource management AI is driving significant changes across the agricultural landscape. One of the most impactful uses of AI in agriculture is precision farming. With AI-powered drones and satellite imagery, farmers can monitor the health of their crops, predict yields, and precisely manage the use of water, fertilizers, and pesticides. This ensures that resources are used efficiently, leading to healthier crops and better harvests. Automation is another game-changer. AI-driven machinery, like robots and smart tractors is taking over labour intensive tasks such as planting and harvesting. When it comes to dealing with pests and diseases, AI is proving to be a valuable ally. Through image recognition technology, AI systems can detect pests and diseases early on, allowing farmers to act quickly and effectively. This early intervention helps in managing pest outbreaks and choosing the least harmful, most effective solutions. Additionally, AI helps farmers predict market demand for their crops, allowing them to adjust production levels, minimize waste, and strike a balance between economic and environmental needs. By combining information from various sources such as weather reports, market trends, and soil health data AI helps farmers make smarter decisions and manage risks more effectively. In the realm of breeding, AI is accelerating the development of new plant varieties and livestock breeds by analysing genetic data, helping create crops and animals with desirable traits. In essence, AI is making agriculture smarter, more efficient, and more sustainable. Its growing influence is setting the stage for a more resilient and productive agricultural sector, both in India and around the world.

Keywords: Agriculture, Artificial Intelligence, machine learning, robotics and satellite imagery.

Export related issues for organic farming

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Organic farming is one of the most important agricultural methods that emphasizes the use of natural processes and materials to grow crops in various cropping systems and raise livestock. It prevents synthetic fertilizers, pesticides, genetically modified organisms (GMOs), and artificial additives use. Instead, organic farmers use techniques such as crop rotation, composting, biological pest control, and cover cropping to maintain soil health, enhance biodiversity, and promote sustainable ecosystems. The aim is to produce food that is healthier for consumers and better for the environment. Organic farming practices also often focus on animal welfare and sustainable land use. The biggest challenge in organic products marketing is assured product integrity. Without traceability and use of block chain technology it will be very difficult to win consumer confidence. Challenges related to India's organic control system and increased incidences of fraud continue to impact the credibility of India's organic sector. The problem with regard to organic certification is that loopholes in the system are taken advantage of by unscrupulous elements. Maintaining sustainability in the global economy and balancing organic principles with commercial imperatives. Ex: APEDA in October last year had derecognised five firms by suspending accreditation to Aditi Organic Certification for a year and banning four. Pursuing international harmonization of standards and certification. The guidelines for organic production, processing, transportation and certification etc are beyond the understanding of ordinary Indian farmer. Pesticide issues: European Union blacklisting five Indian organic certification agencies and concerns being raised over the country's process when some shipments cleared by them failed to meet the norms for ethylene oxide (ETO) presence. Developing locally applicable agronomic solutions to production constraints, such as weeds, animal health and soil fertility.

Key words: APEDA, Export issues, Organic Farming

Avian Diversity in Direct Seeded Rice Paddy Agro-ecosystems of Haryana: A Comprehensive Study

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Birds play a critical role in rice cultivation by maintaining ecological balance and controlling pest populations. However, the diversity of bird species in rice paddies can be influenced by various factors, including pest prevalence and pesticide use. This research aims to explore the species of birds present in conventional rice paddies during different growth phases of rice in selected regions of Haryana. A pilot study conducted in the paddy field ecosystems of Haryana reported 87 bird species with 39 families and 16 orders observed through Visual Encounter Surveys (VES) conducted weekly from June 2021 to November 2023. Notably sighted avifauna included members of the four bird species (Alexandrine Parakeet, Asian Woollyneck, Black-Headed Ibis, and Painted Stork) are listed as Near Threatened in the 'IUCN' (2010) category. Surprisingly, 13 rare species were observed in the study area, with global declining population trends. The Passeriformes order, with 44 species, is the most diverse in the study area. In all habitats, analysis of food and feeding guilds, as well as perching activity, revealed that the insectivorous guild (32) is dominant, followed by Omnivore (29), Carnivore (13), Granivore (7), Frugivore (5), and Nectarivore (2). Interestngly, 8 species having globally declining population trends are still common in the study area. Out of the total observed species, 23 have declining population trends at global level. This study underscores the potential for avifaunal research in agricultural landscapes in Haryana and emphasizes the need for conservation measures to protect biodiversity. Public engagement in awareness campaigns and conservation activities is essential for preservation of avian diversity in these regions. Given that paddy fields primarily support grassland and wetland bird species, there are significant information gaps in monitoring bird populations across different stages of rice cultivation. This highlights the necessity to understand the role of paddy fields in supporting avian populations and diversity.

Keywords: Avian, direct seeded rice, cultivation, diversity, conservation.

Agroforestry for Sustainable Development in Agriculture: Unlocking the Potential

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Agroforestry, the integration of trees and shrubs with crops and/or livestock, has emerged as a promising approach to sustainable agriculture. This study aims to provide a comprehensive overview of the benefits and challenges of agroforestry for sustainable development in the agricultural sector. The review begins by highlighting the key advantages of agroforestry, including improved soil health, carbon sequestration, biodiversity conservation, income diversification, climate resilience, and sustainable land use. Agroforestry helps build soil structure, prevent erosion, and increase nutrient cycling, leading to higher crop yields and improved quality. The trees in agroforestry systems absorb carbon dioxide from the atmosphere and store it in the soil and biomass, mitigating climate change. By providing diverse habitats, agroforestry supports a wide range of plant and animal species, promoting biodiversity. Farmers can generate income from a variety of tree, crop, and livestock products, reducing their reliance on a single commodity. The study then delves into the specific agroforestry practices that contribute to sustainable development. Alley cropping and silvopastoral systems are identified as the most sustainable, with the potential to boost farm income and transform the animal husbandry sector. According to the World Agroforestry Center, agroforestry can increase crop yields by 50% and sequester 3.5 tons of carbon per hectare per year. To address these challenges, the study emphasizes the importance of developing supportive policies, providing extension services, and fostering collaboration among farmers, researchers, and policymakers. By integrating trees and crops in innovative ways, agroforestry can help to improve soil health, promote biodiversity, and mitigate the effects of climate change, while also providing a source of income diversification for farmers.

Keywords: Agroforestry, Sustainable Agriculture, Climate Resilience, Mitigation, Diversification

Capacity Building of farmers and other stakeholders in Natural Farming

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Farmers' capacity building is an ongoing process that enables access to information, support, and empowerment while encouraging technical advancements. Enhanced Food Safety Agricultural education informs farmers about the correct methods for handling, storing, and processing agricultural products. This understanding is essential to avoid food contamination and ensure the safety of the food consumed by the public, ultimately improving public health. Diversified Income Sources include Farmers with a range of skills that can venture into alternative income streams like beekeeping or goat farming. Diversification serves as a safeguard during low crop yields or market instability, thereby lowering financial risk. Informed farmers often become community leaders, capable of mobilizing resources, advocating for better infrastructure, and launching initiatives to improve rural living standards, fostering stronger and more self-reliant communities. Mitigation of Rural-Urban Migration By offering sustainable income opportunities and improving the quality of life in rural areas, agricultural education reduces the migration of people to cities in search of employment. This helps manage urban growth and eases the strain on urban resources and services. Climate Change Resilience Farmers educated in climate-smart agriculture practices are equipped with techniques to handle changing weather patterns, such as using drought-resistant crops or efficient irrigation systems. Market Access and Trade Opportunities Farmers who understand market dynamics and quality standards can better market their products, increasing both local and international sales, which contributes to economic growth on regional and national levels.

Keywords: Capacity Builduing, Climate, Diversification, Farmer, Market access

EMPOWERMENT OF WOMEN THROUGH DIVERSIFICATION IN AGRICULTURE

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Women are the backbone of the development of rural and national economies. They comprise 43% of the world's agricultural labor force, which rises to 70% in some countries. 70 to 80% of the agricultural production comes from small farmers, who are mostly rural women. Women comprise the largest percentage of the workforce in the agricultural sector, but do not have access and control over all land and productive resources. Many studies show that in rural India, the percentage of women who depend on agriculture for their livelihood is as high as 84%. Women make up about 33% of cultivators and about 47% percent of agricultural laborers. These statistics do not account for work in livestock, fisheries and various other ancillary forms of food production in the country. In 2009, 94% of the female agricultural labor force in crop cultivation were in cereal production, while 1.4% worked in vegetable production, and 3.72% were engaged in fruits, nuts, beverages, and spice crops. Women's participation rate in the agricultural sectors is about 47% in tea plantations, 46.84% in cotton cultivation, 45.43% growing oil seeds and 39.13% in vegetable production.[6] While these crops require labor-intensive work, the work is considered quite unskilled. Women also heavily participate in ancillary agricultural activities. According to the Food and Agriculture Organization, Indian women represented a share of 21% and 24% of all fishers and fish farmers, respectively. Rural women is play a crucial role in agricultural development and allied fields, including crop production, livestock production, horticulture, post-harvest operations, fisheries, etc. Women must be empowered by enhancing their awareness, knowledge, skills and technology use efficiency so that agricultural production multiplies at a faster pace, environmental degradation is reduced and conservation of resources is practiced earnestly, thereby, facilitating overall development of the society. All this signifies the importance of having a full understanding of the role and contribution of farm women so that the extension services may accordingly be devised and geared to fully integrate them in agriculture by better serving their specific needs and interests. It is the concern for their integration in the process of agricultural development, which has today become instrumental for policy debates, research initiative and organizational efforts from women's perspective sectoral Concerns and ConstraintsThey also contribute to decision making processes for crop production, seed production and management, post-harvest management of agricultural and horticultural produce, biomass utilization, livestock management, marketing and financial management. In addition, women take up small ventures to generate additional family income. Therefore, the role of women in agriculture and allied occupations, and household activities needs proper recognition.

Laboratory Evaluation of Insecticide Toxicity on the Egg parasitoids of Maize Fall Armyworm, *Spodoptera frugiperda* (J. E. Smith)

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Integration of insecticides and biological controls is an important tactic of Integrated Pest Management (IPM). Egg parasitoids are promising natural enemies of many lepidopteran insect pests including *Spodoptera frugiperda* (J. E. Smith). However, this hymenopteran egg parasitoids are adversely affected by most insecticides. In this context, the chemicals and botanicals used in maize ecosystem for the control of insect-pests were evaluated for their safety against egg parasitoids *viz*., *Trichogramma chilonis* Ishii*, Trichogramma pretiosum* Riley*, Telenomus remus* Nixon at field recommended concentration by glass vial method under laboratory conditions and fresh adults were released at 1st, 5th and 10th day of treatment and observations were taken after 24 hours after release. The study documented that spinosad 45% SC and spinetoram 11.7% SC are found to be relatively harmful with 100% mean mortality. The emamectin benzoate 5% SG, chlorantraniliprole 18.5% SC, imidacloprid 17.8% SL and thiamethoxam+lambda-cyhalothrin 9.5% SC are found to be slightly to moderately harmful with 53.33-96.23% mortality. Similarly, azardirachtin 1% EC treatment is found to be safest for all the parasitoids tested. So, this could be used as a compatible insecticide for the management of *S. frugiperda* on priority, and spinosad 45% SC and spinetoram 11.7% SC should be avoided along with these egg parasitoids. The adults of egg parasitoids also revealed that the adult mortality per cent decreased gradually with advancement of time from first to tenth day after treatment except spinosad and spinetoram. So, waiting period must be maintained for the release of adults after insecticide spray and care should be taken while incorporating the insecticides along with the biocontrol agents during formulation of IPM schedules.

Keywords: Egg parasitoids, Insecticides, Integrated pest management (IPM), Mortality, *Spodoptera frugiperda*

Foreign body syndrome in bovines: Economic loss to farmers

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Foreign body syndrome (FBS) is a common issue that occurs when cattle and buffaloes consume indigestible foreign objects. The disease is caused by ingesting indigestible metallic and non-metallic blunt or sharp foreign particles. Indiscriminate feeding habits, feed scarcity, industrialization, and mechanization of agriculture are all risk factors for FBS. Foreign body syndrome is distinguished by severe depression, unwillingness to move, abduction of forelimbs, gradual weakening, a sharp decline in milk yield, varied appetite to full inappetency, fever, ruminal stasis, recurrent tympany, scarce hard feces, abdominal pain, and death. Foreign body syndrome is diagnosed based on history, clinical signs and symptoms, haemato-biochemical findings, radiographic examination, and ultrasonographic results. Although rumenotomy is the preferred treatment, FBS can be significantly reduced with correct management methods, increased knowledge among livestock caretakers, and oral administration of rumen magnets. This illness causes catastrophic economic losses due to severe milk loss, treatment costs, possible mortality, and fetal losses in affected pregnant animals. Because of its significant economic relevance in dairy cows, FBS remains a source of concern around the world, prompting several recent advancements in disease diagnosis and prevention.

Keywords: *Foreign body syndrome, bovines, farmers*

Carbon Sequestration and Biomass Yield of Salix in Silvopastoral Systems: The Impact of Plant Spacing in Himalayan cold desert

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Willow (*Salix tetrasperma*), a versatile agroforestry tree well-suited to cold desert environments. It stands as a "wonder species" and a vital lifeline for local communities, exemplifying an exceptional agroforestry system in the Himalayan cold desert. Generally, willow is mostly preferred for its poles and fodder leaves purposes especially in cold arid region. Salix-based silvo-pasture systems play a multiple role in cold desert regions by aiding in fodder production and contributing to climate mitigation through carbon sequestration as well as provision of wood. Salix plantations were established with three different spacing viz., 2×2m, 4×2m and 4×4m and intercropped with Alfalfa (*Medicago sativa*) to evaluate the impact of geometry of Salix-alfalfa systems on growth, biomass and carbon stock of salix trees in Leh, Ladakh. Plant height (cm), collar diameter (cm), number of branches (poles), clear bole height (cm), above ground biomass (fresh and dry) and carbon stock of salix trees were recorded after five years of planting. This study revealed that the higher number of primary branches (6.185) were obtained in 4×2m spacing. Maximum clear bole height (33.22 cm) recorded in 2×2m spacing followed by 4×2m spacing (32.66 cm) due to higher intra-competition that induced self-pruning of branches. The spacing with 4×2m produced maximum fresh biomass (3963.75 kg/ha) and dry biomass (2373 kg/ha) followed by 2×2m spacing (3832.5 kg/ha and 2159.85 kg/ha fresh biomass and dry biomass respectively). Maximum carbon stock recorded in 4×2m spacing (3963.75 kg/ha) followed by 2×2m spacing (3832.5 kg/ha). The 4 × 2m spacing configuration in Salix-alfalfa systems exhibited the highest number of poles, indicating good branching development.

Keywords: Salix, Silvopastoral Systems, Biomass, Carbon sequestration, Cold Desert

Growth and Reproductive performances of freshwater ornamental black molly (*Poecilia sphenops*) reared in inland saline water

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The study explored the feasibility of rearing black molly in inland saline water to assess survival, growth, reproductive performance, and colouration for 120 days. The experiment found a positive relationship between water quality and fish adaptability to different salinity levels. Fish showed good survival and growth at lower salinity levels but were affected at higher salinity. Fish demonstrated adaptability up to 14 ppt with over 80% survival rate and no adverse effects on growth up to 10 ppt. However, higher salinity treatments (12-16 ppt) significantly affected fish growth and reproductive performances, while intermediate salinity treatments (6-10 ppt) resulted in the best outcomes. The study assessed reproductive performance based on factors such as GSI, absolute fecundity, relative fecundity, ovary weight, ovary volume, and ovary diameter. The findings indicated variations in the range of 5.33-11.66%, 10.25-14.68 nos.egg/fish, 4.67-12.22 nos. of fry/body weight, 0.17-0.34 g, 655.12-876.34 mm^3, and 2.21-3.03 mm, respectively. Furthermore, the average fry production across different treatments varied between 12.85-34.78, with a fry survival rate of 85.56-93.61%. Coloration analysis, which was based on carotenoids and digital imaging, revealed varying results, with salinity having no direct effect, except at higher salinity levels. Overall findings from survival, growth, reproductive performances, and coloration studies on black molly indicated that while the fish demonstrated the ability to adapt and grow under salinity conditions of up to 12 ppt in inland saline water, the optimal salinity level, with respect to the overall performance of the fish, was determined to be 8 ppt. However, further field trials are recommended to enhance understanding of the effects of salinity (inland saline water) when coupled with multiple factors under natural conditions.

Keywords*:* inland salinity, black molly, reproductive performance, fish behaviour, fish colouratio

Investigation of prevailing goat management practices under field conditions in Lower Gangetic Plains of India: Semi-intensive vs Intensive

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The present study was undertaken to compare two management practices (semi-intensive and intensive system) for goat rearing under Lower Gangetic Plains of India. A total of 100 farmers from Nadia district, West Bengal, India covering two blocks namely Kalyani and Chakdah were investigated regarding various rearing practices of goat including deworming, vaccination, frequency of cleaning shed and suitable cleaning agent used in the farm. Parameters related to type of goat shed under semi-intensive and intensive production systems were also considered. From the study, it was reported that goats managed under semi-intensive were dewormed (46.9%) comparatively lower than that of goats in intensive (56.9%) system. Nevertheless, vaccination of goats in both the system stands equal and most of the farmers do not performed vaccination (63.3 vs 62.7). Under intensive, daily (82.4 %) cleaning of shed was found to be more prevalent than semi-intensive (65.3%). It was observed that only 7 to 10 % farmers used disinfectant for cleaning their shed while the rest (90.0 %) cleaned with plain water only. In semi-intensive, goat shed is preferably more attached with residential building type (69.4 %) than separate establishment while it was found to be equal in intensive system. From the study it can be concluded that encouraging frequent deworming and vaccination at regular intervals with hygienic measures would enhance animal productivity and welfare.

Keywords: Deworming, goat, hygienic measures, intensive, semi-intensive and vaccination

Developing and evaluating a magnetic field-assisted freezing system to preserve the freeze-thaw properties of perishable foods.

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This study aimed to examine the impact of a developed electromagnetic field system on the freezing characteristics and quality of whole frozen tomatoes. The system incorporated an electromagnetic field generating device to apply a magnetic field ranging from 2.5 mT (0.025 kGauss) to 3.0 mT (0.030 kGauss) within an existing deep freezing setup. Freezing experiments were performed to analyze the freezing curve and assess the effect of the electromagnetic field on the effective freezing time and rate compared to conventional freezing methods. Sensory characteristics, including visual appearance, texture, and thawing loss, were evaluated after thawing the samples at room temperature. The results showed that the magnetic field enabled the complete freezing of tomato samples in a significantly shorter time (220–260 minutes) compared to ordinary freezing (1460 minutes), with a notable reduction in the freezing point and an increased degree of super-cooling. Thawing loss was significantly lower ($p < 0.05$) for electromagnetically frozen samples, recorded at 0.02% compared to 1.73% in the control group. Additionally, electromagnetically frozen tomato samples maintained freshness and textural qualities, such as cell structure hardness, similar to fresh tomatoes even after thawing, indicating this method may effectively preserve the quality of perishables for extended periods.

Dark fermentation of sugarcane biomass hydrolysate by *Enterobacter aerogenes* for hydrogen production

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Hydrogen is a highly attractive energy source due to its high energy content and zero CO_2 emissions. Currently, most of the hydrogen is produced from fossil fuels. However, environmental concerns necessitate the exploration of alternative sources of energy. Biohydrogen production from lignocellulosic biomass presents an efficient solution to meet global energy demand while simultaneously promoting clean energy production and waste utilization. The study aimed to determine the optimum reaction conditions for pre-treatment of whole sugarcane biomass and subsequent hydrogen production through dark fermentation of sugar rich hydrolysate. A Box-Behnken design and Response Surface Methodology (RSM) were employed to study the interactions of three factors: acid concentration, time, and solid-liquid ratio on reducing sugar content of the hydrolysate. The optimal conditions were identified as 2.28% acid concentration, 56 min autoclave and a 1:16.5 solid-liquid ratio, resulting in the release of 21.97g of reducing sugars in the hydrolysate for 100g of biomass. The hydrolysate was detoxified and used for dark fermentation in a 2L working volume with *Enterobacter aerogenes* as the pure inoculum. It was observed that hydrogen production increased from 22.95 ml/L at 24 h to 108.3ml/L at 72 h and then declined thereafter. Throughout the fermentation process, total reducing sugars and total sugars were consumed, while volatile fatty acid content increased with maximum content of 0.780 g/L at 120h of fermentation. The hydrogen production was further enhanced to 318.2ml/L with the supplementation of 30mg/L of Fe_2O_3 nanoparticles in the hydrolysate. The study demonstrated that the hydrogen production through dark fermentation is a valuable strategy to efficiently manage the sugarcane waste biomass and addition of iron nanoparticles can significantly enhance hydrogen production rate.

MUTAGENIC STUDIES IN M_3 GENERATION OF *LATHYRUS*

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123 mutants along with two checks (NLK-73 and Ratan) were evaluated in three replications in *Rabi* 2019. Data were recorded on germination percentage, mortality percentage, days to first flower, days to maturity, plant height, number of branches plant^{-1} , number of pods plant^{-1}, 100 seed weight and seed yield plant^{-1}. Analysis of variance indicated that the mean square due to between family were highly significant for all traits, which revealed the presence of significance genetic variability between the families. Intra class correlation (t) lead the inference that differences between individual within family is large and each family differentiated distinctly from the other at lower level in M_3 generation hence, equal weightage to σ^2f and σ^2w were suggested to be considered for selection in M_3 generation. High genotypic and phenotypic coefficient of variation was recorded for seed yield plant^{-1} and 100 seed weight and moderate for other characters. High heritability was recorded for number of branches plant^{-1}, days to 1st flower, seed yield plant^{-1} and moderate for others. Genetic advance as a percentage of mean was high for seed yield plant^{-1}, 100 seed weight, number of branches plant^{-1} and plant height. Seed yield plant^{-1} was the only character which recorded high GCV, PCV, heritability and genetic advance hence this character was considered for selection in M_3 generation as influenced by additive gene action.

(Key words: *Lathyrus*, gamma rays, mutation, M_3 generation)

In vitro regeneration studies in the commercial guar (*Cyamopsis tetragonoloba* L. Taub.) variety RGC-1002

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Guar gum is a commercially important polysaccharide obtained from cluster bean (*Cyamopsis tetragonoloba* L. Taub.), commonly called guar. RGC-1002 is a drought tolerant, high yielding guar variety which also shows less instances of diseases. Availability of an efficient *in vitro* regeneration system for RGC-1002 is important for developing elite clones and application of biotechnological advances. Therefore, in the present study, we established an *in vitro* regeneration system for RGC-1002. Three different explants, viz., cotyledon, hypocotyl and cotyledonary nodes were inoculated for *in vitro* shoot regeneration in Murashige and Skoog (MS) medium containing different combinations of plant growth regulators. However, *in vitro* shoot initiation was only observed from the cotyledonary node explants after 10-15 of inoculation on growth medium. Highest percentage of *in vitro* shoot regeneration (61%) was recorded in MS medium containing 2 mg/L IBA, 3 mg/L BA and 1 mg/L GA3. Direct hairy root induction, instead of shoot induction, was observed in the cotyledon explants cultured on MS medium supplemented with kinetin.

To Optimized *in vitro* Propagation Protocol for *Punica granatum* cv. Bhagwa

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In this study, we present advancements in the *in vitro* propagation of *Punica granatum* cv. Bhagwa, a premium pomegranate cultivar renowned for its high yield and soft seed. The research focuses on refining tissue culture techniques to achieve efficient clonal propagation, which is crucial for both commercial cultivation and genetic conservation. To studies on optimization of a micropropagation protocol from double nodal segment and meristem tip explants testing various combinations of plant growth regulators and media formulations to enhance shoot regeneration and root development. Key variables, including cytokinin and auxin concentrations, as well as culture conditions such as light and temperature, were systematically evaluated. For the establishment of nodal explant various nodes viz. I st, II nd, III rd and IV th nodes were tried, among all II nd and III rd nodal segments shows maximum regeneration potential (79%) on the Murashige and Skoog (MS) medium 1.8 mg/l BAP and 0.4 mg/l NAA. The meristem tip explants shows maximum shoot regeneration (44.4%) on the Murashige and Skoog (MS) medium containing 5 mg/l BAP. For shoot multiplication Murashige and Skoog (MS) medium containing BAP 0.2 mg/l and NAA at 0.1 mg/l and addition of adenine sulphate 60 mg/l significantly improved shoot multiplication, 82 % nodal explants initiated multiple shoots and on the other hand 54 % meristem tip explants shows multiple shoots. While rooting was most effective (64%) on a half-strength MS medium supplemented with 1.8mg/l IBA and 0.4mg/l NAA. These optimized conditions yielded high-quality plantlets, which were successfully hardened in the potting mixture containing vermiculite and cocopeat at 1:1 ratio. This work provides a robust framework for the large-scale propagation of *Punica granatum* cv. Bhagwa, offering valuable insights and practical protocols for nursery production and conservation efforts. Our findings contribute to the efficiency of pomegranate cultivation and underscore the potential for *in vitro* techniques to support the sustainable development of high-value fruit crop

Effective utilization of rice fallow through cultivation of short duration pulses and oilseed crop in West Tripura District

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Rice fallow is the unutilized land after the harvesting of rice crop in rice based cropping system. Keeping land fallow after harvesting of aman rice is very much common picture of West Tripura district. Total 2151 ha rice fallow area was estimated during 2022-23 in West Tripura district. Rainfed rice agro ecosystem plays an important role in food production and there is a huge scope for utilizing residual moisture in rice fallows to cultivate short duration and low input demanding crops. It is a potential avenue for efficient utilization of resources for sustainable crop intensification and to boast land productivity. However success of rice fallow is largely depend on method and cultivar of rice.

With this view to increase the productivity of rice fallow, Krishi Vigyan Kendra West Tripura conducted several demonstrations of short duration pulses and oilseed crop in rice fallow of the farmers of West Tripura district. The objective of the demonstration was to utilize the rice fallow and to increase the system productivity of rice based cropping system. Rice variety gomati was chosen for cultivating during kharif season. Villages were identified through Participatory Rural Appraisal (PRA). Awareness programme on utilization of rice fallow and training programme on methodology of crop cultivation in rice fallow was conducted before taking the demonstration. Field day programme was also conducted in the farmer's field in standing crop. Different pulse like greengram, lentil, field pea and toria among oilseed crop were tested in rice fallow of the district. The farmers who were engaged with the demonstration could able to achieve 15 to 20 % increase in yield of the system. Growing crop in rice fallow not only increases the system productivity but also increases the cropping intensity of the District.

Keywords: Rice fallow, Pulse crop, Oilseed Crop, Cropping intensity, Cropping Syste

Extraction of Bioactive compound i.e. Tannins from berries and its tannin acyl hydrolase mediated biotransformation to access its anti-carcinogenic and anti-angiogenic activity

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Tannins are the astringent-tasting polyphenolic compounds naturally occurring in plants. They vary in complexity and have different molecular weights. Broadly, these are of two classes: hydrolysable tannins and condensed tannins. Tannins are reported to have many health-benefiting activities, such as radical scavenging, antimicrobial and antiparasitic. Moreover, it is also documented to interact with and modulate complement system. Tannins have the ability to bind to the proteins in the aqueous system and thus are involved in sequestering complement proteins. These are antigenotoxic, antiangiogenic, have antitumor activity and are able to inhibit enzymes, specifically inducing apoptosis in cancer cells. Thus, due to their increased effectiveness, they are being studied for advanced cancer treatments through dietary interventions. Tannins are present in many natural foods consumed by humans such as tea, red wine, berries, nuts and seeds, legumes, pomegranate and many more. This article discusses about the tannin extraction from berries and role of enzyme tannin acyl hydrolase in metabolism and transformation of tannins by hydrolysing the ester bonds of hydrolysable tannins into ellagic acid and gallic acid. These biotransformed tannins are more readily absorbed and bioavailable in the body and have antiproliferative and cytotoxic effects against cancer cell lines and can modulate various signalling pathway involved in cancer development and progression. The mechanism by which tannins interact with gut microbiome and are transformed into ellagic and gallic acid is an active area of research and its therapeutic benefits are further discussed in this article.

Keyword: Berries, tannins, hydrolysable tannins, biotransformation, cancer treatment, therapeutic potential, tannin acyl hydrolase, gut microbiota.

Effect of organic inputs on varietal performance of linseed in acidic soil of Meghalaya

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The linseed (*Linum usitatissimum* L.) is one of important crop among the new crops introduction in North East Hill (NEH) region of India under organic production system, even though it was grown as *Paira* and *Uttera* crop in Eastern India in Rice – Fallow systemThe use of bio-inputs such as *Beejamrutha* and *Jeejamrutha* is getting significance due to their impact of soil microbes and overall soil biological and chemical properties. As the organic production practices are suitable and promoted in NEH region, the investigation of role of organic inputs on nutrient concentration and accumulation in linseed is worthy. For this a field experiment was conducted at college of Agriculture (CAU-I), Kyrdemkulai, Meghalaya, India (25^0.74' N and 91^0 81' E) during *rabi* season of 2023. The nutrient concentration and uptake in grain and stove of three linseed varieties (T-397, RLC-163 and NDL-2014-15) were determined as affected by four treatments (T1: Beejamrutha +Jeevamrutha, T2: N_1 + Vermicompost @1.5 t ha^{-1}, T3: N_1 + Biofertilizer, T4: N_1 + Vermicompost @1.5 t ha^{-1} + Biofertilizer) in factorial randomized block design. The treatments were replicated thrice and standard procedures were followed for determining the concentration and uptake of nitrogen, phosphorus and potassium. The biofertilizer used in the investigation were prepared by College of Post-Graduate Studies in Agricultural Sciences, Umiam, Meghalaya and contains *Azotobacter*, Phosphate Solubilizing Bacteria (PSB), Potassium Solubilizing Bacteria (KSB) and Zinc Solubilizing Bacteria (ZnSB). The results showed that, varieties were differed significantly in nitrogen, phosphorus and potassium concentration as well as uptake in both grain and stover. This indicates that, both concentration and dry matter production contributes to the changes in the uptake of nutrients. The variety NDL-2014-15 recorded significantly highest concentration of N, P and K. The increase in uptake of N, P and K in grain in NDL-2014-15 was 6.74 – 6.94 kg/ha, 2.46 – 2.57 kg/ha and 4.33 – 4.44 kg/ha, respectively over other varieties and similar increase was also recorded in stover and total uptake. The highest concentration and uptake of N, P and K was recorded with application of *Beejamrutha* and *Jeejamrutha* + vermi-compost (1.5 t/ha) + biofertilizer which was significantly superior over other combinations. The significance variations across bio-input combinations indicate the complimentary and additive effect of combination of nutrient sources and response of linseed varieties to organic inputs.

Keywords: Linseed, Nitrogen, biofertilizer, beejamrutha, Jeevamrutha.

Growth, yield, quality and economics of soybean as influenced by plant growth regulators and their stages of application

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The field investigation entitled "Growth, yield, quality and economics of soybean as influenced by plant growth regulators and their stages of application" was conducted at Regional Research Centre, Amravati under Dr.Panjabrao Deshmukh Krishi Vidyapeeth, Akola during kharif 2017-18 to 2019-20. The experiment was laid out in a factorial randomized block design with fifteen treatments combinations and three replications with a view to find out the effect of the four bio-regulators (salicylic acid, ethrel, chloromequat chloride and nitrobenzene) and their stages of application on growth, yield and quality of soybean. From the pooled data of three years reveled that, application of nitrobenzene 20% @ 500 ppm found significantly more plant height (54.63 cm), number of branches plant^{-1}(3.53), number of pods plant $^{-1}$(28.95), test weight (11.06 g), seed yield (1981 kg ha^{-1}), straw yield (2562 kg ha^{-1}), protein content (39.45%), oil content (18.65 %), GMR (Rs. 65460 ha^{-1}), NMR (Rs. 34705 ha^{-1}) and B:C ratio (2.12) and it was at par with chloromequat chloride @1000 ppm in all characters, whereas, application of growth regulators at flower initiation stage recorded numerically more plant height (53.37 cm), number of branches plant^{-1} (3.26), number of pods plant $^{-1}$ (28.52), test weight (10.79 g), seed yield (1955 kg ha^{-1}), straw yield (2498 kg ha^{-1}), protein content (39.47 %), oil content (18.62%), higher GMR (Rs. 65585 ha^{-1}), NMR (Rs. 34102 ha^{-1}) and B:C ratio (2.10) . Interaction effect on growth, yield, yield attributes, quality and economics parameters showed non significant effect.

Keywords: soybean, growth regulators, salicylic acid, ethrel, chloromequat chloride and nitrobenzene

AGRIVOLTAIC SYSTEMS: SYNERGISTIC INTEGRATION OF PHOTOVOLTAIC POWER GENERATION AND AGRICULTURAL PRODUCTION

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Agrivoltaic systems present an innovative method for sustainable land utilization by combining solar power generation with agricultural activities on the same land. By positioning photovoltaic panels over or adjacent to crops, these systems aim to optimize both energy production and agricultural yield. The dual advantages of agrivoltaics include the generation of renewable electricity and the provision of shade, which can alleviate heat stress on crops and enhance water use efficiency. The primary challenge lies in finding the optimal balance between the light intercepted by the panels and the light necessary for photosynthesis to maintain healthy crop growth. Achieving this balance involves careful consideration of panel placement, height, spacing, and the selection of crops that thrive under these conditions. When properly implemented, agrivoltaic systems can harmonize solar energy production with agricultural productivity, offering a sustainable approach that meets the growing demand for both food and renewable energy.

Keywords: *Renewable, Photovoltaic, Sustainable Agriculture, Energy Generation, Dual Income*

IMPACT OF CLIMATE CHANGE ON TURMERIC FARMERS IN MIZORAM

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Northeast India in general and Mizoram in particular is much less developed but having diverse agro-climatic zones and hilly terrain compared to the mainland India and thus, the region as a whole is prone to different kinds of climatic shocks. Assessing vulnerability to climate change and adoption of appropriate adaptation measures provides important insights on the varying levels of vulnerability and is crucial for reducing the adverse effects, and it is expected that farmers with higher adaptive capacity would be better equipped to respond to the rapidly changing climatic conditions. The present study was conducted in Mizoram state in the North Eastern Himalayan region of India. Out of the eleven districts in Mizoram, Lunglei and Mamit were the two districts selected from the higher and the lower producing districts, respectively for the present study. Primary data were collected from 334 turmeric farmers from the selected districts. In the current study, Intergovernmental Panel on Climate change-Vulnerability Index (IPCC-VI) was used to assess the livelihood vulnerability and Cost-benefit analysis was used for assessing the cost and benefit of adaptation. The study shows that vulnerability of Lunglei district was significantly higher (0.68) compared to Mamit district (0.52) as the district was relatively more exposed and sensitive to climatic factors and the adaptive capacity was also lower than Mamit district. The study suggested that reducing sensitivity and improving adaptive capacity of the households is the key to cope up with household vulnerability to climate change.

Keywords: Climate vulnerability, adaptive capacity, turmeric, Mizoram

Anaerobic digestion of waste for sustainable energy production: Principles, Applications, and challenges

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The contribution of Anaerobic digestion (AD) technology in the energy sector plays significate role in waste management and enhancing the capturing the carbon. This chapter deals with concept, mechanism and classification of AD technology, various type waste material used and operational conditions for AD technologies. However, application and sustainable challenges related to the AD technologies has been mentioned. Methane and carbon dioxide are the main constitutes of biogas and their production mainly depends on the various factors such as temperature, retention time, pH, loading rate, carbon/nitrogen (C/N) ratio and types of raw material. Also, it emphasizes the digestate which enhance the fertility of soil to improve the yield from plant. Eventually, on one side large amount of waste material available and other side popularity of AD technology restricted due low awareness in the society about the handing of organic waste for the harness the energy from it. However, initial installation cost, less awareness regarding benefits of AD in communities, consistently availability of waste material and market distortions were acknowledged as the factors adversely influencing these AD technologies. Furthermore, sustainable challenges have been explained with the future prospectives, environmental and economic significance. The entire potential of AD has not yet been realised due to operational problems, government policies, and public acceptance.

Keywords: Anaerobic digestion; biogas; waste management; sustainable challenges.

Ameliorating Cr toxicity and boosting rice yield in Odisha's mined areas by using organic manure and seed priming

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Worldwide, heavy metal pollution is becoming one of the biggest problems harming the environment and public health. Natural resource risks have surfaced in the past few years due to heavy metal pollution, particularly Cr contamination, and the explosive growth of the mining, industrial, urban, and allied sectors. Hexavalent Cr is regarded as the eighteenth harmful priority pollutant and is primarily soluble in water. During the rainy season, exposed chromium (Cr) ores and metals in mined regions' soil drain out, polluting soil, water bodies, flora, fauna, and the human population. A study was carried out at ICAR-IIWM, Bhubaneswar, Odisha, to establish a remediation procedure to reduce Cr (hexavalent) translocation in rice. Treatments comprised two levels of chromium (Cr) stress [natural and elevated (20 mg/kg soil)], four levels of amendment [without amendment, vermicompost (10 t/ha), Fe primed (250 ppm) and vermicompost (5 t/ha) with Fe primed (250 ppm)] and two methods of irrigation practice [irrigation applied at 3 days after disappearance of ponded water (DAD) and continuous flooding]. This treatment combination also enhanced the filled grains/panicle by 22% over without amendment. Constant flooding improved yield-related measures such as panicle weight, number of grains/panicle, filled and chaffy grain percentage over 3 DAD. The VSP performed better than each individual treatment in respect of rice grain and straw yield, the grain yield was 58% greater in the VSP than in the control. Compared to the separate applications of vermicompost and seed priming, the application of VSP decreased the Cr content in root, shoot, husk, and grain by 30.1, 29.6, 38.9, and 37.5%, respectively. Using VSP prevented Cr from being absorbed by rice roots and being transported to the aerial portions of plants.

Keywords: *Heavy metal pollution, Chromium stress, vermicompost, seed priming, rice.*

Consumer's Perception on A2 Milk

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The present research aims to investigate the extent to which convenience, nutritional quality, sensory appeal, safety health, price, availability, trust and labeling determinants influence purchase intention and consumption of A2 milk which is highly beneficial for health. The confirmatory factor analysis and structural equation modelling were adopted to analyze the data obtained from 400 consumers. Factor loading, Cronbach's alpha, composite reliability, average variance extracted and correlation estimate indicates good internal consistency, reliability and validity of questionnaire and measurement model. The fit indices i.e. CFI, TLI, GFI, RMSEA and SRMR demonstrated good fit of measurement and structural models. The path analysis of the structural model demonstrated significant and positive relationship between convenience, nutritional quality, sensory appeal, safety attributes, healthiness, price, trust, labeling/product information and purchase intention and consumption of A2 milk. Nutritional quality and healthiness were the key determinants positively influencing consumer's purchase intention and consumption of A2 milk.

Comparative Study of Different Harvesting Methods for Alfalfa

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The dairy industry, which contributes considerably to India's agricultural production, has an intrinsic connection to agriculture. The quality of feed has a direct impact on the health and productivity of dairy cows, which determines the quantity and quality of milk produced. Among the diverse range of fodder crops, alfalfa has emerged as a significant player due to its high protein content, digestibility, and adaptation to Indian agroclimatic conditions. In India, alfalfa is grown on 4000 hectares of land with guaranteed irrigation. The harvesting of alfalfa grass is mostly done by manually, disc type grass cutter, self-propelled vertical conveyor reaper. This research work is carried out to check performance evaluation and compare the harvesting parameters of manual, disc-type grass cutter, and self-propelled vertical conveyor reaper. The average field efficiency of the disc-type grass cutter and self-propelled vertical conveyor reaper is 98.67% and 76.78% with fuel consumption of 5.76 l/acre and 1.81 l/acre, respectively. Cutting efficiency of manual harvesting, disc-type grass cutter, and self-propelled vertical conveyor reaper is found to be 97.74%, 94.40%, and 76.29% respectively. The cost of operation of manual harvesting, disc-type grass cutter, and self-propelled vertical conveyor reaper is found to be Rs. 2100/-, 1242/-, and 836/- per acre, respectively.

Keywords: grass cutter, reaper, field efficiency, fuel consumption, cutting efficiency

Cover Crop Management and Vegetable Cropping System for Sustainability of vegetable crop production and soil health

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Cover crops (CCs) and sustainable vegetable cropping systems (CSs) are integral to the long-term health of soil and the sustainability of vegetable crop production. In addition to enhancing vegetable crop production and increasing farm income they offer multitude of benefits by lessening the negative effects of conventional agriculture like nutrient leaching, soil erosion, weed problem, reduced soil health and fertility etc. Over time, the use of CCs like tillage radish/forage radish (*Raphanus sativus* L.) can reduce the need for synthetic fertilizers, herbicides, and pesticides, leading to lower input costs and more sustainable production systems. Soils enriched with organic matter and protected by CCs are more resilient to extreme weather conditions, such as droughts and heavy rains. Forage radish also known as Daikon radish/Japanese radish is an excellent nitrogen scavenger and can provide excellent soil cover, conserve soil moisture, helps in sequestering carbon, reduces bulk density, improves porosity, increases organic matter of soil and prevents weed growth. The objective of the research was to study the effect of forage radish CC management and residue return of vegetable CSs on the yield, cost economics of vegetable crops in a CS and the influence of residue return of CCs and vegetable CSs on soil healthCost economic analysis of different treatments revealed that treatment combinations CC_1CS_2 (cent percent forage radish CC followed by chilli-dolichos bean CS) recorded the highest B:C ratio of 6.39. The lowest B:C ratio of 2.20 was recorded by the treatment combinations CC_0CS_3 (control plots without CC and cowpea-amaranth CS). The residue returns of CC and vegetable crops in the CS were found to be beneficial in improving physical and chemical properties of soil mostly in the 0-15cm soil profile. Therefore, for sustainable production of vegetable crops in a CS, as well for improving soil health, forage radish CC (*Raphanus sativus* L. var. longipinnatus), syn. Daikon or Japanese radish can be used as CC before sowing of spring summer and summer season vegetable crops.

***Key Words*:** Cover crop, forage radish, vegetable cropping system, sustainable production

Change detection of Land use and Landcover classes using Remote Sensing and GIS of North 24 Parganas of West Bengal a review

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North 24 Parganas is a part of the Kolkata Metropolitan Area, one of the fastest-developing city areas in India. The major changes in land use and land cover (LULC) in the district have been seen in specific regions due to various factors. Land use changes in the district, including urbanization in Kolkata's northern suburbs (which include Barasat, Rajarhat, and Salt Lake), industrialization in the northwestern areas (Barrackpore, Kanchrapara), conversion of wetlands and mangroves near the Sundarbans and agricultural land conversion in the east (Bangaon, Habra, and Basirhat), necessitate careful planning and sustainable management practices to balance development needs with environmental conservation. To monitoring these changes Remote sensing and GIS technologies played a crucial role. By analyzing high-resolution satellite images from Landsat TM, Landsat 5, 7, and 8 using both supervised and unsupervised classification techniques, researchers have utilized indices like NDVI, MNDWI, NDBI, and BUI to assess land use and cover. Accuracy of the analysis was validated using the KAPPA Index and KHAT statistics.

Key words: LULC changes, RS, GIS, Classification indices, KAPPA, KHAT

Depletion of mineral elements, oil and protein content in seeds of *Gossypium* spp. following infestation by newly emerging pest, dusky cotton bug (*Oxycarenus* spp.)

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Dusky cotton bug (DCB) (*Oxycarenus* spp.) is emerging as a major pest for cottonseeds. It derives its nutrition by sucking oil and sap from the mature cottonseeds, causing significant damage to the embryo along with deteriorating seed vitality. The present study was designed to analyze the losses inflicted by DCB feeding on the nutritive value of seeds of *Gossypium arboreum* (LD 949 and FDK 124) and *G. hirsutum* (PAU Bt 3 and F 2228). The test varieties were demarcated into tolerant and susceptible categories on the basis of the population of DCB nymphs feeding from them. Hence, varieties FDK 124, LD 949 and F 2228 were identified as tolerant while PAU Bt 3 was categorized as susceptible. The net concentration of mineral elements, seed oil content and total soluble protein content was noted to be heavily declined in the cottonseeds post DCB infestation. However, the loss in oil content was much more pronounced in *G. hirsutum* varieties. On the other hand, the protein content of the susceptible variety PAU Bt 3 was observed to be higher than the other varieties in the uninfested state, which however reduced greatly upon DCB herbivory. Moreover, the nymphal population was negatively correlated with the net protein content of cottonseeds ($r = -0.50$, $P \geq 0.05$), suggesting the rapid consumption of proteins by DCB nymphs for their nutrition. The results obtained from the current investigation point out the heavy declines caused in cottonseed quality due to DCB infestation and hence emphasize the seriousness of this pest.

Keywords: Cotton, Dusky cotton bug, Minerals, Oil, Protein

Screening of spices for bioactive compounds and their effect on *in vitro* methanogenesis

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In vitro gas production studies were conducted to assess the impact of six locally available spices (viz. turmeric, ginger, cinnamon, ajwain, clove and oregano) on the rumen fermentation and methane production. Spices were supplemented individually @ 1, 2 and 3% on dry matter basis to the total mixed ration (TMR) containing oat fodder and concentrate mixture in 40:60 ratio. The water soluble saponins were highest in ginger, while methanolic saponins were highest in turmeric. All the spices were rich in essential oils with highest level in cloves and oregano. The net gas production (NGP) was highest in turmeric followed by ginger supplemented TMR. The digestibility of DM and NDF was the highest ($P<0.05$) in TMR supplemented with turmeric. The relative proportion of acetate was low ($P<0.01$) while propionate was high in TMR supplemented with turmeric as compared to other spices. Methane production was lowest in turmeric. Irrespective of the type of spices, the propionate production was observed to be highest when TMR was supplemented @ 1% and 3% of DM. In comparison to un-supplemented diet, fermentative methane decreased by 9.7 (1% level) to 19.4% (3% level). Keeping in view the digestibility of nutrients, fermentability and methane mitigation potential, it was concluded that among the various spices evaluated, turmeric had an edge over other spices and optimum level of supplementation was observed to be @ 1%.

Keywords: Bioactive compounds, Essential oil, Methane mitigation, Net gas production, Spices

Agroforestry system and its effects

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Agroforestry systems integrate trees into agricultural landscapes and have gained recognition for their potential to promote ecological sustainability, improve livelihoods, and increase agricultural productivity. It synthesizes the current state of knowledge based on agroforestry systems, focusing their benefits, challenges, and opportunities. Agroforestry system in the farm of environment services protect soil erosion, bioenergy, affects carbon fixing, diversify agricultural landscapes with trees, sustainable land management practice, control of pests by their natural enemies and habitat of biological diversity in the world. Agroforestry systems have a reversible relationship with livelihood and biodiversity in multi-functional landscapes. We discuss the ecological, economic, and social advantages of agroforestry, including improved soil health, biodiversity conservation, and increased crop yields. We also discuss the challenges and limitations of adopting agroforestry practices.

Keywords: Agroforestry, Landscapes, Biodiversity, Bioenergy, Land management

Sustainable production on steep slope: Assessing intercrop performance under *Gmelina arborea*-based agroforestry system in NE India

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The root system of trees is extensive, which helps to anchor the soil, preventing landslides and soil erosion. This is especially important in regions prone to heavy rains and soil degradation. *Gmelina arborea*, or white teak, is indeed a fast-growing, deciduous tree that has become popular in India for its versatility and quick returns. It's valued for its high-quality wood, which is used in various industries like furniture, plywood, and construction. Additionally, its rapid growth and ease of establishment make it a favorable option for agroforestry systems, especially in regions with steep slopes or degraded lands. In Northeast India, where jhum cultivation (shifting cultivation) is prevalent, *Gmelina arborea*-based agroforestry models offer a sustainable alternative. This model of agroforestry, especially under high slope conditions, has likely been assessed to address key issues such as soil erosion, water retention, and long-term agricultural productivity. By integrating *Gmelina arborea* into agroforestry systems, farmers can achieve economic benefits while contributing to soil conservation, biodiversity enhancement, and long-term sustainability. It was observed that soil moisture and temperature were higher under *Gmelina arborea* intercropping compare to sole turmeric, ginger and taro. Crop growth parameters of turmeric, ginger and taro were also recorded higher under *Gmelina arborea* intercropping. Soil fertility was also higher under *Gmelina arborea* intercropping than sole.

REGULATION OF MAMMARY GLAND TUMORIGENESIS BY CURCUMIN, BAICALEIN AND ITS COMBINATION IN RAT MAMMARY CANCER MODEL

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The aim of the present study was to investigate the anti-tumor activity of curcumin and baicalein alone and in combination in 7,12-dimethylbenz[a]anthracene (DMBA) induced mammary tumor model. The experimental trial was carried out in 38 female Wistar rats of 6-8 weeks using DMBA for induction of breast cancer. The animals were divided into 5 groups i.e., Group I (SHAM), Group II (DMBA @ 80 mg/kg bw orally single dose), Group III (DMBA @80 mg kg bw single dose orally + curcumin @100mg/kg bw orally), Group IV (DMBA @80 mg kg bw single dose orally + baicalein @10mg/kg bw ip) and Group V (DMBA @80 mg kg bw single dose orally + curcumin @100mg/kg bw orally + baicalein @10mg/kg bw ip). After single dose of DMBA, the herbal drugs were given every alternate days for 20 weeks. Tumors developed only in DMBA group whereas early changes of tumor development like stage of cell death, hyperplasia and dysplasia were observed in group III and IV Oxidative stress parameters and proinflammatory cytokines showed significant rise in DMBA group with significantly low activity of anti-oxidant enzymes. Herbal drugs were able to ameliorate the above parameters (Group-III, IV and V) with maximum effect in the combination group. Further, Immunohistochemical and molecular studies on EMT confirmed the ameliorative effect of curcumin and baicalein.

Keywords: Baicalein, Cancer, Curcumin, DMBA, EMT, Immunohistochemistry

Identification of SNPs and miRSNPs from whole transcriptome analysis and association with thermotolerance in Crossbred and Indigenous cattle

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Karnal

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Upon exposure to adverse conditions such as heat shock, translation of cellular mRNAs is tightly regulated to allow rapid adaptation to environmental changes. Multiple genetic studies have investigated the post transcriptional regulatory mechanisms of miRNA during stresses. Although the heat-stress response has been extensively studied for decades, very little is known about its effects on nucleic acids and nucleic acid-associated processes especially repair mechanisms. Genetic variations especially SNPs that occur at miRNA binding sites on the target genes that, if functional, can alter the miRNA-mediated regulation of these variant genes. SNPs were identified from the whole transcriptome analysis data in Karan Fries and Tharparkar cattle. A total of 6,28,879 SNPs were selected after quality control. Out of these, a total of SNPs were identified to be fixed in the Tharparkar population. Variant annotation of unique SNPs in the Tharparkar indicated 30.02% SNPs were missense mutations. These SNPs are linked with key enzyme in hepatic gluconeogenesis. Functional annotation of genes with unique /fixed SNPs in Tharparkar cattle showed regulation of triglyceride catabolic process, inositol phosphate-mediated signaling, syncytium formation and regulation of cellular response to insulin stimulus. The major genes identified associated with theromotolerance indicated PIGM, SLAMF9, IGSF9, TAGLN2,CFAP45, VSIG8, ACKR1, CADM3, ENSBTAG00000052902 (chr3); HSF1 (chr 14); NXN, MRM3, GLOD4 (chr19); CACNA1D (chr 22); NFYA, ENSBTAG00000021359, TREM2, TREML1,TREML2 (chr 23) and PHRF1 (chr 29). Further, a total of 5503 were identified as miRSNPs. Of these SNPs in bta-MiR-1584 and bta-mir-2335 were found associated with Heat tolerance, respiration rate and body temperature. The identified SNPs in the miRNA seed region of bta-miR-2335 and bta-miR-1584 may be used for selection of animals for better heat tolerance in Tharparkar and Karan Fries population, after validation on large sample size.

Advancing Chia Varieties: The Role of Mutation Breeding in Enhancing Genetic Variability

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Chia (*Salvia hispanica* L.), native to Central America, has gained global prominence for its exceptional nutritional benefits, including high levels of omega-3 fatty acids, fiber, and antioxidants. As the demand for chia increases, breeding programs worldwide are focusing on improving genetic diversity, yield, and quality traits. Leveraging the crop's small genome size, global research efforts utilize molecular genetics and genomics to enhance nutritional and quality attributes. In India, where chia is a recent addition to agriculture, research spearheaded by ICAR-NIASM is dedicated to developing genetic variability to optimize local adaptation and enhance the seed yield and quality. In a pioneering mutation study, chia seeds were subjected to gamma irradiation at doses of 400, 500, and 600 Gy, which revealed that higher doses decreased germination rates, delayed seedling emergence, and slowed growth. Over 1,000 M_1 plants were evaluated, leading to the selection of more than 25,000 M_2 macro mutants with diverse morphological variations. Novel traits, including purple pigmentation, bold seeds, and modified foliage shapes and colour, were observed in M_2, along with variation for plant height and maturity. In M_4, stable lines exhibiting desirable and novel characteristics, such as early flowering, bold seeds, pigmentation and chlorosis and crinkling foliage were identified. These promising lines are undergoing multilocation trials to confirm trait stability and potential for registration. Interestingly, in M_5 generation, identified a mutant line with sturdy, extra dwarf and dark green and crinkling thicker foliage indicating the importance of delaying the selection in mutation breeding. Hence, the mutation is considered as potential tool to create genetic variability and ultimately aimed to advance chia varieties, enhancing their productivity and quality to meet growing demands.

Keyword: Chia, omega-3, mutation, pigmentation, selection

To Optimized in vitro Propagation Protocol for Punica granatum cv

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In this study, we present advancements in the in vitro propagation of Punica granatum cv. Bhagwa, a premium pomegranate cultivar renowned for its high yield and soft seed. The research focuses on refining tissue culture techniques to achieve efficient clonal propagation, which is crucial for both commercial cultivation and genetic conservation. To studies on optimization of a micropropagation protocol from double nodal segment and meristem tip explants testing various combinations of plant growth regulators and media formulations to enhance shoot regeneration and root development. Key variables, including cytokinin and auxin concentrations, as well as culture conditions such as light and temperature, were systematically evaluated. For the establishment of nodal explant various nodes viz. Ⅰst, Ⅱnd, Ⅲrd and Ⅳth nodes were tried, among all Ⅱnd and Ⅲrd nodal segments shows maximum regeneration potential (79%) on the Murashige and Skoog (MS) medium 1.8 mg/l BAP and 0.4 mg/l NAA. The meristem tip explants shows maximum shoot regeneration (44.4%) on the Murashige and Skoog (MS) medium containing 5 mg/l BAP. For shoot multiplication Murashige and Skoog (MS) medium containing BAP 0.2 mg/l and NAA at 0.1 mg/l and addition of adenine sulphate 60 mg/l significantly improved shoot multiplication, 82 % nodal explants initiated multiple shoots and on the other hand 54 % meristem tip explants shows multiple shoots. While rooting was most effective (64%) on a half-strength MS medium supplemented with 1.8mg/l IBA and 0.4mg/l NAA. These optimized conditions yielded high-quality plantlets, which were successfully hardened in the potting mixture containing vermiculite and cocopeat at 1:1 ratio. This work provides a robust framework for the large-scale propagation of Punica granatum cv. Bhagwa, offering valuable insights and practical protocols for nursery production and conservation efforts. Our findings contribute to the efficiency of pomegranate cultivation and underscore the potential for in vitro techniques to support the sustainable development of high value fruit crops.

Potential tree foliages as alternate roughage source for dairy animals in Mizoram

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Tree foliages are vital components of ruminant ration and become main roughages during lean periods and natural calamities. In the present study, tree foliages fed to dairy animals in Mizoram were collected and evaluated for nutritional composition. It was observed that different tree foliages are utilized in different parts of Mizoram for feeding to dairy animals. Total 40 different tree foliage were collected by visiting dairy farmers of different regions and identified. The preliminary analysis revealed dry matter (DM) content of different tree foliages varied from 26.04 to 57.59%. The proximate principles were found to be highly variable. The crude protein, ether extract, crude fibre and total ash contents of different tree foliages varied from 10.34 to 26.46%, 0.86 to 4.36%, 12.34 to 32.48%, and 5.37 to 24.62%, respectively on DM basis. The calculated nitrogen free extract ranged from 48.62 to 75.76% on DM basis depending on tree foliages. The calcium and total phosphorous level in different tree foliages ranged from 0.53 to 2.31% and 0.17 to 0.48%, respectively on DM basis. Out of the 40 different tree foliages, 15 species were found to be frequently utilized as roughage source by the dairy farmers, namely *Khiang* (*Schima wallichii* Choisy), *Lam-khuang* (*Artocarpus heterophyllus* Lam.), *Thei-tat* (*Artocarpus lakoocha* Roxb.), *Bel-phuar* [*Trema orientalis* (L.) Blume], *Ba-tling* (*Wendlandia budleioides* Wall. Ex Wight & Arn.), *Hnahkiah* (*Callicarpa arborea* Roxb.), *Hriang* (*Betula alnoides* Buch.-Ham. Ex D. Don.), *Ri-hnim* (*Ficus retusa* L.), *Si-hneh* [*Eurya cerasifolia* (D.Don) Kobuski], *Thel-ret* [*Ficus elastica* Roxb. Ex Hoemen.], *Thei-tit* [*Ficus prostrate* (Wall. Ex Miq.) Buch.-Ham. Ex Miq.], *Vang* [*Albizia chinensis* (Osb) Merr.], *Zai-rum* [*Anogeissus acuminate* (Roxb. Ex DC) Gull.], *Theihai* (*Mangifera indica*), and *Thing-kha* [*Derris robusta* (DC.) Benth.]. Availability and ease of collection were the two main criteria for selecting the tree foliages for feeding to dairy animals as collection is constrained by undulating topography

Optimizing Growth, Yield, and Quality of Traditional Rice Varieties of Wayanad, Keralathrough IntegratedNutrient Management Practices.

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Rice (Oryza sativa L.) holds critical global significance as a staple food, supporting billions and bolstering economies worldwide. Although the white rice varieties lead the world's rice consumption, the traditional rice varieties of India gaining attention globally, these are nutritional hubs to tackle the nutrition deficiency in today's lifestyle. In Wayanad, Kerala, traditional rice varieties are pivotal for cultural heritage, and agricultural sustainability, necessitating efforts to maximize their growth, yield, and quality. This study examines the efficacy of integrated nutrient management (INM) practices towards improvement of these rice varieties. To explore the potential of INM, this study has been conducted during the 2022 and 2023 Kharif seasons, the research employed a split-plot design featuring four traditional rice varieties of Kerala: Kothampalarikkayama (V1), Raktha Shali (V2), Njavara (V3), and Chennellu (V4) - as main plots. Seven nutrient management treatments, including Farmers practice (RDF – 90:45:45 NPK ha-1) and various combinations of green manuring, organic amendments (vermicompost and farmyard manure), and biofertilizers, were evaluated for their impact on growth parameters, physiological traits, yield attributes, grain yield, and economic viability. Significant varietal and treatment effects were observed. Physiological assessments highlighted Kothampalarikkayama's enhanced chlorophyll content and water retention with vermicompost and biofertilizers. Yield attributes such as panicle length, tiller production, and filled grains per panicle were optimized in Kothampalarikkayama and Raktha Shali, indicating their suitability under specific nutrient management strategies. Economic analyses underscored the profitability of integrated nutrient practices, with Njavara treated with green manuring and farmyard manure showing the highest gross income and net returns.

Keywords: Traditional rice varieties, Integrated Nutrient Management, growth parameters, yield attributes, economic viability

Impact of Textile Dyes on Health and the Environment and Bioremediation Capability of living Organism

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The water is an essential resource for life on the planet and for human development. The textile industry is one of the anthropogenic activities that most consume water and pollute water bodies. Therefore, the present work aims to undertake a review on the main effects of the release of industrial dyes and the essential bioremediation mechanisms. The textile dyes significantly compromise the aesthetic quality of water bodies, increase biochemical and chemical oxygen demand (BOD and COD), impair photosynthesis, inhibit plant growth, enter the food chain, provide recalcitrance and bioaccumulation, and may promote toxicity, mutagenicity and carcinogenicity. Because manufacture and use of synthetic dyes for fabric dyeing has therefore become a massive industry today. Synthetic dyes have provided a wide range of colorfast, bright hues. However their toxic nature has become a cause of grave concern to environmentalists. Use of synthetic dyes has an adverse effect on all forms of life. Presence of sulphur, naphthol, vat dyes, nitrates, acetic acid, soaps, enzymes chromium compounds and heavy metals like copper, arsenic, lead, cad- mium, mercury, nickel, and cobalt and certain auxiliary chemicals all collectively make the textile effluent highly toxic. Other harmful chemicals present in the water may be formaldehyde based dye fixing agents, chlorinated stain removers, hydro carbon based softeners, non bio degradable dyeing chemicalsDespite some disadvantages, the bioremediation is essentially positive and can be progressively enhanced by modern biotechnological techniques that are related to the generation of more degrading and more resistant engineered organisms. This is a sustainable solution that provides a fundamental and innovative contribution to conventional physicochemical treatments. The resources of environmental biotechnology can, therefore, be used as tangible technological solutions for the treatment of textile dye effluents and are related to the ethical imperative of ensuring the minimum necessary for a quality life for the humankind.

Keywords: textile, environment, dying, environment hazard.

Comprehensive Genome Wide Analysis of WRKY Gene Family in *Avena sativa*

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The WRKY transcription factor family plays a critical role in plant signaling, affecting various physiological processes. This study focused on identifying and characterizing WRKY proteins in *Avena sativa* (oat) using an extensive in silico approach. WRKY factors are categorized into three groups based on their conserved WRKYGQK domain and associated zinc finger motifs: Group I, which has two WRKY domains; Group II, featuring one WRKY domain with a C2H2 zinc finger motif; and Group III, containing one WRKY domain with a C2HC zinc finger motif. From a proteome-wide search using 628 reference WRKY sequences from other species, 162 candidate WRKY proteins in *A. sativa* were identified. Analysis of these proteins revealed significant variability in protein length and molecular weight: *As*WRKY66, the longest, has 1498 amino acids and weighs 168.78 kDa, while *As*WRKY111, the shortest, comprises 133 amino acids and 14.46 kDa. Isoelectric points ranged from 4.61 to 10.32. All WRKY proteins were predicted to be in nuclear region. MEME motif analysis identified 10 distinct motifs, with variations in WRKY heptapeptides and zinc finger structures. Gene Ontology analysis revealed diverse functions, including DNA binding and transcription regulation, and Phylogenetic analysis clustered WRKY proteins into Groups I, II, and III, with Group II further divided into IIa, IIb, IIc, IId, and IIe. This In Silico analysis establishes a foundation for understanding WRKY genes in *Avena sativa*, providing valuable insights for future wet lab research. It enables targeted expression studies to explore the functional roles of these transcriptionfactors in oat growth, development, and stress responses. This work sets the stage for advanced functional genomics and crop improvement strategies, potentially benefiting other crops as well.

Organic Farming: Opportunities and Challenges in Sustainable Agriculture

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Organic farming is an agricultural technique that focuses on sustainable practices, reduces the use of synthetic chemicals, and promotes ecological balance. It has various advantages, including better soil health, increased biodiversity and reduced environmental damage. Organic farming has recently achieved widespread recognition and momentum among producers and consumers, increasing its relevance and becoming a buzzword. India produced 1.35 million MT of certified organic goods, such as sugarcane, oil seeds, cereals, millets, cotton, pulses, medicinal herbs, tea, fruits, spices, dried fruits, vegetables, coffee, cotton, fibre, and so on. The need for a renewed emphasis on organic farming has developed as a result of the growing health risks caused by the excessive useof different agricultural chemicals and their consequent presence as residues in food above the maximum allowed residue levels (MRLs). The primary advantages of organic farming are protecting the environment and enhanced weather resilience, increased farmer incomes and reduced costs of external inputs, improved social capabilities, increased job opportunities, and improved food security. Growing consumer demand forhealthy and ecologically friendly products creates opportunities in organic farming,potentially increasing farmers' economic viability. Organic farming also promotes community growth, local adaptability, and creativity. However, organic farming faces a number of challenges, including higher initial costs for switching from conventional practices, lower yields during transition periods, difficulties managing nutrients in the soil, limited accessibility to organic markets and certifications, and competitors such as conventional agriculture. Pest and disease management might be problematic owing to limited chemical inputs and the lack of research into organic alternatives. To ensure organic farming's long-term development, farmers, governments, consumers, and researchers must work together to address these problems and capitalize on possibilities.

Keywords: Organic farming, sustainability, resilience, challenges, opportunities

Gene Expression Dynamics In Maize

Reproductive Physiology Under Chilling Conditions: Implications For Yield

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Cold stress during the reproductive phase significantly impacts on maize (*Zea mays L.*) by inducing physiological and biochemical abnormalities in reproductive organs, which often leadto fertilization failure or premature abortion of seeds. Cell cycle regulation plays an importantrole in growth during adverse conditions as it affects cell cycle duration and reduce the cell division rate. Temperature directly affects the enzyme kinetics of many biochemical reactions,such as cell cycle regulatory kinase CDKA (cyclin dependent kinase), and thereby leaf growthand leaf area may inhibited up to 20%. The reduction in leaf area subsequently reduces photosynthetic rates which alters source strength In addition to the metabolic effects outlined above, chilling temperatures can directly influence by reducing leaf area. The Pheophorbide an oxygenase (PaO) gene is expressed in reproductive tissues as well. Following low-temperature treatment, TaPaO1 exhibits heightened expression during meiosis and is specifically localized around the chloroplasts. Chloroplasts in maize anthers are in endothecium, which provides nutrients and energy for another development. The disruption of chloroplast membrane components resultingfrom the loss of ZmGPAT6 function hinders the progression of chloroplast photosynthesis andstarch transport. This deficiency leads to nutrient deficits in pollen, ultimately causing abortion.Despite growth down-regulation, exogenous abscisic acid (ABA) application enhances maize cold tolerance by improving pollen germination and tube growth, while also mitigatingoxidative stress through increased antioxidant levels. while indole-3-acetic acid (IAA) promotes assimilate transport to developing kernels, highlighting their roles in maize yield under cold stress conditions. Understanding these physiological and biochemical responses is crucial for developing strategies to mitigate the detrimental effects of cold stress on maize reproductive success and yield stability.

Keywords: Cold Stress, Maize, Physiological Responses, Fertilization, Cell Cycle, Reacti

Fidelity in Fruition: Microsatellite Markers Reveal GeneticStability in Pomegranates

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The genetic fidelity of pomegranate (Punica granatum L.) cultivars is crucial for maintaining desired traits in commercial agriculture. This study investigates the genetic fidelity of the Bhagwa variety of pomegranate, a prominent cultivar known for its superior fruit quality, using microsatellite markers. Microsatellites, or simple sequence repeats (SSRs), are highly informative markers due to their high polymorphism and abundance in the genome. We employed a panel of SSR markers to assess the genetic stability of the Bhagwa variety across multiple clonal propagations. The analysis involved the extraction of genomic DNA from 21samples of the Bhagwa pomegranate including parent and micropropogated plants, followed by PCR amplification with 25 SSR primers. The resulting amplicons were analyzed using gel electrophoresis to identify variations. Our results demonstrated a high level of genetic uniformity among the clonal plants, with minimal variation in SSR profiles, indicating strong genetic fidelity. The study confirms that the Bhagwa variety maintains its genetic integrity through clonal propagation, ensuring the consistency of desirable agronomic traits. These findings are significant for the commercial production of pomegranate, providing assurance of genetic stability and reliability of the Bhagwa cultivar.

Gene pyramiding for improved grain iron and zinc content in wheat (*Triticum aestivum* L.)

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Micronutrient deficiency is a major problem worldwide mostly in the developing countries with high dependence on staple foods. More than 2 billion people in the developing world are affected by iron and zinc deficiency. Wheat is a major staple crop and helps to reduce micronutrient deficiency, globally. *Ae. kotschyi* Boiss. has higher iron and zinc content than *T.aestivum* L. and has an efficient genetic system for uptake/translocation of the micronutrients, which could be effectively used for biofortification of wheat cultivars. The introgressed lines showed higher GFe and GZn content, which was associated with improvedyield relative to elite wheat cultivar PBW343 LrP. The present study reports the development of wheat lines with high grain iron (GFe) and grain zinc (GZn).Wheat introgression lines (PRH3-15-5/MB-64-1-1 and 49-1-73-8-5) with improved GFe and GZn developed earlier, were used for pyramiding of 6 genes *IREG, FRO7, IRT2, MTP3,YSL15, NAS2*. Intron targeted amplified polymorphic (ITAP) markers were used for foreground MAS for five generations (F_1 to F_5). In F_5 generation 40 plants were identified as containing all the introgressed genesin a homozygous state.A set of 40 F_6 lines will be evaluated in randomized block design withtwo replication for agronomic and nutritional quality traits at the during next crop season.

Keywords: Wheat, grain zinc and grain iron, pyramiding, ITAP markers.

Navigating Export-related Issues for Organic Farming: Challenges and Opportunities

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The organic farming sector faces unique challenges and opportunities when navigating export-related issues. As global demand for organic products grows, farmers and exporters must contend with complex regulatory frameworks, logistical hurdles, and market fluctuations. One major challenge is ensuring compliance with diverse international standards and certification requirements, which can be time-consuming and costly. Additionally, organic farmers must address concerns around pesticide residues, contamination, and supply chain transparency to maintain consumer trust. Logistical challenges, such as maintaining the integrity of organic products during transportation and storage, also pose significant obstacles. Furthermore, market fluctuations and competition from conventional farming practices can impact profit margins and market access. Despite these challenges, opportunities abound for organic farmers and exporters. Growing consumer demand for sustainable and healthy products has created new market openings, particularly in regions with established organic markets like the European Union and the United States. Moreover, organic farming can contribute to sustainable development goals, such as environmental conservation, social equity, and economic growth. To capitalize on these opportunities, stakeholders must collaborate to streamline certification processes, enhance supply chain infrastructure, and promote market education and awareness. Governments, industry organizations, and farmers can work together to develop supportive policies, share best practices, and invest in research and development. By navigating export-related issues effectively, the organic farming sector can unlock its full potential, contributing to a more sustainable and equitable food system.

Keywords: Organic farming, issue, export etc.

Challenges and Opportunities in Organic Farming

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In traditional agriculture, the emphasis has been on increasing yields and reducing food costs, often at the expense of environmental health. With global food production set to double, it's crucial to adopt practices that mitigate environmental impact, even if they come with higher production costs. This shift is vital for sustainable food production and protecting the environment for future generations. Organic farming offers significant ecological benefits, such as improved crop protection, stable yields, and system resilience. It reduces chemical residues and has fewer major negative environmental impacts. Economically, organic farming performs comparably to conventional methods, maintains high animal welfare standards, and relies on robust certification processes subject to ongoing policy reviews. The strong consumer demand and brand recognition for organic products, along with the value of indigenous knowledge, are notable. Organic farming also has the potential to support cooperative rural and regional development The progress of organic farming is hindered by a lack of decisive government support. Compared to conventional farming, organic methods often result in lower yields due to factors like pest pressure and nutrient limitations. Organic farming is also more labour-intensive, requiring significant human effort for tasks such as hand weeding and crop rotation. Additionally, the infrastructure for processing and distributing organic produce is less developed, creating challenges in getting products to market. Despite growing demand, organic food remains a niche market, making it difficult for farmers to find consistent buyers and fair pricing. This abstract highlights the opportunities in Organic farming that offers significant ecological and economic benefits, but its growth is hindered by lower yields, high labor demands, limited infrastructure, and insufficient government support.

Keywords: Organic farming, Traditional agriculture, Boosting yields, Reducing food costs, Environmental health, Sustainable food production,

Dual purpose chilli hybrid Arka Khyati enhances profitability of chilli growers

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Chilli is one of preferred vegetable crop of *Kharif* and *rabi* season of North Karnataka regions. The front line demonstrations (FLD's) on Chilli hybrid Arka Khyati were conducted by ICAR-Krishi Vigan Kendra of Bagalkot, Karnataka. Arka Khyati is a new medium pungent, light green and turn deep red on maturity and high yielding dual purpose hybrid (both for fresh chilli and dried chilli) developed by IIHR, Bengaluru. Improved crop management practices were demonstrated in farmer's field for three consecutive years 3 years during *kharif* season from 2019-2020, 2020-21 and 2021-22 to check the performance of Arka Khyati over pvt. hybrids. As an outcome of FLD, it was noticed that the demo chilli hybrid (Arka Khyati) recorded average yield of 26.48 t/ha with net return of Rs. 286700 as compared to farmers practice, which produced average yield of 19.6 t/ha with net return of Rs. 178500. Timely plant protection measures reduced the average chilli leaf The average Benefit cost ratio was high in Arka Khyati chilli was high (3.59) compared to check (2.54). On an average 35.10% yield increase was observe in demo plots over farmers practice. The results clearly showed the positive impact of front line demonstrations over farmer practice towards increasing the productivity of chilli in Bagalkote district of Karnataka. Demonstrated technology proved more remunerative and economically feasible to the chilli growers than their conventional methods.

Keywords: Arka Khyati, Chilli, Crop yield, Extension gap, Technology index

The Role of Stingless Bees (*Tetragonula iridipennis*) in Boosting Cucumber (*Cucumis sativus*) Crop Yields

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Since most plants rely on stingless bees for pollination, they are essential to the success of many commercial crops. Using pollinators, especially honeybees, is regarded as one of the most economical and sustainable ways to increase the production of crops that depend on cross-pollination. According to recent studies, stingless bees may be useful pollinators in greenhouse environments. As adaptable foragers, these bees gather nectar and pollen from a variety of plant types. It's interesting to note that a single species of stingless bee can gather nectar supplies from up to 100 distinct plant types each year. It is important to remember, though, that stingless bees can also display a behavior known as flower constancy, in which they focus on a particular kind of flower for a prolonged amount of time. In spite of this behavior, pollen and nectar are the principal benefits that flowers provide to pollinators. Cucumber plants were subjected to stingless bee pollination in a polyhouse setting during the experiment, which ran from May to August 2023 in V.R.C., GBPUAT, PANTNAGAR. Control crops were produced in a pollination-free environment using a net. A number of factors, such as fruit set, fruit quality, and total production, were closely observed and contrasted between the two groups. Furthermore, stingless bees' feeding habits inside the polyhouse were studied to assess how effective they were as pollinators. In comparison to the pollination-free net covered environment, preliminary results indicate a considerable increase in fruit set and yield in cucumber plants subjected to stingless bee pollination within the polyhouse. In addition, the way stingless bees behave shows how effective they are at pollinating cucumber blossoms in a polyhouse limited area. This study provides important information for sustainable agricultural practices and pollinator conservation efforts by highlighting the significance of stingless bee pollination in increasing cucumber crop output, particularly in controlled conditions like polyhouses.

Keywords: stingless bees, cucumber, pollinators, pollination, production, pollination-free

Kajali: The First Registered Breed of Sheep from Punjab.

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"Kajali" is a recently registered sheep breed of Punjab. The breed was registered by Breed Registration Committee of the Indian Council of Agricultural Research, on 24th January 2020 with the Accession number INDIA_SHEEP_1600_KAJALI_14044. With this inclusion country has a total of 44 registered breeds of sheep. Kajali breed derived its name from black circles around the eyes.. White Kajali – The majority of Kajali animals fall under this category having white bodies and black or dark brown faces and ears. The colour of the face and ear is spread over with varying degrees and patterns even up to 95% of the face and ear and 2. Black Kajali- Animals have complete black or black-brown bodies with about 50 % of animals having a white tail (varied from 6 to 55 cm). The animals are generally large with well-built bodies having convex to Roman noses, long and pendulous ears and long tails touching to ground. Both sexes are polled however in some males' horns are also observed. The Adult body weight of males and females is about 55 kg and 42 kg, respectively which generally varies from 30 to 70 kg in males and 26 to 58 kg in females. The average adult body length, height at withers, chest girth, ear length and tail length are about 45, 71, 72, 85, 24 and 53 cm respectively. The biometry and body weight of sheep reflect that Kajali is quite large, one of the country's heaviest sheep and comparable with Munjal. Body weight (kg) of male lambs in the age groups of birth, 0-1, 1-3, 3-6 and 6-12 months are 4.30, 9.4, 19.6, 26.5 and 33.6 kg, respectively and corresponding figures in female lambs are 3.6, 9.7, 17.5, 23.0 and 30.5 kg respectively. The age of maturity is 12-15 months in males and about 15-18 months in females. This breed needs to be conserved and propagated for its fast growth rate, good mutton quality and well adapted to the geographical area of Punjab.

Keywords: Sheep, Kajali, Punjab, Body weight, Mutton, lambing

RECENT ADVANCES IN QUALITY SILAGE PRODUCTION AND UTILIZATION

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The rapid increase in the global population has led to a corresponding rise in demand and per capita consumption of livestock products such as milk, meat, and eggs. This trend has created an emerging need to bridge the gap between supply and demand for livestock feed. One effective strategy to address this challenge is the preservation of fresh fodder in the form of silage, which can provide a year-round feed supply for livestock. Silage serves as a high-quality feed alternative, particularly during lean months and drought conditions when fresh fodder is scarce. By preserving green fodder during periods of surplus production, silage ensures a continuous supply of nutritious feed during off-seasons. The ensiling procedure involves harvesting green plants at their optimal dry matter stage and moisture content (> 50 %). These plants are then chopped into smaller pieces, approximately 1 cm in length, and packed tightly into silo bags or pits under anaerobic conditions to initiate fermentation. The sealed silos are then left to ferment for 45-50 days. After this period, the silage is ready for feeding. High-quality silage typically has a moisture content of around 70% and a pH between 3.5 and 4.2. The nutritive value of the fodder is enhanced through ensiling, and its inclusion in livestock feed rations has been shown to increase milk yield and milk protein content. Crops such as maize, sorghum, bajra, and napier grass are considered ideal for ensiling due to their high levels of fermentable sugars and water-soluble carbohydrates, along with a dry matter content exceeding 35%. By ensiling these superior forage crops, farmers can maintain livestock production and ensure good animal health during lean periods. This, in turn, leads to the production of nutritious dairy products and contributes to increased farmer income through higher milk production

Varietal evaluation of Onion for yield and quality under Manipur condition

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The field experiment on varietal trial of onion for yield and quality was conducted at ICAR RC NEHR Manipur Centre Lamphelpat during 2023-24. The experiment was laid out in RBD with threereplication. Five Onion varieties viz. Bhima Subhra, Bhima Super, Bhima Dark Red, Bhima Shakti, Bhima Red from ICAR-DOGR were evaluated against local cultivars as check (Priya) for their growth, yield and quality under Manipur condition at ICAR Manipur Centre Lamphelpat. The study revealed the highest plant height (64.40 cm), number of leaves per plant (7), leaf length (49.44cm) and yield per plot (13.50 kg) with variety Bhima Dark Red followed by Bhima Shakti (11.67 kg) and Bhima Red (11.47 kg) while the variety Bhima Super recorded the highest mean bulb weight of 179.27 mm, highest diameter of bulb (74.33 mm) and length of bulb (67.13 mm)followed by Bhima Dark Red with bulb of (153.33 g), diameter of bulb (72.20 mm) and length of bulb 62.67 mm. The maximum yield per plot (13.50 kg) and yield per ha (36 t/ha) was found with the variety Bhima Dark Red followed by Bhima Shakti (11.67 kg) and Bhima Red (11.47 kg) while the variety Bhima Super recorded the highest mean bulb weight of 179.27 mm, highest diameter of bulb (74.33 mm) and length of bulb (67.13 mm) followed by Bhima Dark Red with bulb weight of (153.33 g), diameter of bulb (72.20 mm) and length of bulb 62.67 mm. TSS content was found to be highest with Bhima Dark red (13.27 Brix) followed by Bhima Shakti (12.27 Brix) while lowest TSS was recorded with Bhima Subhra (9.80 Brix).

Keywords: varieties, yield, quality, onion

Effect of parenteral administration of levamisole and antioxidants on faecal parasitic load during PPR vaccination in goats

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In the present study, faecal parasitic load of Rohilkhandi goat kids were evaluated due to injectable antioxidants and Levamisole during PPR vaccination. 18 goats were randomly distributed in three groups based on their body weight and age i.e., CON: vaccinated with no treatment; T1: vaccinated with Levamisole (commercially available) administration; T2: vaccinated with antioxidants administration (vitamin E and selenium). The study period lasted for 14 days. The data recorded revealed a decrease from day 0 to day 14 in shedding of oocysts per gram and OPG of faeces of all animals. However, the variations in and PEG OPG between groups at different time periods were statistically non-significant (P>0.05). It can be stated that both Levamisole and antioxidants supplementation can help in reducing PEG and OPG in faeces of animals during PPR vaccination.

Keywords: Goats, PPR, Levamisole, antioxidants, OPG, EPG

Extrusion Technology: An Innovative Approach to Seafood processing

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CITAAS/AB/2024/579

Recently dynamic increase of the snack food market certainly reflects the preferences and lifestyles of consumers. The important factors like growing population, rising income levels, urbanization, increasing super markets chains and shifting consumer habits are driving this surge in demand for packaged snacks due to of their long shelf-life, satisfying taste and easy storage.. Convenience is undoubtedly play very important role, as busy schedules, increasing working women percentages and on-the-go lifestyles push consumers towards quick and easy snack options. Extruded snack like products are mostly cereal based and developed mainly from corn, wheat, and rice. However, rice has relatively low protein content and an amino acid profile that is high in glutamic and aspartic acid, while lysine is the limiting amino acid. Thus, proteinaceous additives are needed to ensure nutritional diets. Fish is good source of animal protein and highly regarded for its nutritional benefits which plays a crucial role in human health. Therefore, starch-based extruded products was made nutritious by fortification low cost fish meal to get health benefits. A few number of fish extruded products were developed, are discussed in this paper.

Keywords: Extrusion technology, fish and fishery products, spoilage, microorganism, food preservation

EFFECT OF CULTIVARS AND SOWING TIME ON QUALITY SEED PRODUCTION IN *PISUM SATIVUM* L. UNDER PROTECTED CONDITIONS

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The present investigation titled **"Effect of cultivars and sowing time on quality seed production in *Pisum sativum* L. under protected conditions"** was carried out at Khaltoo Research Farm and Laboratory of the Department of Seed Science and Technology, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2021-2022. The field experiment was laid out in Randomized Block Design (factorial) with three replications while the laboratory studies were done using Completely Randomized Design having four replications. There were nine treatment combinations involving three cultivars i.e., V_1 (Pusa Pragati), V_2 (Pb-89) and V_3 (Azad P-1) and three sowing dates viz., D_1 (1st October), D_2 (15th October) and D_3 (1st November). The interaction V_1D_3 showed maximum pod length (11.43 cm), seedling dry matter (449.15 mg), seedling vigour index-II (44587.35), and V_3D_3 interaction showed maximum plant height (181.83 cm), maximum days to 50% flowering (124.00 days), shelling percentage (62.95%). Minimum days taken to field emergence (7 days) in V_2D_2 were at par with V_3D_3 and minimum days to 50% flowering (58.33 days) and days to seed harvesting (146.00 days) were found in V_1D_1. Maximum number of seeds per pod (7.867) were found in V_1D_2. Maximum number of pods per plant (19.30), seedling length (25.27 cm), seed vigour index-I (2542.54) was obtained from V_3D_1. Maximum seed yield yield (13.85 g/pant, 1.08 kg/plot, 0.54 kg/m^2 and 26.99 q/ha was found in V_2D_2. 100 seed weight (21.06) was maximum in V_2D_1. Germination percentage showed non-significant results with maximum of 100% in V_2D_1 and minimum of 98.25% in V_3D_3. Hence it was concluded that V_2D_2 (Pb-89 sown on 15th October) can be recommended for quality seed production of garden pea under naturally ventilated polyhouse.

Keywords: Pea; quality seed; polyhouse; sowing dates; cultivars

Nano Urea: Revolutionizing Nitrogen Management in Global Agriculture

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Nano Urea represents a groundbreaking innovation in nitrogen management, poised to transform global agriculture. Traditional nitrogen fertilizers, while essential for crop productivity, often suffer from inefficiencies, leading to significant nitrogen losses through leaching, volatilization, and runoff. These losses not only reduce the effectiveness of fertilizers but also contribute to environmental issues such as water pollution, greenhouse gas emissions, and soil degradation. Nano Urea, with its ultra-small particle size and high surface area, offers a promising solution to these challenges by enhancing nitrogen use efficiency (NUE) in crops. Nano Urea is engineered at the nanoscale to ensure more precise and controlled release of nitrogen, tailored to the specific needs of plants. This innovative approach enables plants to absorb nitrogen more effectively, reducing the need for excessive fertilizer application. As a result, Nano Urea can significantly reduce the amount of nitrogen required, minimizing environmental impact while maintaining or even enhancing crop yields. Moreover, its potential to improve NUE aligns with global sustainability goals, addressing the urgent need for eco-friendly agricultural practices. The widespread adoption of Nano Urea could revolutionize nitrogen management in agriculture, leading to more sustainable farming practices and contributing to global food security. However, the transition to Nano Urea also presents challenges, including the need for extensive field trials, farmer education, and regulatory frameworks to ensure its safe and effective use. As research and development in this field advance, Nano Urea could become a cornerstone of future agricultural practices, offering a sustainable alternative to conventional nitrogen fertilizers and playing a crucial role in the global push towards more efficient and environmentally responsible farming systems.

CONSTRAINTS AND SUGGESTION OF MAIZE GROWERS INPRODUCTION AND MARKETING OF *KHARIP* MAIZE IN SOLAPUR DISTRICT OF MAHARASHTRA

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This study covers the constraints and suggestions of maize growers in Solapur district of Maharashtra regarding production and marketing. It envisages suggesting possible corrections measures to bring about the desired improvement in production and marketing of maize. Multistage sampling design was adopted for selection of study area with 90 sample size. The data was collected from cultivators with the help of pretested schedule through personal interview method and data were analyzed by employing techniques like frequency and percentage analysis. The data was pertained for the year 2018-19. The results inferred that 88% of the sample farmers expressed the inadequate and untimely rainfall and high input cost. 84% was their major problem in the production of maize, Apart from these unavailability of labour 77%, then 75 % sample farmers expressed lack of irrigation facility problem, pest and disease problem 72% and lack, high cost of fertilizer 61% and 55% lack of credit facility were identified as the other constraints faced by the farmers during the production of maize. It was suggested that Release resistant varieties, Availability of input at reasonable price, timely supply of water for irrigation, Use of plant protection chemical, providing improved seed.

Keywords: Multistage sampling, inadequate & untimely rainfall, production, Marketing

GRAFT COMPATIBILITY ANALYSIS AND CHLOROPHYLL FLUORESCENCE MEASUREMENT THAT REFLECT THE GRAFT-UNION PROCESS OF THE HETEROGRAFT POMATO

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The major emphasis in this investigation is on the assessment of pomato using different combinations of potato and tomato for graft compatibility analysis, successful grafting, and measurement of photosynthetic efficiency of the grafted plants. However, the compatibility of the pomato plant was evaluated by histological study at different day intervals. The treatments were comprised to make all possible combinations using different growth habits of tomato scions *viz.* Lakshmi (determinate type), Aviral (semi-determinate) and Yuvraj (indeterminate type) are grafted on two potato varieties *viz*. Kufri Pukhraj and Kufri Jyoti used the cleft and splice method of grafting. Under polyhouse 25 days old tomato seedlings were grafted on 15 days old potato rootstocks using the splice and cleft grafting method. After the grafting operation, the observations recorded such as chlorophyll fluorescence for rootstock, scion, and union site (graft interface), graft success rate (%) of different graft combinations and histological study for the graft union process at different day intervals of pomato plants. The study revealed that grafted pomato plants in appropriate combinations improve graft success rates significantly demonstrating that potato and tomato have a close genetic association and a high degree of graft compatibility. The histological study showed the method of successive graft union process or fast healing and stronger contact in the graft interface at the initial stage of grafting and appreciable grafting success rate of the pomato plants. Chlorophyll fluorescence measurement reveal the highest efficiency of grafted seedlings which put more effort into the graft union process had the highest F_v/ F_m value.

Keywords: Heterograft; pomato; rootstock; scion; graft union process; cellular arrangement; photosynthetic efficiency.

ASSESSING THE SENSORY IMPACT AND IDEAL CONCENTRATION OF CULCUTTA BETEL VINE (*Piper betel)* LEAVES IN COW MILK SHRIKHAND

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CITAAS/AB/2024/584

The current study was conducted at the Animal Husbandry and Dairy Science Section, College of Agriculture, Nagpur (Dr. PDKV, Akola) during the 2022-2023 period. The research aimed to identify the optimal level of Calcutta betel vine leaves extract for use in shrikhand production, focusing on sensory evaluation, cost analysis, and physio-chemical properties. Given the limited variety of shrikhand available in the market, this study could potentially contribute to expanding the range of options. The experiment included five treatments: a control (T1) and shrikhand made from cow milk chakka with varying levels of Calcutta betel vine leaves extract—2.0%, 4.0%, 6.0%, and 8.0%—in treatments T2, T3, T4, and T5, respectively. The findings revealed that treatment T4 achieved the highest mean flavour score (8.5), while T5 recorded the lowest (5.0). Similarly, for body and texture, T4 scored the highest (8.5), with T5 scoring the lowest (5.2). In terms of color and appearance, T4 again had the highest score (8.5) and T5 the lowest (5.5). Overall, the highest acceptability was found in T4 (8.5), attributed to the inclusion of 6.0% betel vine leaves extract in the shrikhand. The study concluded that adding 6.0% Calcutta betel vine leaves extract produces shrikhand of acceptable quality

Income Analysis of Production and Marketing of Agri-enterprise: A Study of Farmer Livelihoods

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This study examines the income dynamics of agri-enterprises and their impact on farmer livelihoods. Agri-enterprises have emerged as a vital component of agricultural development, offering farmers opportunities to enhance their income and improve their livelihoods. However, the financial viability of these enterprises remains a concern. The research focuses on analysing the income generated from production and marketing activities of agri-enterprises, exploring factors influencing income levels, and assessing the impact on farmer livelihoods. The study reveals that agri-enterprises can significantly contribute to farmers' income, with marketing activities generating higher returns than production alone. The analysis highlights the importance of market access, value addition, and diversification in enhancing income. Additionally, factors like farm size, education, and experience influence income levels. The study also explores the challenges faced by farmers, including price volatility, lack of market information, and limited access to credit and technology. The findings suggest that agri-enterprises can improve farmer livelihoods by increasing income, reducing poverty, and enhancing food security. However, supportive policies, institutional interventions, and capacity-building initiatives are necessary to address the challenges and unlock the full potential of agri-enterprises. The study contributes to the understanding of agri-enterprise income dynamics and their impact on farmer livelihoods, providing insights for policymakers, practitioners, and researchers. By identifying strategies to enhance income and address challenges, this research aims to promote sustainable and equitable agricultural development, ultimately improving the well-being of farming communities.

Key words: Income, production, marketing etc.

MANAGEMENT OF STEM ROT OF GROUNDNUT (*Arachis hypogaea* L.) INCITED BY *Sclerotium rolfsii* Sacc.

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Groundnut is major oil seed crop which is infected by Stem rot pathogen (Sclerotium rolfsii Sacc.) that cause even 80 per cent yield loss.To manage this soil borne facultative pathogen the present investigation on the management of stem rot incited by *Sclerotium rolfsii* Sacc. was taken up. Fifty *Trichoderma* spp. were isolated from rhizospheric soils of groundnut collected from 50 villages of Rayalaseema districts (Chittoor, Kadapa, Anantapuramu and Kurnool) of Andhra Pradesh. Ten isolates were identified as *T. asperellum* (GT1, GT4, GT11, GT15, GT23, GT25, GT60, GT61, GTNT and GTW38(2)) and proved to be effective in inhibiting sclerotial population of *S. rolfsii* and these isolates .Among these isolates, *T. asperellum* GT4 has inhibited mycelial growth of *S. rolfsii* to 78.43 per.Among eight different combination fungicides hexaconazole 4% + zineb 68% WP (Avtar 72 WP) was found to be effective and compatible with *Trihchoderm* isolate GT4.Among ITK iputs Modified Panchagavya has recorded highest mycelial inhibition at 10 dilution (60.78%) and at '0' dilution (85.88%) with highest sclerotial inhibition at 100 dilution (96.87%) and complete inhibition (100%) of sclerotial population of *S. rolfsii* agement of stem rot pathogen in field studies conducted during Kharif, 2018 and 2019 revealed that treatment T12 [(seed treatment with hexaconazole 4% + zineb 68% (Avtar 72 WP) @ 0.01% + seed treatment with T. asperellum GT4 @ 10 g kg-1 + soil application of neem cake @500 kg ha-1] was found to be best and this treatment as recorded least PDI (mean PDI as 12.42% and 10.31%) with maximum plant height (60.18 cm and 92.17 cm),root length (12.53 cm and 11.67 cm), dry pod yields (3269 kg ha-1and 2964 kg ha-1)and dry haulm yields (6633 kg ha-1 and 5739 kg ha-1) with least disease severity of late leaf spot (16.67% and 15.13%).In pot culture studies conducted in 2018 and 2019, the treatment T12 was found to be best and this treatment recorded least PDI (mean PDI as 7.50% and 8.80%).

Keywords: Stem rot,groundnut,*Sclerotium rolfsii,*modified panchagavya,*Trichoderma,*neem cake

HEMIPTERAN AND HYMENOPTERAN ABUNDANCE AND DIVERSITY IN VARIOUS ORGANIC RICE REGIMES

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Field studies were carried out during rabi 2020-21 in the experimental fields of Indian Institute of Rice Research, Rajendranagar. The experiment was laid out in Randomized Block Design with five treatments with different inputs, viz., *Trichoderma* based organic treatment, *Pseudomonas* based organic treatment, Organic rice without seed treatment in comparison with Farmers' practice and an untreated control. Observations on insect fauna were recorded at 30,45, 60, 90 and 120 DAT using five sampling methods viz., visual count method, yellow pan traps, yellow sticky traps, sweep net counts and D-Net sampling. After collection, their abundance, diversity and density were worked out to compare the impact of organic and inorganic inputs. Results revealed that, among overall, 3,307 individuals belonging to 13 families of Hemipteran predators and 12,573 individuals constituting 15 families of Hymenopteran parasitoids, Miridae (73.48 per cent) and Eulophidae (64.33 per cent) were documented as most abundant families. The highest Shannon-Wiener index of diversity, Simpson Index of diversity, True diversity index and density were recorded for *Trichoderma* based organic treatment (1.11), Organic rice without seed treatment and untreated control (0.55), farmers' practice (2.8) and *Pseudomonas* treatment (3.81 insects/sq. m), respectively. Which indicating the effect of organic inputs on arthropod diversity and density.

Keywords: Hemiptera, Hymenoptera, Organic rice, *Trichoderma*, *Pseudomonas*

Cotton crop cultivation using - Dada Lad Technology

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The studies were conducted at the selected plots of various farmers from Hadgaon taluka of Nanded district in state of Maharashtra during the period of July 2023 to Jan 2024. With the aim of increasing farmer cotton production and protecting the soil from chemical disturbance by proper use of fertilizers. In the 2022-2023 cotton season, India produced 343.47 lakh bales (5.84 million metric tonnes) of cotton, which was 23.83% of the world cotton production. India's cotton yields are among the lowest in the world, producing only 550 kilograms of cotton per hectare annually. The Dada Lad technique is an innovative method for growing cotton that can double the average productivity of cotton in irrigated areas of Maharashtra. Cotton crop bears monopodial and sympodial branches. Monopodia is the first branch which comes early and grows fast by consuming more fertilizers. They are 3-4 in numbers. These branches compete with the main plant for growth. 80% of the fertilizer given to the plant is taken up by the branches. After 40 to 45 days of planting, this branch should be cut at 1 to 2 inches from the trunk with the help of secateurs. Fruiting branches grow horizontally parallel to the ground from the main stem. The number of these branches on a plant depends on height of the plant. There are 12 to 15 fruit branches and they cover a lot of space. After 80-90 days or when the cotton crop attains growth up to 4 feet remove the top portion. This limits the height of the plant and increases the branching growth of the plant. Removing the monopodia and topping helps to fill the balls and increase the weight of the cotton in the bolls. In this technology, proper planting distance of cotton i.e. 3 x 1 Feet in medium to low soil and balanced use of fertilizers as per requirement along with cutting of branches and low height of the plants is recommended. 14,000 plants can be grown in an area of 1 acre in closer spacing method. As a result, boll weight increases and more cotton is produced. By adopting this technology, 18 to 20 quintals of cotton can be produced.

Keywords: Monopodia, Sympodia, Secateur, closer spacing

Analysis of growth parameters on application of Inorganic nutrients and biofertilizers in Palak.

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Palak, a highly nutritious leafy green, is crucial for human diets due to its rich content of vitamins, minerals, and antioxidants. To keep up with its growing demand, farmers often use fertilizers to boost palak's growth and yield. Traditional inorganic fertilizers, which include Nitrogen, Phosphorous, and Potassium (NPK), are commonly applied, but their overuse can negatively impact both the environment and human health. As a more sustainable option, biofertilizers can promote plant growth while preserving soil health. In a study conducted at the College of Horticulture in Rajendranagar, Hyderabad, various treatments were tested to evaluate their effects on palak growth. The experiment involved ten different combinations of fertilizers and biofertilizers. These included varying rates of inorganic nutrients (75%, 50%, and 25% NPK kg/ha), alongside biofertilizers such as Azotobacter, Phosphorus Solubilizing Bacteria (PSB), Potassium Solubilizing Bacteria (PSB), Arka Microbial Consortium (AMC), and Arka Vegetable Special, applied at 5 gm/litre every 15 days for a total of three applications, with three replications. The results showed that the best growth was achieved with a combination of 50% of the Recommended Dose of Inorganic Fertilizers (NPK kg/ha) and 50% of Biofertilizers (including Arka Microbial Consortium and Potassium Solubilizing Bacteria), along with Arka Vegetable Special as a micronutrient spray. This study aims to find an optimal fertilization strategy that enhances palak growth while ensuring environmental sustainability, by examining parameters such as leaf area, leaf area index, specific leaf area, specific leaf weight, and leaf area duration. By analyzing these growth parameters, researchers and farmers can improve palak cultivation practices, increases yields and enhance resource use efficiency.

Keywords: Inorganic nutrients, Biofertilizers, Growth, Palak and leaf area.

Germination studies in Guaiacum

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The present investigation entitled 'Seed germination and growth studies in guaiacum' was carried out at Maharajbag Nursery Unit, Horticulture Section, College of Agriculture, Nagpur in 2022 to 2023. Completely Randomized Design was used consisting of twelve treatments and replicated thrice. The result revealed that significantly early germination was recorded in GA_3 500 ppm concentration treatment. Whereas the maximum germination percentage, plant height, shoot length, vigour index, fresh weight, dry weight and survival percentage were recorded in hot water at 60°C treatment. However, the maximum stem girth of plant was recorded in seed treated with GA_3 500 ppm concentration.

Keywords: Guaiacum, Seed, germination, Hot water, GA_3, H_2SO_4, KNO_3,

Biochemical and Sensory Properties of Jam with different proportion of Pulp, Leaves, Seed Extraction of Papaya (Carica papaya)

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The study titled "Biochemical and Sensory Properties of Jam with Different Proportions of Pulp, Leaves, Seed Extraction of Papaya (*Carica papaya*)" aimed to explore the feasibility of using papaya processing waste, including leaves and seeds, to create a novel, diabetic-friendly jam. This research was conducted at the Horticulture Laboratory, Department of Horticulture, Lovely Professional University, Phagwara, during the 2023-2024 period. A completely randomized design was employed to assess nine different jam formulations, which varied the proportions of papaya pulp, jaggery (a natural sweetener), and leaf-seed extract. Biochemical parameters (such as total soluble solids, acidity, sugars, pH, and phenolics) and sensory attributes (including taste, flavour, colour, texture, and overall acceptability) were evaluated at the initial stage, after three months, and after six months of storage at both ambient and refrigerated temperatures. The study aimed to determine the optimal amounts of pulp, leaf, and seed extract for making papaya jam, as well as to understand how the ingredients interacted over various storage periods. Results showed significant variations among the different jam formulations. Specifically, total soluble solids (76.2°B), acidity (0.47%), total sugar (61.34%), and reducing sugar (26.59%) increased during storage. In contrast, moisture content (10.1%), ascorbic acid (99 mg/100g), non-reducing sugar (2.31%), pH (3%), total phenolics (54.8 mg), and sensory scores decreased over the six-month storage period. Among the different formulations, the jam containing 60% pulp, 40% jaggery, and 10% leaf-seed extract (T8) exhibited the most desirable qualities, including high TSS content, favourable sensory scores, and the longest shelf life. The formulation with 60% pulp, 40% jaggery, and 5% leaf-seed extract (T4) showed the highest reducing sugar content and enhanced flavour and consistency. This research highlights a promising method for utilizing papaya processing waste to develop a value-added product with potential health benefits for individuals with diabetes. The findings support sustainable food production practices and encourage the development of innovative, healthier food options.

Keywords: Shelf life, Diabetic-friendly food, Jaggery, Leaf-seed extract, Sensory evaluation, Food processing waste.

Invitro studies on Micropropagation of Palash (*Butea monosperma*)

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The study titled "In vitro Studies on Micropropagation of Palash (*Butea monosperma*)" aimed to establish a standardized protocol for the micropropagation, shoot regeneration, and root induction of *Butea monosperma*, an endangered and valuable medicinal plant. *Butea monosperma* is a multipurpose tree species belonging to the Fabaceae family, one of the largest families of flowering plants, comprising approximately 650 genera and 1800 species. This medium-sized deciduous tree sheds its leaves in the spring. In vitro clonal propagation offers significant advantages for the conservation of germplasm, large-scale production, and cultivation of elite plants of *Butea monosperma*. Given the challenges and the pressing need to produce a substantial number of true-to-type plants in a limited timeframe, micropropagation provides a more reliable and rapid method for plant production. This technique is crucial for maintaining and enhancing desirable traits such as growth rate, flower colour, and disease resistance. Traditional propagation methods, such as seed propagation, face limitations including poor germination percentages and low seed viability. Moreover, vegetative propagation methods are labour-intensive and time-consuming compared to seed propagation. Therefore, optimizing in vitro micropropagation protocols is essential to overcome these challenges and ensure efficient and effective plant production. To develop a standardized protocol a completely randomized design was employed to evaluate the efficacy of various cytokinins, including benzyl adenine (BA), Kinetin (Kin), meta-Topolin (mT), and 2-isopentenyl adenine (2-iP), in inducing in vitro shoot formation from nodal and shoot tip explants of *Butea monosperma*. Rooting of regenerated microshoots was optimized under both in vitro and ex vitro conditions. In vitro rooting was conducted on ½ MS liquid medium with auxins, while ex vitro rooting was performed in a soil and vermiculite mixture. The final and most critical stage of the study involved acclimatization, which was tested using different potting substrates to determine the most effective conditions for successful plant establishment. This study presents a detailed protocol for the in vitro propagation of *Butea monosperma*, optimizing cytokinin and auxin combinations to enhance shoot induction and root development and acclimatization of regenerated plantlets.

Keywords: endangered, Auxins, Cytokinins, acclimatization, conservation

Effect of Brassinosteroids on irrigation water-induced changes in Loquat (*Eriobotrya japonica*)

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Loquat, a minor fruit rich in vitamins, minerals, and antioxidants, is gaining importance in India due to its adaptability to dry climates and low water requirements. Taking into consideration the significance of loquat for supplementing nutritional requirements, besides, generating a significant amount of livelihood for the fruit growers the study has been planned to evaluate the effect of brassinosteroids on growth and development of loquat seedlings under variable irrigation levels. The experiment was laid out in a factorial randomized block design consisting of different level of brassinosteroids application (10, 20, 40 and 80 ppm) at different levels of irrigation i.e. 25, 50 and 75 percent of field capacity. During the study, different plant growth parameters such as germination percentage, shoot length, root length, leaf area index, root- shoot fresh weight, root -shoot dry weight *etc.* were regularly observed under different treatments in the present study. Furthermore, the different soil related parameters such as field capacity, soil nutrient content, EC, pH *etc.* were recorded to determine the impact of irrigation water on the soil quality. The plant sample were also evaluated for the occurrence of different stress induced traits to determine the most suitable treatment for the maximum growth and development of seedlings. It was observed that the plants that applied with 75% of irrigation water as per the field capacity in combination with 20 ppm concentration of brassinosteroid resulted in significantly superior growth followed by 75% and 50% irrigation level as per field capacity in combination with 20 and 20 ppm concentration of brassinosteroids, respectively. However, the plants applied with 25% irrigation water as per field capacity with 80 ppm concentration of brassinosteroid resulted in inferior growth under both fresh and STP water in the present study. Therefore it can be concluded that the study was helpful to determine the most desirable combination of brassinosteroids and irrigation levels under different abiotic stress conditions that would be helpful for crop diversification and doubling farmers income under problematic soil and water regimes.

Keywords*: Brassinosteroids, irrigation water, abiotic stress and loquat*

Advancement to protect canine semen by microencapsulation of Canine semen with Alpha-lipoic Acid (ALA)

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Artificial insemination (AI) has changed drastically canine reproduction, demanding superior-quality cryopreserved semen. Conventional extenders, dependant on egg yolk, pose risks of pathogen contamination and biosecurity. Moreover, microencapsulation and alpha-lipoic acid (ALA) supplementation have been investigated to augment semen preservation. This study compared with microencapsulation and without microencapsulation in egg yolk extenders fortified with ALA. Semen from six adult Labrador dogs was processed, with microcapsules prepared using sodium alginate. Post thaw semen quality assessments included motility, viability, hypoosmotic swelling test (HOST), and acrosomal integrity. Results revealed superior outcomes with microencapsulated semen, particularly when supplemented with ALA. Where the two treatments were taken while treatment 1 were without microencapsulated or ALA and treatment 2 with microencapsulation or ALA. Semen Motility percentages were notably higher with Treatment 2 (47.83±0.85) then without microencapsulation or ALA (44.61aY±0.57), Similarly in case of viability, hypoosmotic swelling test (HOST) and acrosomal integrity; 50.42bX±0.92, 53.52bX±0.60 and 80.85aX±1.40 noticeably higher compared without microencapsulation. percentages were markedly increased. Comparison with previous studies reaffirmed the efficacy of microencapsulated semen, showing consistent improvements across semen quality parameters. Microencapsulation further supported these gains, indicating its potential in improving cryopreservation results. ALA supplementation notably contributed to sustaining sperm vitality and function, stressing the importance role of antioxidants in semen preservation. This research advances canine reproductive technologies by introducing innovative semen preservation strategies. Microencapsulation and antioxidants, emerges as a powerful solution for enhancing post-thaw semen quality. These findings hold significant implications for breeders and pet owners, facilitating successful AI procedures and ensuring reproductive success in canines.

Keyword: Microencapsulation, ALA, HOST, Motility, Acrosomal Integrity

Study on Post Harvesting Methods and their Impacts on Guava Cultivation

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This study investigates the post-harvesting methods employed in guava (*Psidium guajava L.*) cultivation and their subsequent impacts on fruit quality, shelf-life, and marketability. Guava, a tropical fruit with significant nutritional and economic value, requires careful post-harvest handling to maintain its quality from farm to consumer. The research encompasses an analysis of various harvesting techniques, including manual and mechanical methods, and evaluates their effectiveness. Additionally, it explores post-harvest treatments such as cleaning, sorting, grading, and storage practices, examining how these methods influence the fruit's physical and biochemical properties. The findings highlight the importance of selecting appropriate post-harvest strategies to enhance guava's marketability and extend its shelf-life, ultimately benefiting growers and consumers. The study aims to provide practical recommendations for optimizing post-harvest handling in guava cultivation, ensuring better yield, reduced losses, and improved economic returns for farmers. The dissertation aims to explore and analyze various post-harvesting methods employed in the preservation and enhancement of guava shelf life. Guava (*Psidium guajava L.*) is a widely cultivated tropical fruit known for its rich nutritional content and distinctive flavor. However, guava's perishable nature poses significant challenges in maintaining its quality and extending its shelf life post-harvest. The research begins with a comprehensive review of the existing literature, encompassing studies on guava physiology, biochemical composition, post-harvest deterioration processes, and currently employed preservation techniques. This review sets the foundation for understanding the complexities of guava post-harvest management and identifying gaps in current knowledge and practices.

Management of Post-Harvest Anthracnose Disease of Mango Caused by *Colletotrichum Gloeosporioides*

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The present study has been conducted for the management of postharvest anthracnose of mango (*Mangifera indica*) at Desh Bhagat University, Mandi Gobindgarh, and Punjab. The fruit market survey was conducted at three markets of Mandi Gobindgarh, District Fatehgarh Sahib. For the management of postharvest anthracnose disease, 13 treatments were considered including control with three replications. The experiment was laid out in a Complete Randomized Design (CRD). The assigned treatments was as T_1 = Autostin 50WDG at 500 ppm concentration, T_2 = Autostin 50WDG at 1000 ppm concentration, T_3 = Tilt 250EC at 500 ppm concentration, T_4 = Tilt 250EC at 1000 ppm concentration, T_5 = Dithen M-45 at 500 ppm concentration, T_6 = Diathen M-45 at 1000 ppm concentration, T_7 = Rovral 50W at 500 ppm concentration, T_8 = Rovral 50W at 1000 ppm concentration, T_9 = Garlic extract 1:1 (Extract: water), T_{10} = Garlic extract 1:2 (Extract: water), T_{11} = Alamanda extract 1:1 (Extract: water), T_{12} = Alamanda extract 1:2(Extract: water) and T_{13}= Control. Among the three-fruit market, the highest disease incidence 18.62% and disease severity 14.78% of post-harvest anthracnose disease was recorded Main bazaar while the lowest disease incidence 12.52% and disease severity 9.32% was recorded Mandi Gobindgarh. In case of chemical and botanical fungicides, treatment, T_4= Tilt 250EC at 1000 ppm concentration showed the best performance in controlling mycelia growth of Anthracnose diseases. The highest growth inhibition of mycelia 82.12, 76.47 and 60.98% respectively at 3,5 and 7 DAI was reduced from the treatment Tilt 250 EC followed by Rovral and Autostin. Regarding percent (%) infected area, the lowest infestation 2.50, 3.00 and 4.50% at 3, 5 and 7 DAI,respectively and highest percent (%) reduction of infected area over control 92.13%, 92.06% and 92.80% at 3, 5 and 7 DAI,respectively was also achieved from the treatment, Tilt 250EC at 1000 ppm concentration. In terms of management practices using hot water treatment at 55°C treated mango showed the lowest mycelia growth of Anthracnose at 3, 5 and 7 DAI 3.78cm, 4.22cm and 5.60 cm, respectively and highest percentage of growth inhibition of mycelia 47.21cm, 45.76cm and 30.86cm at 3, 5 and 7 DAI. The lowest infected area 5.5%, 8% and 25.50% at 3, 5 and 7 DAI, respectively and highest by 81.67%, 85.45% and 72.28% at 3, 5 and 7 DAI, respectively.

Effect of Bio Fertilizer on Growth, Yield and Fruit Quality on Guava

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An investigation carried out on "Effect of Bio Fertilizer on Growth, Yield and Fruit Quality on Guava" was carried out in the research farm of Desh Bhagat University, Mandi Gobindgarh district Fatehgarh Sahib, Punjab during September 2023 to April 2024. This study evaluates the effect of biofertilizers on the growth, yield, and fruit quality of guava *(Psidium guajava L.)*. A field experiment was conducted over two growing seasons, employing a randomized complete block design with four treatments: Control (T_1): No fertilizer application, Chemical Fertilizer (T_2): Standard recommended doses of chemical fertilizers (NPK), Bio-Fertilizer (T_3): Application of bio-fertilizers containing beneficial microorganisms such as nitrogen-fixing bacteria, phosphate-solubilizing bacteria, and mycorrhizal fungi and Combined Fertilizer (T_4): A combination of chemical fertilizers and bio-fertilizers. Growth parameters such as plant height, canopy spread, and leaf chlorophyll content were measured, along with yield components including the number of fruits per tree and fruit weight. Fruit quality was assessed based on parameters like total soluble solids, vitamin C content, and titratable acidity. The results indicated that bio-fertilizer application (T_3) significantly enhanced plant growth and development compared to the control (T_1). The highest increase in plant height and canopy spread was observed in the combined treatment (T_4), followed by bio-fertilizer alone (T_3). Yield analysis revealed a notable increase in the number of fruits per tree and average fruit weight in the bio-fertilizer (T_3) and combined (T_4) treatments. Furthermore, fruits from bio-fertilizer-treated plants (T_3) exhibited superior quality attributes, including higher total soluble solids and vitamin C content, along with lower titratable acidity. In conclusion, the application of bio-fertilizers (T_3) not only improves the growth and yield of guava but also enhances the fruit quality, making it a viable and sustainable alternative to conventional chemical fertilizers. The study underscores the potential of bio-fertilizers in promoting sustainable agriculture and improving the nutritional quality of guava fruits.

Effect of different packaging materials on shelf -life of Kinnow (*Citrus reticulata*) fruits during storage

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An investigation was conducted to study the "Effect of different packaging materials on the shelf-life of kinnow (*Citrus reticulata*) fruits during storage" at the Horticulture Laboratory, Faculty of Agriculture and Life Science, Punjab, during late February to March 2023. The experiment followed a completely randomized design (CRD) with three replications and seven treatments, utilizing seven different packaging materials. The packaging materials tested included high-density polyethylene (HDPE) (15 micron), shrink film (15 micron), and cling film (15 micron). Additionally, liquid paraffin wax (10%) was employed as a coating material to assess its impact on the shelf-life and quality of kinnow fruits. Observations were recorded 30 days after storage, focusing on the physical, physiological, and chemical properties of the fruits. The results indicated that the fruits treated with the combination of cling film (15 micron) and 10% wax (T_7) exhibited superior performance compared to other treatments. This treatment significantly preserved the fruit's physical appearance, reduced physiological weight loss, and maintained better chemical properties, such as acidity and total soluble solids, throughout the storage period. Based on the findings, it is recommended that packaging kinnow fruits with cling film (15 micron) combined with a 10% wax coating is the most effective method for extending their shelf-life while maintaining quality during storage. This study highlights the potential of using appropriate packaging materials and coatings to enhance the post-harvest life of kinnow fruits, which can be beneficial for both producers and consumers.

Effect of post-harvest treatments on the quality regulation of mango (*Mangifera indica*) fruit during ambient storage conditions

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An investigation carried out on "Study the effect of post-harvest treatments on the quality regulation of mango *(Mangifera indica)* fruit during ambient storage conditions" was carried out at Post Harvest Horticultural Laboratory under faculty of Agriculture and Life Science, Punjab during May 2023 to August 2023. The experiment had three replications with seven treatments using a completely randomized design (CRD). The mango fruits of cv. Dasheri were treated with chemicals and stored at ambient temperatures. There was seven different treatment levels were T1 = Control, T2 = Calcium nitrate@ 2%, T3 = Calcium nitrate@ 4%, T4 = Calcium chloride@ 1%, T5 = Calcium chloride@ 2%, T6= Gibberellic acid 25ppm and T7 = Gibberellic acid 50ppm. The Fruits which were treated with Calcium chloride@ 2% i.e., T5 were significant among all the treatments and recorded lowest PLW (13.24%) minimum fruit spoilage (15.06%), highest shelf life (20 days) over control (7.85 days). The 2nd best treatment which was found to be significant was, fruits treated with Calcium chloride@ 2% i.e., T4. The chemical parameters such as total sugars (15.91%), ascorbic acid (13.59mg/100g) and TSS (16.15°brix) were found to be significant in the fruits treated with Calcium chloride@ 2%. It was concluded that fruits treated with Calcium chloride was found be effective in increasing the shelf life and quality of mango fruits.

Enhancement of Post-Harvest Shelf Life of Kinnow Fruits

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The 2023 study titled "Enhancement of Post-Harvest Shelf Life of Kinnow Fruits" was conducted in the Fatehgarh Sahib district of Punjab, focusing on improving the shelf life of kinnow fruits. The research employed a randomized block design at farmer's fields, testing nine different treatments: control (water spray), four concentrations of kinetin (15 ppm, 20 ppm, 25 ppm, 30 ppm), and four concentrations of gibberellic acid (GA3) (5 ppm, 10 ppm, 15 ppm, 20 ppm). Each treatment was replicated three times, leading to a total of 27 treatment combinations. After harvesting, the fruits were transported to the post-harvest laboratory of the Department of Horticulture for analysis of their physico-chemical parameters. The application of plant growth regulators was performed according to standardized protocols. The results highlighted that fruits treated with GA3 exhibited the least physiological weight loss and minimal degradation, showing a significant improvement in shelf life compared to other treatments. In contrast, the control fruits, which only received a water spray, recorded the highest physiological loss in weight. This study demonstrates the effectiveness of GA3, particularly at higher concentrations, in preserving the quality and extending the shelf life of kinnow fruits post-harvest.

Study the effect of different levels of ripening agent (Ethylene gas) on the quality of Banana (*Musa sapientum* L.)

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CITAAS/AB/2024/601

The study titled "Effect of Different Levels of Ripening Agent (Ethylene Gas) on the Quality of Banana (*Musa sapientum* L.)" was conducted at the Horticulture Laboratory, Faculty of Agriculture and Life Sciences, Desh Bhagat University, in the Mandi Gobindgarh district of Fatehgarh Sahib, Punjab, from August to November 2023. The experiment aimed to evaluate the impact of varying concentrations of ethylene gas on the ripening process and quality of banana fruits. The study was designed as a completely randomized design (CRD) with five treatments: T_1 (Control), T_2 (100 ppm ethylene gas), T_3 (200 ppm ethylene gas), T_4 (300 ppm ethylene gas), and T_5 (400 ppm ethylene gas), each replicated four times. Banana fruits harvested at 75–80% maturity were exposed to ethylene gas at concentrations ranging from 100 to 400 ppm for 5 minutes. The untreated control (T_1) fruits remained shriveled, green, and did not ripen uniformly, even after 8 days of storage. In contrast, bananas treated with 300 ppm ethylene gas (T_4) achieved full ripeness within 6 days, exhibiting excellent external color and overall quality. During the ripening process, total soluble solids, acidity, and total sugars showed an increasing trend up to 6 days, whereas fruit shear force and total chlorophyll content in the peel decreased. The results demonstrated that treatment with 300 ppm ethylene gas was optimal for achieving desirable ripening characteristics in bananas, resulting in superior external appearance and fruit quality. This study highlights the effectiveness of ethylene gas as a ripening agent and its potential application for improving the post-harvest quality of bananas.

fruit during ambient storage conditions

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CITAAS/AB/2024/602

An investigation carried out on "Study the effect of post-harvest treatments on the quality regulation of mango *(Mangifera indica)* fruit during ambient storage conditions" was carried out at Post Harvest Horticultural Laboratory under faculty of Agriculture and Life Science, Punjab during May 2023 to August 2023. The experiment had three replications with seven treatments using a completely randomized design (CRD). The mango fruits of cv. Dasheri were treated with chemicals and stored at ambient temperatures. There was seven different treatment levels were T_1 = Control, T_2 = Calcium nitrate@ 2%, T_3 = Calcium nitrate@ 4%, T_4 = Calcium chloride@ 1%, T_5 = Calcium chloride@ 2%, T_6= Gibberellic acid 25ppm and T_7 = Gibberellic acid 50ppm. The Fruits which were treated with Calcium chloride@ 2% i.e., T_5 were significant among all the treatments and recorded lowest PLW (13.24%) minimum fruit spoilage (15.06%), highest shelf life (20 days) over control (7.85 days). The 2nd best treatment which was found to be significant was, fruits treated with Calcium chloride@ 2% i.e., T_4. The chemical parameters such as total sugars (15.91%), ascorbic acid (13.59mg/100g) and TSS (16.15°brix) were found to be significant in the fruits treated with Calcium chloride@ 2%. It was concluded that fruits treated with Calcium chloride was found be effective in increasing the shelf life and quality of mango fruits.

Cultivation of Strawberry (*Fragaria × ananassa*) cultivars under polyhouse conditions

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Strawberry (*Fragaria × ananassa*) is a highly appreciated fruit for its excellent flavour, wonderful taste, attractive color, high nutrient profile and cosmic medicinal value. It was demonstrated that genotype is the main source of variation and the single most important factor that influences the growth, yield and quality of fruit. Seven micro propagated strawberry cultivars viz. Sabrina, Cristal, Barak, Hadar, Gili, Winter Dawn and Sweet Charlie were evaluated in a polyhouse at Himachal Pradesh 2024-25. The results showed that there was significant variation in vegetative growth, flowering and yield in different strawberry cultivars. The maximum number of leaves (77.35) and flowers (35.50) was recorded in Cv. Winter Dawn whereas, the minimum of leaves (40.20) was recorded in Cv. Barak. The runner production (9.73) and leaf area (46.86 cm2) was significantly higher in cv. Hadar as compared to other cultivars. The cv. “Sabrina” exhibited maximum fruit length (4.72 cm) , berry weight (21.80 g) ,fruit volume (21.34 ml) and total sugars (7.51%). The maximum number of fruits per plant (29.05) and yield per plant (501.15 g/plant) was recorded in the cv. Winter Dawn followed by cv. Sweet charlie (414.75 g/plant). The two vs. Winter Dawn and Sweet Charlie were found to be promising with respect to maximum growth and yield .The highest cost benefit ratio (2.31) was observed in cv. Winter Dawn.

Post Harvesting of Apples (*Malus* x *domestica*)

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Post-harvest management of apples (*Malus x domestica*) is crucial in maintaining the quality, shelf life, and marketability of the fruit. This thesis explores various post-harvest practices and technologies aimed at preserving the freshness and nutritional value of apples, from the moment they are harvested to the point of consumption. The study focuses on several key areas: optimal storage conditions, the use of controlled atmosphere storage (CAS), the role of packaging technologies, and the application of post-harvest treatments to reduce spoilage and extend shelf life. The research investigates the impact of different storage temperatures and humidity levels on the preservation of apples, identifying the conditions that minimize the risk of physiological disorders such as chilling injury, scald, and fruit rot. The effectiveness of CAS, which involves manipulating oxygen, carbon dioxide, and nitrogen levels, is examined in detail to determine its ability to maintain apple firmness, color, and flavor over extended periods. Furthermore, the study evaluates various packaging materials and techniques, including modified atmosphere packaging (MAP) and edible coatings, for their effectiveness in reducing moisture loss, delaying ripening, and protecting the fruit from mechanical damage during transportation. Post-harvest treatments, such as the application of antioxidants, fungicides, and ethylene inhibitors, are also analyzed for their potential to enhance the longevity and quality of apples. The findings of this research offer valuable insights into the most effective post-harvest practices for apples, providing recommendations for industry stakeholders, including farmers, storage facility managers, and retailers. The study concludes with suggestions for future research, particularly in the areas of sustainable and eco-friendly post-harvest technologies, which could further improve the efficiency and environmental impact of apple storage and distribution.

Post-harvest treatment of Guava (*Psidium guajava* L.) fruits by using different levels of NAA for quality regulation during ambient storage

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CITAAS/AB/2024/605

An investigation on the "Post-harvest treatment of Guava (*Psidium guajava* L.) fruits using different levels of NAA for quality regulation during ambient storage" was conducted at the Horticultural Laboratory, Faculty of Agriculture and Life Sciences, Desh Bhagat University, Mandi Gobindgarh, Fatehgarh Sahib, Punjab, from July to October 2023. The study aimed to evaluate the effects of various concentrations of Naphthalene Acetic Acid (NAA) on the quality and shelf-life of guava fruits during storage. The experiment was designed using a completely randomized design (CRD) with five treatments and three replications. The treatments included T_1 (Control), T_2 (Dipping NAA at 100 ppm), T_3 (Dipping NAA at 200 ppm), T_4 (Dipping NAA at 300 ppm), and T_5 (Dipping NAA at 400 ppm). The treated fruits were stored at an ambient temperature of 20 ± 2°C for a period of 12 days. Quality parameters, including both physical and chemical characteristics, were assessed at 4-day intervals throughout the storage period. Among the treatments, the fruits treated with NAA at 300 ppm (T_4) demonstrated superior results in terms of maintaining physical attributes such as firmness, color, and weight, as well as chemical properties like total soluble solids, titratable acidity, and ascorbic acid content. These findings suggest that the application of NAA at 300 ppm is optimal for preserving the quality of guava fruits during ambient storage, extending their shelf life and maintaining desirable post-harvest characteristics. Overall, the study highlights the potential of NAA as a post-harvest treatment for enhancing the storage quality of guava fruits, providing valuable insights for the horticulture industry in terms of post-harvest handling and storage practices.

Effect of Micro Nutrient and Plant Growth Regulators on Fruit Set Yield and Quality of Mango

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CITAAS/AB/2024/606

The present investigation entitled "Effect of micro-nutrient and plant growth regulator on fruit set, yield and quality of mango" was conducted at Main Experiment Station, Department of Horticulture, Desh Bhagat University, Mandi Gobindgarh, Punjab during 2023-24 with a views to find out the effect of GA3, NAA, ZnSO4 and Borax alone on fruit set, yield and quality of mango fruit. Two doses each of GA3 NAA viz. 20, 40 ppm, ZnSO4 0.5%, 1.0% and Borax 0.25% and 0.5% with control (water spray) were arranged in Randomized Block Design with three replications and total of nine treatments. The maximum number of fruit set/panicle, fruit retention, fruit yield and minimum fruit drop were recorded with the application of GA3 40ppm. All the physical characters were influenced by foliar sprays of GA3 40 ppm. The fruit length, breadth, fruit weight, pulp weight and pulp/stone ratio were recorded maximum with the foliar application of GA3 40 ppm. Chemical characters viz., Total soluble solids, non-reducing sugar and total sugars content were also found maximum with the foliar application of the ZnSO4 1.0% and maximum ascorbic acid and reducing sugar found under ZnSO4 0.5%. The acidity in the fruit was drastically reduced under ZnSO4 1.0% treatment. Therefore, foliar application of GA3 40ppm and ZnSO41.0% twice in second fortnight of March and April can be recommended to mango grower of Eastern Uttar Pradesh for obtaining maximum yield and prime quality fruits.

Disease Management of Apple caused by *Venturia Inaequalis*

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CITAAS/AB/2024/607

Effective management of apple diseases, particularly those caused by *Venturia inaequalis*, is essential for ensuring high yields, quality fruit, and the economic viability of apple production. This research provides a comprehensive review of major apple diseases, current management practices, and the integration of innovative disease management (IDM) strategies, with a focus on the use of resistant cultivars. Key diseases such as apple scab, fire blight, powdery mildew, cedar apple rust, and bitter rot present significant challenges to apple growers. Successful disease management involves a combination of cultural practices, chemical controls, biological agents, and the deployment of resistant varieties. The study emphasizes recent advancements in precision agriculture, highlighting the application of genomic and molecular techniques for disease control. Additionally, it explores the impact of climate change on disease dynamics, underscoring the need for adaptive management strategies. Technological innovations, including smart sensors and IoT, offer real-time monitoring and precise control, thereby enhancing the efficiency of disease management. Experimental findings indicate that UV exposure for 15 minutes effectively controlled 65.04% of various fungal rots. Neem oil (1%) as a skin coating provided complete control of all fungal decays studied, while cinnamon and clove oils at 1% concentration achieved 99.21%, 98.70%, and 97.93% control, respectively. Botanical Formulation 2 (BF2) at 10% concentration, used to impregnate fruit trays, controlled 97.67% of test fungi. In vitro studies showed that cow urine inhibited fungal growth by 79.21%, while *Trichoderma hamatum*, yeast isolate, *Bacillus subtilis*, and *Trichoderma harzianum* recorded growth inhibition of 71.97%, 66.63%, 64.98%, and 62.43%, respectively. Sodium orthophenylphenate (SOPP) at 1% was most effective in preventing fungal decay, and mancozeb (0.1%) was identified as the most effective fungicide, inhibiting 84.83% of fungal growth in vitro. A combination of mancozeb preharvest spray (0.3%) with other treatments was highly effective in reducing rot incidence and maintaining fruit firmness, quality, and safety. These findings highlight the importance of integrated approaches and continuous research to develop robust disease management frameworks that minimize losses and ensure long-term sustainability in apple production.

Effect of post-harvest treatments on shelf-life of Kinnow fruits during storage

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The study titled "Effect of post-harvest treatments on the shelf-Life of Kinnow fruits during storage" was conducted from January to April 2023 at the Horticulture Laboratory of the Faculty of Agriculture and Life Sciences, Desh Bhagat University, in the Mandi Gobindgarh district of Fatehgarh Sahib, Punjab. The primary objective was to evaluate the impact of different post-harvest treatments on the shelf-life and quality of kinnow fruits during storage. The experiment was structured using a completely randomized design (CRD) with seven treatments, each replicated three times. The treatments included T_1 (Control), T_2 (LDPE 25 micron), T_3 (HDPE 15 micron), T_4 (Polypropylene 25 micron), T_5 (LDPE 25 micron + wax 10%), T_6 (HDPE 15 micron + wax 10%), and T_7 (Polypropylene 25 micron + wax 10%). Kinnow fruits were stored under these varying conditions to assess changes in their physical and chemical properties over time. Results indicated that fruits treated with HDPE 15 micron (T_3) maintained superior quality characteristics throughout the storage period, particularly when assessed 30 days after storage. The T_3 treatment proved to be the most effective, yielding excellent results in terms of both physical appearance and chemical composition of the kinnow fruits, outperforming the other treatments. The fruits in this group displayed enhanced retention of firmness, color, and overall quality, suggesting that HDPE 15 micron is particularly effective in extending the shelf-life of kinnow fruits during storage. In conclusion, the study demonstrated that post-harvest treatment with HDPE 15 micron is highly effective in preserving the quality of kinnow fruits, making it a valuable method for extending shelf-life and maintaining fruit quality during storage. This finding has practical implications for improving the post-harvest management of kinnow fruits, potentially reducing losses and ensuring better marketability.

Phenotypic and biochemical insight into the host plant resistance against Brown Planthopper (BPH) attack in Rice

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Due to alarming rate of population in a country like India, ensuring food security poses challenges under varied climatic conditions. In this context, there is continuous need to increase production and productivity of rice and other cereals. However, the production is severely affected by several biotic and abiotic factors. Brown planthopper (BPH) (*Nilaparvata lugens* Stål.) is one of the key pests that pose a severe threat in the important rice production regions *i.e*. east and south-eastern India. In order to control the BPH various broad-spectrum chemical pesticides are being used by farmers. This practice resulted several issues including the killing of the beneficial insects, environmental pollution, human health and pest resurgence. So, an alternative environmental friendly pest control strategies *i.e.* integrated pest management system that include biological control, natural chemical control and genetic control been developed. As a part of the genetic control of BPH, a study has been carried out to identify resistant rice variety through phenotypic assessment and genotypic evaluation. Further antioxidant enzyme assay was performed to detect their activities under BPH stress condition. Out of the 26 rice varieties evaluated through standard seed box screening test with susceptible & resistant check for resistance to BPH attack, one variety Hasanta recorded lowest damage score. This variety has highest trichome density. Genotyping using BPH resistance gene specific markers confirmed the resistance behaviour of this variety. Hasanta variety was therefore used for biochemical analysis under control and stress conditions. Enzyme assay at both 12 hr and 24 hr BPH stress condition indicated an increase in activity of Catalase & Peroxidase enzymes while the Super oxide dismutase activity reduced. This study provided information on the molecular & biochemical mechanisms underlying resistance in rice. The genes identified provide broad spectrum and durable BPH resistance and hence can be used in BPH resistance breeding programme.

Keywords: Brown Planthopper, trichome, phenotype, genotype, markers, antioxidant enzymes

Vertical Farming: A New Frontier in Urban Vegetable Production

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Vertical farming is a transformative innovation in urban agriculture, providing a sustainable and efficient method for producing vegetables in densely populated areas. As urbanization increases and arable land becomes scarce, vertical farming offers a viable alternative to traditional agriculture, which is often limited by space, seasonal changes, and environmental impact. This approach involves growing crops in vertically stacked layers within controlled indoor environments, such as repurposed warehouses or specially designed vertical structures. By utilizing advanced technologies like hydroponics, aeroponics, and LED lighting, vertical farming allows for precise control of growing conditions, optimizing factors such as light, temperature, and nutrient delivery. This not only maximizes space use but also reduces water consumption by up to 90% compared to conventional farming and eliminates the need for pesticides. A key advantage of vertical farming is its ability to produce fresh vegetables year-round, independent of external climate conditions. This continuous production cycle ensures a consistent supply of high-quality produce and enables frequent harvesting, resulting in higher yields per square foot than traditional farming methods. Additionally, by locating farms closer to urban centers, vertical farming reduces the carbon footprint associated with transportation, contributing to environmental sustainability and improving urban food security. However, the widespread adoption of vertical farming faces significant challenges, including high initial costs, energy demands, and the need for specialized technical knowledge. While energy consumption, particularly for lighting and climate control, remains a major operational expense, advancements in energy-efficient technologies are helping to mitigate these issues. As the industry continues to evolve, overcoming these challenges will be crucial to making vertical farming a more accessible and cost-effective solution for urban vegetable production, ultimately enhancing food security and reducing the environmental impact of agriculture in increasingly urbanized settings.

Keywords: - Vertical farming, Urban agriculture, Sustainable agriculture, Urban food security.

Effect of Thermal Pollution on Microbial Community: A Review

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The increasing need for electricity has made thermal pollution a serious environmental issue, particularly associated with the construction and operation of nuclear power plants. Warm water from nuclear power plants is released into surrounding rivers, lakes, and other aquatic environments. This deliberate warming of natural water bodies has the potential to alter the composition, behavior, and functioning of microbial communities, which are essential to the health and stability of these ecosystems. The impact of temperature on microbial populations is significant, as it affects their reproduction, food requirements, and enzyme and chemical compositions. Studies have shown that different microorganisms can adapt to different temperatures, leading to selective enrichment and changes in the dominance of certain species. However, disruptions to the microbial community can have significant consequences for the purification of natural waters; as well as the decomposition of organic pollutants. It is important to consider the potential impacts of thermal pollution on aquatic ecosystems and to develop strategies to mitigate these effects

Keywords: Thermal Pollution, Microbial Community, Biodiversity

Empowering Coconut Growers: Unleashing Entrepreneurial Spirit and Value-Added Products

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India, the world's largest coconut producer, contributes 34.73% of global output, with 10 million people reliant on it for their livelihood. Coconut generates Rs. 2,66,350 million in GDP and supports 15,000 coir industries employing 6 lakh workers. Empowering growers through innovation and value-added products will enhance income, drive entrepreneurship, and transform the coconut industry for global impact. Hence the study was conducted on coconut growers and an attempt was made to measure the entrepreneurial behaviour of coconut growers in Tumakuru district of Karnataka. An ex-post facto research design was used for the study, with data collected from 45 small and 45 large coconut growers across three taluks of Tumakuru district. From each taluk, 15 small and 15 large growers were selected, totalling 90 respondents. A comparison between small and large growers was conducted to assess their entrepreneurial behaviour. eleven dimensions are selected and the results are categorized as low, medium, and high based on mean values. The results show that, among small farmers, 42.22% exhibit low entrepreneurial behaviour, while 31.11% fall into the medium and high categories. For big farmers, 31.11% display low behaviour, with a greater distribution in the medium (37.78%) and high (31.11%) categories. Overall, most farmers (34.44%) fall into low and medium behaviour levels, with only 31.11% showing high entrepreneurship. The higher average score of big farmers suggests they may have better resources or opportunities, leading to slightly more entrepreneurial activity compared to small farmers. Encouraging innovation, providing resources, and promoting value-added products especially in small farmers is crucial to enhance entrepreneurship among them.

Keywords: Empowering, Entrepreneurship, Opportunities, Value-added products

Open-Source GIS technology: A Review

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The development of open-source software has greatly changed how geographic information systems (GIS) operate. The open-source software community began using open-source software in developing countries to save money associated with licensing costs. People also began developing open-source software in developing countries to enable technical innovation, through the distribution of source-code software to individuals and groups. Since the advent of OSGeo, and its annual event FOSS4G starting in 2006, software like QGIS, GRASS GIS, GeoServer, and GDAL have developed into serious competitors in the open-source GIS market. These technologies represent adaptable, low-cost, customizable options to traditional proprietary GIS. They also support a wide variety of data formats and integration options, for applications in the environmental sector, urban planning, agriculture and much more. In this paper, we studied open-source GIS technologies, and their advantages, along with the criteria describing open-source GIS as influenced by factors such as licensing, community support, usability, integration capabilities, security, and cost. The open-source software model encourages collaboration and continuous improvement, sustaining competitive advantage with adaptable, innovative, open-source GIS tools. The open-source GIS model has facilitated access to spatial data analysis and management for existing and new users across all types of sectors. Users can manipulate data, without being restricted by proprietary systems, that develop customized software for their specific needs.

Keyword: QGIS, GRASS GIS, GeoServer, GDAL

Application of Adult Education Principles for Effective Professional Development of Extension Educators in Cooperative Extension System

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Identifying the components of effective professional development for Extension educators is still a daunting task. To assist Extension administrators and professional development leaders in land grant universities, I synthesized the literature review and included it as a framework. It is expected that this framework could serve as a guide to design and implement professional development programs for Extension educators.

The framework shows that the identification of training needs precedes the professional development of Extension educators. Their decision to attend a professional development program depends on a variety of factors, including educational background, past experiences, perceptions of the community issues they will have to address through their programs, career goals, specific skills expected for the educational program in which they work, and institutional mission goals (e.g., increased need for program accountability data requires training on program evaluation, need to train educators based on core competencies expected by specific organizations, and understanding of training needs thorough feedback provided by administrators during annual performance appraisal).

The two major components that influence Extension educators' learning are (1) learning preferences determined by their cognitive ability, individual preferences regarding how they wish to learn, access to resources (e.g., access to technology), ability to use resources (e.g., technology literacy) adequately, time available for learning, and metacognitive awareness related to their own learning preferences; and (2) learning motivators governed by instructors' ability to use the principles and practices of adult education and humanistic philosophy. An instructor's ability to promote enhanced cognition is vital to their maturation as an Extension educator. Both formal and informal learning over time increases their higher-order cognitive thinking skills improving their ability for knowledge acquisition, decision-making, evaluative thinking, and creative program design.

The framework indicates that the process of acquiring knowledge and skills by Extension educators is not dictated by their participation in a professional development offering only. It is influenced by two other components: (1) the instruction methods (both in the classroom or outside of the classroom), learning atmosphere, and instructional materials used; and (2) their opportunity to be involved in and correspond with the various modes of learning, such as interaction with communities and participation in meetings and seminars as a part of the informal learning, and in-service trainings and graduate courses as a part of the formal learning.

PROCESS OPTIMIZATION FOR THERMO-MECHANICAL MODIFICATION OF WHOLE WHEAT FLOUR FOR END USE FUNCTIONALITY

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The present investigation was carried out to optimize the thermo-mechanical (extrusion) variables to modify the functionality of the whole wheat flour. Whole wheat (PBW 869) flour was subjected to extrusion processing and optimization of processing variables including barrel temperature (120-160 °C), feed moisture (14-18 %), and screw speed (250-350 rpm) has been performed on the basis of functional properties *viz*. bulk density, water absorption index, water solubility index and oil absorption index using Response Surface Methodology. The optimized extruded flour was then characterized for morphological characteristics using scanning electron microscopy, macromolecular features using Fourier Transform Infrared (FTIR) spectroscopy and starch crystallinity using X-ray Diffraction. The applied statistical model suggested that the optimized conditions for the extrusion process were feed moisture (16.03 %), barrel temperature (138.52 °C) and screw speed (297 rpm) to obtain the extruded whole wheat flour with water absorption index of 3.52 g/g, bulk density of 511.08 Kg/cm^3, water solubility index of 23.83 % and oil absorption index of 1.88 g/g having 0.829 desirability of the model. The morphological further suggested that two major changes occurred during extrusion were starch gelatinization and protein denaturation. Heat and moisture during extrusion caused the starch granules in wheat flour to swell and lose their crystalline structure, resulting in gelatinization This process increased the water absorption capacity and viscosity of the starch. Heat and mechanical forces denatured the proteins in the wheat flour, particularly gluten. This denaturation lead to the formation of a new protein network, affecting the texture and rheological properties of the extrudate. Further, the high temperature and shear forces during extrusion disrupted the crystalline regions of starch granules, leading to a decrease in overall crystallinity. It could be inferred from the study that the thermo-mechanical modification brought significant changes in the functionality of the whole wheat flour enhancing its suitability as a potential ingredient for end use products like pasta, noodles and bakery items.

Effect of Dietary Supplementation of Elephant Apple (*Dillenia indica*) on Haemato-biochemical Parameters of Rhode Island Red Birds

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The Elephant Apple (*Dillenia indica*), a fruit commonly found in specific regions of India, was the focus of this study aimed at assessing its impact on the hemato-biochemical parameters of Rhode Island Red (RIR) laying hens. In this experiment, 120 RIR hens, aged 22 weeks, were randomly divided into four distinct treatment groups. These groups included T1- Standard diet, T2- Standard diet +0.1% Elephant Apple fruit powder, T3- Standard diet+0.5% Elephant Apple fruit powder, T4- Standard diet+1% Elephant Apple fruit powder. Results indicated that the T4 group, which received the highest concentration of the fruit powder, showed a significant ($P<0.05$) increase in blood hemoglobin and mean corpuscular volume. Moreover, notable differences were observed across the groups concerning serum glucose, serum cholesterol, and serum triglyceride levels. It was concluded that incorporating Elephant Apple (*Dillenia indica*) powder into the diet of RIR hens could enhance hemato-biochemical parameters in layer bird.

Keywords: Elephant Apple, Rhode Island Red, Haemato-biochemical parameters, Standard diet.

Effect of Dietary Supplementation of Elephant Apple (*Dillenia indica*)on Egg Production Performance and Nutrient Utilization of Rhode Island Red Birds

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This study was designed to evaluate the effects of adding Elephant Apple (*Dillenia indica*) powder to the diet of Rhode Island Red (RIR) laying hens. A total of 120 RIR hens, each 22 weeks old, were randomly assigned to one of four dietary groups such as T1: Standard diet, T2: Standard diet with 0.1% Elephant Apple powder, T3: Standard diet with 0.5% Elephant Apple powder, T4: Standard diet with 1% Elephant Apple powder. Metabolic trials were performed to assess how efficiently the birds utilized the nutrients in their feed. Results indicated significant ($P<0.05$) improvements in Egg Production (notable increases were observed during the sixth fortnight). In feed intake significant ($P<0.05$) differences were recorded during the first, fifth, and sixth fortnights. In Hen Day Egg Production and Feed Conversion Ratio (FCR) significant changes were evident in the sixth fortnight. In body Weight Gain Significant differences were found among different treatment groups. Metabolic trial revealed significant variations in organic matter and ether extract utilization. It was concluded that supplementation of elephant apple affects production performance in layers.

Keywords: Elephant Apple, Rhode Island Red, Production Performance.

Eco-Friendly Extraction and Characterization of Lemongrass as a Potential Natural Herbicide: Evaluating Efficacy on Weeds

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Lemongrass (*Cymbopogon citratus*) has the potential as a natural herbicide due to its essential oil content, which includes compounds such as citral, limonene, and myrcene. These compounds exhibit various biological activities that contribute to weed control and have been researched worldwide. However, the eco-friendly extraction of lemongrass and its effect on weed control had not been documented previously. Therefore, this study aimed to assess the effect of organically derived lemongrass extract (using cow urine and water) on weeds such as *Trianthema portulacastrum* and *Chloris barabata*. The dried lemongrass was extracted at 1:10 and 1:20 ratios by fermenting for 1, 5, and 10 days. After fermentation, the supernatant was filtered and applied to the mentioned weeds as pre-emergence (using petri plate and paper cup methods) and post-emergence (in microplot experiments) treatments by diluting to 25%, 50%, and 75%, and compared to a control (water alone). The extracts obtained were also subjected to GC-MS analysis, which detected active compounds such as phenol; 1,4-benzenedicarboxylic acid, dimethyl ester; diethyl phthalate; and hexadecanoic acid, methyl ester. The growth of weeds was inhibited by a 75% spray concentration of cow urine extract at a 1:10 ratio and a water extract at a 1:20 ratio obtained on day 1. This caused yellowing of Trianthema leaves in the microplot studies, drying of Chloris barbata in the cup studies, and inhibited germination of both weed species compared to the control. Further evaluation is needed under cropped field conditions to understand the extent to which these extracts interact with crops in terms of yield.

Unmanned Arial Vehicle (UAV) for Spraying Application in Field and Orchards.

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Plant protection is a crucial aspect of agriculture, ensuring soil fertility and bountiful harvests. However, traditional manual and semi-mechanized plant protection methods are limited by high labor intensity, low efficiency, and increased risk of poisoning incidents. The introduction of boom sprayers has improved efficiency but faces challenges in mountainous regions. Small unmanned aerial vehicles (UAVs) have emerged as a solution, offering high work efficiency, strong disaster response capabilities, and low risk. UAVs can effectively reduce pesticide harm to humans and environmental pollution. Researchers have focused on popularizing UAVs in pesticide application, targeting specific areas occupied by insects, pests, diseases, or weeds. However, conventional pesticide application methods have low application efficiency, leading to soil and environmental contamination. The use of UAVs in agriculture has gained attention, with predictions suggesting drones will cover 80% of the commercial market. UAVs can be equipped with tools to obtain valuable information about land, crops, diseases, and weather conditions. One of the primary uses of drones in agriculture is pesticide spraying, which can detect damaged crops and apply pesticides precisely, saving money and contributing to environmental sustainability. However, challenges persist, including uniformity of droplet distribution, droplet coverage ratio, penetrability of pesticide into the crop canopy, and working efficiency of UAVs. The literature review highlights various studies on UAVs, focusing on the effect of operating parameters on droplet deposition and biological efficiency. Qiu et al. (2013) studied the spraying performance of CD-10 UAV under the influence of flight height and velocity. Gao et al. (2013) studied the control efficiency of bifenthrin on wheat midge sprayed by single rotor electric UAV. Qin et al. (2014) studied the influence of spraying parameters of N-3 UAV on droplets deposition of maize canopy. Other studies have also investigated the atomization characteristics of UAV nozzles, droplet size distribution, and spraying performances of UAVs. Wang et al. (2017) studied the deposition and spraying liquid coverage of UAVs. Yallappa et al. (2017) developed an hex-copter with 6 BLDC motors and two LiPo batteries. Kurkute et al. (2018) worked on quadcopter UAV and its spraying mechanism. Meng et al. (2022) observed that the systemic chemicals should be used when UAV is adopted as the sprayer due to the poor droplet distribution uniformity in the cotton canopy and the application parameters should be optimized at different cotton growth stages before pesticide spraying. Sreenivas et al. (2024) observed uniform deposition of droplets and droplet density, whereas, application rate and field capacity were higher with minimum spray drift recorded when drone-mounted sprayer was performed at a height of 1.2 m above the crop canopy. The results of these studies indicate that UAVs can be an effective tool for spraying applications in fields and orchards, but further research is needed to improve spraying performances and feasibility status. This study aims to contribute to the development of UAV technology for agricultural applications and provide technical reference and guidance for safe aerial spraying in agricultural production. Keywords: UAV, spraying application, field, orchard, agricultural production, efficiency, safety.

A Comparative Analysis of Environmental and Social Practices in the Sugar Industries of Brazil and Southern Maharashtra

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This paper reviews the worldwide sugar business, focusing on South Maharashtra in India and Brazil. The study employs a systematic approach to evaluate the environmental sustainability, as well as the social and economic impact of sugar production in these regions. Businesses are reassessing their tactics as people become more aware of social fairness and climate change, making the sugar industry an ideal subject for research due to its important environmental and social ramifications. While Brazil's sugar market has grown dramatically due to advances in farming methods and technologies, Southern Maharashtra continues to rely significantly on traditional agricultural practices, particularly sugar cultivation. The intent is to shed light on the contrasts between these industries by analyzing their environmental assessment methodologies, social responsibility efforts, and sustainable business practices. Furthermore, it attempts to add useful insights to the continuing discourse about promoting sustainable practices in the global sugar industry.

Keywords: Sugarcane, Environmental practices, Social practices, Sugar industry, Comparative analysis, Maharashtra, Brazil

Fruit fly species diversity in arid fruit crops of Rayalaseema region of Andhra Pradesh

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The study to document the diversity of fruit fly species infesting arid fruit crops, custard apple and ber in Rayalaseema region of Andhra Pradesh was conducted at College of Horticulture, Anantharajupeta during 2023-24. Random collection of infested fruit samples through roving survey in potential crop growing areas of Kurnool, Ananthapur and Nandyal districts of Rayalaseema was done and brought to the laboratory for rearing and further species identification. The study revealed that infestation of three major fruit fly species *viz*., *Bactrocera dorsalis*, *Bactrocera zonata* and *Bactrocera correcta* in both the crops. The fly infestation levels of different species varied from 75-93% of *B.dorsalis*; 30-33% of B. *correcta* and 16- 25% of *B. zonata*. From the study it can be concluded that, there is a complete displacement of ber fruit fly, *Carpomyia vesuviana*, a monophagous species by genus *Bactrocera*. This displacement may be due to wide host range and adaptability of *B. dorsalis* complex in fruit crops.

Keywords: Fruit flies, Arid fruits, Ber, Custard apple, Infestation

Standardization of in vitro sterilization procedures and molecular identification of endogenous contamination in cultures of black ginger (Kaempferia parviflora wall ex. Baker)

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The success of culture initiation depends on explant surface sterilization techniques.In the present investigation, an attempt was made to eliminate endogenous fungal contaminants from the surface of plant material, thus obtaining axenic culture with highest survival rate. Black ginger is one of the most important medicinal crops in all over the world. However, during micropropagation surface sterilization is the most important step in preparation of explants. The effect of different fungicides, antibiotics and sterilizing agents: Mercuric (II) chloride (HgCl2), Sodium hypochlorite (NaOCl), Hydrogen peroxide (H2O2) and Ethanol, were evaluated for sterilization of rhizome buds of Kaempferia parviflora by varying their concentration and time of exposure. Fungal contaminants formed during the initiation of culture were determined by DNA sequencing. In second experiment different nanoparticles were evaluated for sterilization of rhizomes. The percentage of bacterial contamination, fungal contamination, total contamination and survival of cultures were observed. The result showed that among all sterilization treatments 100% AgNPs for 60 minuteswas the most effective treatment. Highest rate of contamination free culture 90.00% was achieved with this treatment.

Seed mycoflora associated with desi and kabuli chickpea

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The experiment was conducted at the Department of Seed Science and Technology to evaluate seed mycoflora association in desi and kabuli chickpea using various seed biopriming agents. Seeds of chickpea were exposed to seven different biopriming and control (untreated seed). Various microbes, including *Aspergillus niger*, *Aspergillus flavus*, *Fusarium oxysporum*, *Macrophomina phaseolina* and *Curvularia* sp. were identified using both blotter paper and PDA methods. Seed infection by mycoflora ranged from 12.34% to 30.63% in desi chickpea and 17.26% to 33.30% in kabuli chickpea seed samples. The occurrence of *Fusarium oxysporum* was predominant in the seed samples followed by *Aspergillus niger* (4.18%), *Aspergillus flavus* (3.57%), *Curvularia* sp. (3.20%), *Macrophomina phaseolina* (1.85%) in desi chickpea. The blotter paper method revealed a higher number of seed mycoflora compared to the PDA method. The correlation analysis of seed quality parameters with seed mycoflora revealed that germination and seedling length are positively associated. Similarly, seed infection (%) is negatively associated to 100 seed weight, germination percentage, speed of germination, seedling length, fresh weight, dry weight, SVI-I and SVI-II.

Keywords: Biopriming, seed mycoflora, desi and kabuli chickpea

Seasonal dynamics of sucking insect pests and their natural enemies in cotton: a study in Odisha

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The study conducted during the kharif season of 2021 at Bhawanipatna Research Station in Odisha evaluated insect pest populations and their natural predators in cotton fields. Jassids (*Amrasca biguttula biguttula*) started with low numbers, increasing significantly from the 34th week, peaking at 14.57 to 14.98 jassids/ 3 leaves between the 42nd and 43rd weeks, and then declining, with an overall mean of 5.59 ± 4.59 jassids/ 3 leaves. Aphid (*Aphis gossypii*) populations were highly variable, peaking at 38.43 aphids/ 3 leaves in the 34th week before sinking to negligible levels, with a mean of 7.53 ± 11.58 aphids/ 3 leaves. Whiteflies (*Bemisia tabaci*) remained consistently low throughout the season, peaking at 2.42 whiteflies/ 3 leaves in the 46th week, with a mean of 1.00 ± 0.68 whiteflies/ 3 leaves. Thrips (*Thrips tabaci*) increased from the 36th week, reaching a peak of 10.22 thrips/ 3 leaves in the 38th week, with a mean of 3.01 ± 3.42 thrips/ 3 leaves, suggesting significant mid-season impact. Natural predators, including ladybird beetles, spiders, and Chrysoperla carnea, peaked at 3.05 predators/ plant in the 35th week, with a mean of 1.11 ± 0.95 predators/ plant, indicating limited effectiveness in controlling pest populations.

Keywords: Sucking insect pests, natural enemies, Cotton

Evaluation of Efficiency of Patent Kali on Yield of potato and uptake of nutrient in coastal alluvial soils of Odisha

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A field experiment was conducted in K and S deficient coastal alluvial soils of Puri district of Orissa. The soil of the experimental site was having pH 5.30 - 5.77, EC (dS/m) 0.09 – 0.15 , organic carbon 4.0- 6.0 g/kg, Exchangeable Ca 1.4-1.65 meq/100 g, Exchangeable .Mg. 0.6-1.1 meq/100 g, available K (kg ha -1) 27.0-75.0 , available S (kg ha -1) 2.0-9.0, available P (kg ha -1) 13.5-30.0. The soil was acidic in nature, low in organic carbon, exchangeable Ca, Mg, K and Sulphur. Ten different treatment combinations are replicated in a RBD to evaluate the efficiency of patent kali on the yield and nutrition of potato –sesame cropping sequence during rabi 2013-14 in the village of Musunpur on Inceptisol at Puri district. Patent kali – PMS (A fertilizer containing 30% K, 10% MgO & 17% S) and other sources like MOP, MgSO4, S bentonite etc. were taken. The investigation indicated that new product- Patentkali was found to be a better source of K,S andMg as compared to other sources at a higher dose giving highest yield of potato and nutrient uptake and better return. The residual effect of patent kali on build up of soil nutrients like K and S after harvest of two crops proves its efficiency is as better as compared to other sources.

Keywords: Patent kali, Potato, sesame, acid alluvial soil

Qualitative assessment of dried small dhoma fishes prepared by solar tunnel and traditional sun drying

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Dried dhoma fish by solar tunnel dryer and traditional drying method showed decreasing trend in scores for the attribute i.e appearance, texture, odour, taste and colour of dhoma fish.During the past few years there has been decline in the export of Indian cured fishery products mainly because of their poor quality. This causes considerable loss to the fish curing industry in India (Sugumar et al 1995). Solar drying system offers an alternative which can process food item in clean, hygienic and sanitary conditions that confirm to national and international standards with zero energy cost. After the experimentation, it revealed thatsolar tunnel drying method saves time, energy and area as well as improves product quality.Overall acceptability was observed good in the fish dried in solar tunnel dryer. Thus Solar tunnel dried fisheswere proved as better quality than traditionally dried dhoma fishes and can be recommended as good for human consumption.

Keywords: small dhoma fish, traditional drying, Solar drying, quality, product.

Statistical Analysis of Agriculture Diversification in Gujarat: A Brief Overview

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The economic stability of small and marginal farmers in Gujarat is closely linked to agriculture, making crop diversification a potential path for economic upliftment. Diversifying agricultural practices not only helps mitigate farming risks but also addresses nutritional and environmental challenges. This study examines 20 years of data (2000-01 to 2019-20) on key agricultural variables like area, production, and productivity of major crops to assess the growth, trends, and determinants of crop diversification in Gujarat. The analysis shows significant growth in gram cultivation, with notable increases in area (8.61%), production (13.38%), and productivity (5.16%). However, even higher growth rates are observed for cash and commercial crops such as cotton, tobacco, and cumin. The study also finds that technological adoption has positively influenced the density of cash crops, especially between 2008 and 2012. Despite a decline in crop diversification indices over the years, the reduction is minimal, with the highest diversification index recorded in 2003-04. Key factors like credit from scheduled commercial banks and rainfall significantly impacted crop diversification, with bank credit showing a negative effect and rainfall a positive one. The findings suggest a need for policies in Gujarat to promote agro-processing industries, enhance value addition in agriculture, and focus on farm input industries. Such measures could lead to rural employment-led economic growth, helping to alleviate poverty.

Keywords: Crop Diversification Index (HI, OI, EI, MEI, CEI); Growth Rate; Instability; Multiple Regression Analysis

Selection decision making for indirect selection of reproduction and production traits using multi-trait Gibbs sampler in Sahiwal cattle

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What brings prosperity in livestock productivity especially in dairy traits? Out of many ways to answer such question, one most apt is to emphasize on the analytical approach and the traits of economic importance affecting present and future generation in a herd. Reproduction traits are the major attributes which are correlated significantly with the production in dairy cattle. This study was designed to explore genetic parameters of reproduction (AFC: Age at First Calving, FSP: First Service Period), and their correlation with the production (FLMY: First Lactation Milk Yield) and milk composition traits (FLSNFY: First Lactation SNF Yield, FLFY: First Lactation Fat Yield) in Sahiwal cattle. A comparative analytic approach (LSML v/s Bayesian) was considered by using LSML and Gibbs sampler Animal model approach of Bayesian application with a mixed model equation and estimated breeding values (EBVs) for production traits. Marginal posterior means for heritability were varying between 0.17±0.01 to 0.51±0.01 by univariate, bivariate and trivariate analysis, and between 0.12±0.003 to 0.49±0.002 through multi-trait analysis. Heritability estimate was higher for FLSNFY (0.51±0.01) followed by FLFY, AFC, FLMY (0.45±0.01, 0.29±0.04, 0.20±0.01) and lowest for FSP (0.17±0.01). High and positive genetic and phenotypic correlation (0.99±0.0001 and 0.98±0.004) was observed for FLFY-FLSNFY by multi-trait analysis. AFC has moderate positive correlation with considered traits, while FSP has negative genetic correlation (FSP-FLMY: -0.15±0.02; FSP-FLSNFY: -0.11±0.02; FSP-FLFY: -0.04±0.02). High correlations of reproduction traits suggest earlier age selection and directly reflect production potential of herd. Gibbs sampling was advantageous for genetic analysis with heterogeneous (reproduction traits) and homogenous (production traits) factors. Our work revealed improvement in the dairy cattle genetic gain by indirect selection through AFC for FSP, FLMY, FLSNFY and FLFY. Negative association suggests improving management and husbandry practices by reducing FSP to some extent. Indirect selection due to high correlations of FLFY-FLSNFY brings improvement in productivity through a balanced selection decision.

Keywords: Bayesian approach, Zebu cattle, Multivariate Gibbs sampler, Correlation, Breeding value

Effect of Employee-Management Relationships on Organization Performance: A case Study of Star Rated Hotels, Hawassa, Ethiopia

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This study's main objective is to find out how the Employee-Management Relationship and its component parts—communication, conflict resolution, leadership style, shared values and goals, and trust—affect the organization's performance at star-rated hotels. A deductive quantitative research approach and a cross-sectional descriptive research design were employed in the study. Additionally, hotels were chosen and respondent data was gathered using stratified and basic random sampling approaches, respectively. Data for the study were gathered by the distribution of structured questionnaires using a survey research approach. Quantitative data were then generated using SPSS version 26, and these were examined using multiple linear regression models, the Pearson correlation matrix for inferential analysis, and the Measure of Central tendency for descriptive analysis. The relationship between management-employee relations and organizational performance was shown to have a multiple coefficient association of 0.903 (90.3%). The study concludes that there is a considerable improvement in organizational performance when there is a positive interaction between the management and staff of star-rated hotels. Additionally, it offers strategic advice on how management and factory stakeholders should review their approaches to leadership, communication, resolving conflicts, establishing common objectives and values, and building trust. These factors are known to be predictive of the caliber of the connection between employees and management, which in turn affects how well the organization performs in the hotels. The report also recommends specific activities that workers, management, HR specialists, and the government should do in order to maintain and promote positive employee-management relations at the factory. The study recommends further research since the relationship between employees and management is not well examined from a variety of angles and economic sectors.

Keyword: Employee-Management Relationship, Organization Performance, Communication, Conflict Management, Leadership Style. Shard Goal/Value, Trust and Star Rated Hotels.

Impact of pre-sowing treatments on growth, seed yield and vigour of mustard(*Brassica juncea* L.) in rainfed condition

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Indian mustard (*Brassica juncea* L.) commonly known as raya, rai or laha is an importantoilseed crop, among the brassica group of oilseeds in India. It possesses a higher potential of production per unit area than other oleiferous members of the family cruciferae. It is an annual plant or biennial herb. Mustard is the major rabi oil seed crops of India. The origin of Indian mustard has been reported to be in China, it made its way into India through north eastern route. An investigation was carried out during rabi season of 2021-22 to evaluate the effect of pre- sowing seed treatments on growth and yield on mustard under rainfed condition at Organic Research Farm, Karguaji, Institute of Agricultural Sciences, Bundelkhand University, Jhansi. Eight treatments viz. T1- Control, T2- Azotobactor 4 % for 6 hours, T3- Azotobactor 2 % + KNO31 % for 6 hours, T4- Azotobactor 2 % + KNO3 2 % for 6 hours, T5- Azotobactor 2 % + Trichoderma viridae 1 % for 6 hours, T6- Azotobactor 2 % + Trichoderma viridae 2 % for 6 hours, T7- Azotobactor 2 % + Azosprillum 1 % for 6 hours and T8- Azotobactor 2 % +Azosprillum 2 % for 6 hours were tried in Randomized Block Design with three replications. The data collected on various characters was subjected to statistical analysis. The results revealedthat the treatment Azotobactor 2 % + Azosprillum 2 % for 6 hours (T8) gave significantly superior results for plant height, number of branches per plant, number of siliqua per plant,siliqua length (cm), number of seed per siliqua, seed yield (q ha^{-1}) and test weight (g) however, days to 50% flowering was significantly lower for Control (T1). So, based on the results it is feasible to say that pre-sowing seed treatment with Azotobactor 2 % + Azosprillum 2 % for 6 hours can be utilized for enhancing yield of mustard crop.

Keywords: Mustard, pre-sowing seed treatment, rainfed, yield.

Nutritional Status of Adolescent Girls belonging to Gond Madia community from Gadchiroli district of Maharashtra

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Adolescence is defined by the World Health Organisation as the age from 10 to 19, during which many girls face problems related to social, personal, education and health. Yet a recurrent criticism from experts is that the field has traditionally suffered from a lack of both attention and research on marginalised girls during their adolescent years. Girls' issues often concentrate on health and motherhood while boys' concerns have traditionally focused on conflict and employment.

Comparative assessment of average calorie intake per day by adolescent girls belonging to different age groups. It was observed from the data that average calorie intake of adolescent girls belonging to age group 13, 14, 15, 16, 17 and 18 years was 1301.6±95.2, 1299.6±95.4, 1299.5±92.0, 1316.0±96.0, 1300.7±97.9 and 1306.5±97.7 Kcal/d respectively before participating in the nutritional education training program. Whereas average calorie intake after attending this program was 1471.0±259.5, 1427.9±197.9, 1475.6±261.7, 1486.1±261.0, 1475.2±267.0 and 1489.9±275.7 Kcal/d for adolescent girls belonging to age groups 13, 14, 15, 16, 17 and 18 years respectively. Furthermore, the calorie intake data was compared with the Recommended Dietary Allowance (RDA) for calories and the results of this assessment showed that there was an increase in the daily calorie intake by the Gond-Madia adolescent girls, however, though there was an increase, it (calorie intake after participating in the nutritional training program) was significantly ($P < 0.05$) less than that recommended. Furthermore, the comparison of the calorie intake pre and post training was also made and the results showed that for all age groups the energy intake was significantly improved.

Keywords: Adolscent, Calorie, Gond Madia

Allele mining for crop improvement

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Climate change poses significant challenge to agriculture, affecting crop growth, productivity and ultimately food security. Plant genetic resources that are stored in gene banks are expected to include vast number of undiscovered allelic variations. The present challenge is to unlock these variations that can play a vital role in crop improvement. Allele mining is best strategy for discovering and characterizing the alleles that can be utilized for introgression of desirable traits into crops. Allele mining involves the identification of beneficial alleles of genes from a wide range of cultivars and wild species within the genetic resource collections. True allelemining includes not only coding region and also non-coding and regulatory regions which are significant in some gene expressions. TILLING discovered by McCallum *et al.* (2000) involved creating mutations with chemical mutagens, while Eco-TILLING discovered by Comai *et al.* (2004) utilized natural genetic variations present in a population for identification of favourable alleles. Sequencing based allele mining involves the amplification of alleles in diverse genotypes through Polymerase Chain Reaction followed by identification of nucleotide variation by DNA sequencing techniques. Studies conducted in rice in the last 25 years, reveals allele mining by using different approaches like TILLING, by using mutagens like EMS, Az-MNU, which led to the identification of SNPs and INDELs for traits like resistance to blast disease, bacterial blight and tungro disease in *japonica* rice (Wu *et al.,* 2005). By using Eco- TILLING several alleles related to salt tolerance and starch synthesis were mined in rice (Irshad *et al.,* 2020) and majority of the alleles were discovered by using Next Generation Sequencing. In Nipponbare variety of rice 1226791 SNPs were mined and alleles related to *Pi2/Pi9* locus (blast resistance) alleles were discovered through sequencing(Huang *et al.,* 2009). In the near future Sequencing-based allele mining is anticipated to replace other methods as the go-to strategy for discovering new and effective alleles, exposing natural variation. Genomic resources, advanced high-throughput methodologies, cost-effective sequencing platforms, robust bioinformatics tools for the identification of nucleotide polymorphism and molecular marker development techniques for marker-assisted selection(MAS) are essential for the rapid generation of allelic data points in allele mining which can be effectively utilized in crop improvement initiatives.

Evaluating the Drought Adaptation of *Saccharum spontaneum*: A Wild Relative of Sugarcane

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S. spontaneum constitutes the tertiary gene pool of sugarcane and is characterised by its high vigour, ratooning ability, high biomass producing ability, resistance to biotic and abiotic stresses. Forty *S. spontaneum* clones, identified as drought tolerant in the preliminary evaluation, were evaluated for drought stress tolerance along with two standards in split plot design in two replications during 2021-22 crop seasons. The clones were exposed to drought at the tillering phase by withholding irrigation after three months of crop growth. Different observations like no. of tillers per clump, chlorophyll and carotenoid contents and canopy temperature were recorded during drought stress. Fresh and dry biomasses were recorded after 12 months of the crop growth. Among the 40 clones fourteen were planted in pot culture and root characteristics under drought stress were studied. Eleven genotypes recorded less than 20% reduction in no. of tillers per clump under drought stress compared to control. Twenty one clones exhibited high or equal chlorophyll b content and fifteen genotypes recorded high carotenoid content under drought compared to control and indicated stress tolerance. Genotypes SES 69 and IND 03-1229 recorded positive CTD values under drought stress. Fourteen genotypes recorded < 20% reduction in total fresh biomass per clump under drought stress compared to control. Based on different morphological and physiological observations eight genotypes *viz*., IND 04-1372, IND 99-847, IND 99-850, SES 39, SES 297 A, IND 03-1307, IND 99-984, SES 507 were identified as drought tolerant. In case of root study after two weeks of drought imposition the roots were harvested from both control and treatment pots and different observations like cumulative root length, root surface area, root volume and average root diameter were recorded using root scanners. IND 99-847 recorded high cumulative root length, root volume, surface area and root diameter under drought stress compared to control. SES 39 had almost equal root volume both under drought and control conditions. IND 03-1229 exhibited high cumulative root length under drought compared to control. These three genotypes *viz*., IND 99-847, IND 03-1229 and SES 39 had < 20% reduction in fresh biomass under field condition and emphasizing the importance of root characteristics under drought stress.

Physicochemical characterization, mineral content analysis and in vitro propagation of Camarosa variety of strawberry (Fragaria × anannasa duch.)

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Camarosa variety of strawberry is a shortday plant (June bearing) with greater production, larger fruit, firmer fruit and is a more vigorous plant. Variety bear fruit over an extended period when treated appropriately in arid, subtropical climates. Thus to meet out the demand of true to type quality planting material of this variety, experiments were conducted to develop a micropropagation method for camarosa strawberry and phytochemical profiling of this variety. Different physicochemical characters such as fruit size length (34.93), width (30.72), weight (17.74), firmness (5.88), pH (11.14), total soluble solids content (16.83), titratable acidity (5.14) and phytochemicals viz., anthocyanin (36.31), antioxidant capacity (49.08) was determined. The mineral profile was also determined dominated by five major elements—Potassium (23.90), Calcium (16.91), Iron (8.67), Zinc (3.73), Magnesium (1.09) and Copper (1.98) with potassium showing the highest concentrations. Fragaria× anannasa duch. was propagate in vitro using various explants such runners and leaves. The present study demonstrated the combined effects of various growth regulators viz., BAP, IBA, IAA, NAA, Kn, TDZ and GA3 at varied concentration with MS medium on shoot proliferation, multiplication and rooting media. The runner tips were sterilized using 3% percent bavistin for 2 minutes + 0.1 per cent $HgCl_2$ for 120 second, which was been establish on MS medium consisting of 1.5 mg/l BAP+ 0.5 mg/l IBA. The leaves were sterilize using 0.2% mercuric chloride for 30 seconds and established on MS media consisting of 1.0mg/l TDZ and 0.5mg /l IBA. The highest multiplication of the established explants was obtained when MS medium supplemented with1.0 mg/l BAP + 0.5 mg/l Kn used. The maximum rooting of the shoots were obtained on half strength MS medium supplemented with 0.5 mg/l IBA. In vitro plantlets were further hardened using soil:sand:cocopeat. In vitro propagation is suitable for the efficient propagation of true-to-type plants of strawberry cultivars and continuous production of fruits with stable quality.

Contract Broiler Farming in Punjab - An Insight into its Challenges and Opportunities

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Poultry has emerged as one of the fastest growing segments of the agriculture sector in India contributing to the nation's overall economic growth and most importantly in alleviating poverty and malnutrition. The transformation from the backyard poultry practices into highly intensive integration systems has been achieved by standard & efficient practices on nutrition, housing, management and disease control. Contract farming in poultry has been successful in India due to the presence of strong backward linkages. The nature of contracting has been instrumental in sharing growers' risk through buyback guarantee and provision of coping with production failure. Provision of quality inputs such as chicks, feed and medicine help the poultry farmers raise quality chickens. Despite its rapid expansion, the broiler industry face numerous setbacks due to rising feed prices, the introduction of new or reemerging diseases, fluctuating market prices for broilers, etc. The results of the study conducted on 20 contract broiler farms in Punjab brought out that majority of farmers had contracts with IB group. It was revealed by the farmers that the COVID-19 epidemic presented a number of difficulties for the chicken business, including large losses, feed shortages, and higher labor costs. Disease outbreaks, underuse of farms, and expensive labor and building leasing expenses were among the production restrictions. Farmers were further burdened by marketing restrictions like price swings, severe penalties, and partial lifting of flocks. In addition, middlemen such as wholesalers, merchants, and roadside stands had to deal with problems relating to labor costs, transportation costs, and changes in market demand. Restaurants have difficulty keeping up their standards of excellence and adjusting to the tastes of their patrons. The research emphasizes the significant obstacles encountered by broiler farmers and middlemen in the poultry supply chain, particularly amidst the pandemic. It also underscores the necessity of enhanced infrastructure, subsidies, and equitable contract farming methods to guarantee the industry's longevity and expansion. Broiler farming has thus far shown to be a profitable venture in the Ludhiana district, and there is much scope to lower production costs and boost profitability by educating farmers to adopt scientific management and value addition through efficient training.

Influence of TV Viewing on Various Aspects of Rural School Going Children

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A study on "Influence of TV Viewing on Various Aspects of Rural School Going Children" was carried out with an objective to find out the influence of TV viewing on the selected aspects of rural school going children, to study the general TV viewing patterns of rural school going children and to study parental perceptions about TV viewing of their school going children. To carried out this study a sample of 150 rural school going children in the age group of 7-13 yrs residing in 6 villages of Parbhani district (M.S.) namely Asola, Pingali, Pedgoan, Takalgavhan, Paralgavhan and Lohgoan having TV sets at their home and volunteered to participate sincerely in the research study were selected by adopting purposive random sampling method. The data pertaining to the study were collected by personally interviewing the sample rural school going children based on open ended interview schedule cum checklist after developing rapport with them. Similarly all the sample children's parents also were interviewed based on the open ended interview schedule cum checklist for obtaining information additionally required for the study as well as to cross validate the information given by the children regarding the TV viewing pattern of them and also for studying parental views about the same. Approximate time taken for conducting interview of each child and his/her parents was 50-60 minutes. Thus the data collected from the rural school going children and also from their parents were pooled, tabulated, statistically analysed and discussed.

Irrespective of gender relatively higher percentage of rural school going children (37-50%) were found to view TV Programmes telecasted on Big Magic channel followed by Cartoon Network (28 - 42%) and Pogo (24 - 32%). Irrespective of gender about 98 percent of rural school going children reported that they view cartoon serials. More than 70 percent of them had their TV sets in living rooms and a higher percentage of them observed to be maintaining 5-7 ft from TV sets while viewing TV programmes. Irrespective of gender, the findings of the study indicate that significantly a higher percentage of rural school going children (72 – 88%) used to view TV programmes enormously. A higher percent of rural

school going children used to view TV programmes by sitting on floor or on cot (47 - 50%). Irrespective of gender, chitchatting (35 - 46%) and eating (38 - 43%) were observed to be the concurrently done activities of rural school going children while viewing TV programmes. As compared to the rural school going girls, their counterparts boys used to view TV programmes along with their friends and mothers. All the rural school going children stated that viewing different programmes on TV is a source of their recreation, they get acquainted with new information and also this is the source of getting relief. Relatively a higher percentage of their parents reported that viewing TV programmes was advantageous to their offsprings specially for developing communication skills, observation and listening skills, social skills & mannerism and also for learning Hindi language. Predominantly it was notices that causing eye strain, parental aggression and adverse effects on school performance were the disadvantages opined by the majority of rural school going children of TV viewing. However as compared to the rural girls significantly a higher percentage of rural school going boys parents were observed to be shouting to their sons for controlling them from excessive TV viewing. It is obvious from the results that, rural school going boys age (r-0.59**), weight (r-0.72**), height (r- 0.43**) and size of the family (r- 0.69**) were found to have significant positive correlation with the time incurred by them on viewing various programmes on television.

Keywords: TV programmes, Channels, Advantages, Coviewing, Contents, Disadvantages.

Formulation and Evaluation of Eladi Quatha in the Treatment of Urolithiasis

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Urolithiasis is a universal problem. Urolithiasis refers to the development of stones within the urinary tract. Eladi Quatha is an Ayurveda formula that is used for treating urolithiasis. Urinary stones are a common condition, that affects around 12% of the populace, and they tend to recur more frequently in males, with a recurrence rate of 70-80%, compared to females, who experience recurrence at a rate of 47-60%. A kidney stone, can also be as called as renal calculi, is a solid crystalline mineral formation that originates in the kidney or urinary tract. Symptoms of kidney calculi often include the presence of blood in the urine and frequent, intense pain in the abdominal or flank region. Nephrolithiasis is the medical term for kidney stone disease.The present study aimed to formulate and evaluate Eladi Quatha with special reference to Urolithiasis. The main aim of this study is tois to scientifically validate the efficacy of Eladi Quatha in the management of urolithiasis. This involves formulating and standardizing Eladi Quatha through an assessment of its physico-chemical properties. Furthermore, safety evaluations will be conducted using acute and sub-acute toxicity assessmentsto ensure its suitability for human consumption. The study will also investigate the efficacy of Eladi Quatha in animal models of urolithiasis and assess its safety and effectiveness in individuals with kidney stones.

Keywords - Eladi Quatha, Ayurvedic, Urolithiasis, Clinical study, Qualitative analysis, Toxicity study.

Technology generation for Indian Blackberry (*Syzygium cumini*) process and designing convenience food products

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About 70% of Indian population inhabits in rural areas and the majority of them reside in the vicinity of forest in form of different tribal communities. In India utilization of wild plants & fruits by these tribal communities for nutritional as well as medicinal purposes has been documented long back in ancient literature. In the present day wild edible fruits are particularly useful during famine and similar scarcity situation. Even during normal times, wild fruit provide materials of diet to the less advanced section of human community. Although, these wild edible fruits play an important role in food security, but they are ignored hence known as underutilized fruits. However, only a small number of fruits are widely used. Many neglected and underutilized species are nutritionally rich and adapted to low input agriculture. The erosion of these species can have immediate consequences on the nutritional status and food security of the tribal population. Focusing attention on neglected and underutilized species is an effective way to help a diverse and healthy diet and to combat micronutrient deficiencies, the so-called 'hidden hunger'. Popularity of these wild fruits has recently decreased because of their higher perishability and short shelf life as they are available as seasonal surpluses during certain parts of the year and are wasted in large quantities.

In view of the problem of wastage of wild as well as underutilized because of their perishability; the present investigation was undertaken as a step forward to standardize techniques for preservation and long storage of Indian Blackberry (*Syzygium cumini*) fruit commonly known as "Jamun". The study was conducted in four phases for the study Jamun fruit was collected from the local farmer of Korchi district Gadchiroli. Samples were cleaned and subjected to analysis. In the first phase physical and nutritional characteristics of Jamun were assessed. The physical analysis of fruit revealed that fruit consists of 91% of edible portion; remaining was seed. It was quite acceptable in terms of colour, texture, appearance and mouth feel. The chemical analysis revealed that fruit consists of high fibre and low carbohydrates and was also found rich vitamin A & C and Potassium and phosphorus content.

It was also significantly higher in terms of polyphenol and antioxidant content.

The second phase of study was standardization of drying technique. the edible portion of fruit was dried through three different techniques i.e. open sun drying, solar tunnel drying and oven drying and were ground for development of pulverize. The result showed that 7-8 hours of drying was suitable for drying of Indian Blackberry. Solar tunnel drying was not found suitable for the pulverize. Visual and Organoleptic observation revealed that pulverize developed from sun drying was most acceptable compare to other pulverizes. Therefore it was taken further for the incorporation in different recipes.

In the third phase two convenient food products namely candies and shots were developed through incorporation at 10, 20,30,40,50 percent in which 40 percent incorporation was acceptable by panel members as compared to other pulverizes. The developed products were stored for the period of six months.

In the fourth phase quality evaluation of product was performed in terms of sensory and nutritional evaluation at 0, 3, 6 months. Jamun Shots only sustained for the period of two weeks and Jamun Candies was evaluated up to 6 months and it was organoleptically and nutritionally acceptable after 6+ month's storage. The shelf study was also conducted on Jamun fruit as well as sundried pulverize which was stored for six months. The results indicated that both were quite acceptable after six months storage at 15 Degree Celsius.

Unleashing The Potential of Biotechnology for Sustainable Development

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The Sustainable Development Goals (SDGs) of the United Nations aim to eradicate poverty, protect the planet, and foster shared prosperity using methods that are both sustainable and inclusive by the year 2030. This necessitates the adoption of a collection of different tactics in order to overcome obstacles and cultivate synergies among the many Sustainable Development Goal targets, which will ultimately make it easier to accomplish these lofty objectives. Highlighting the world's progress toward the Sustainable Development Goals (SDGs) via the usage of biotechnological developments is the purpose of this assessment. This evaluation will include objectives, strategies, synergies, and difficulties. We examined research papers that had been published in journals that were subjected to peer review, as well as reports from the United Nations and scholarly publications that were pertinent to the present issue. We were able to identify a number of significant obstacles that the nations, particularly the developing ones, are encountering in their pursuit of sustainable growth. Inadequate governance, weak nations, violent wars, growing inequality, limited economic growth, climate change, environmental degradation, and food insecurity are some of the issues that fall under this category. But because it supplies the foundation of resources for civilization as a whole, the environment is highlighted. One of the more recent scientific discoveries, biotechnology offers a broad range of applications that can maximize resource utilization. It involves manipulating organisms to carry out certain tasks through genetic engineering. The removal of hazardous waste and the recovery and recycling of resources are two more environmentally beneficial uses of biotechnology. Since the base of resources has grown, these have similar significance in terms of sustainable development. However, there could be some really negative effects from employing biotechnology. Therefore, the high rates of extinction that are currently occurring in plant and animal species are limiting the possibilities for biotechnology in the future.

Keywords: Biotechnology, Sustainable development, SDGs.

USE OF INDIGENOUS CROP VARITIES IN CLIMATE CHANGE ADAPTATION ACROSS SELECTED AGRO CLIMATIC ZONES OF KARNATAKA

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Indigenous Technical Knowledge (ITK) refers to the traditional knowledge and practices developed by indigenous and local communities over generations. This knowledge is specific to a particular culture or society and is passed down through generations by word of mouth. They are often highly adapted to the local environment and play a crucial role in climate change adaptation in the specific areas. In the present study an attempt has been made to document some of the ITKs used by the farm families in Northern Dry Zone (NDZ), Northern Transition Zone (NTZ), Hilly Zone (HZ) and Coastal Zone (CZ) of Karnataka. Qualitative approaches like Focus Group Discussions (FGDs), observations and Key Informants Interview were employed to document the ITKs. The study reveals that, to maintain productivity during natural crisis, communities have used indigenous seed varieties such as Sorghum (Doddarasi and Champakali), Navara rice, West Coast Tall coconut, Mangalore areca nut and Karimunda black pepper are preferred due to their adaptability to local conditions, high yields and specific beneficial properties. Indigenous sorghum varieties like Doddarasi and Champakali are likely to be well-adapted to local climatic conditions. These varieties might have developed resilience to local stress factors such as drought, pests and diseases over time. In order to meet water needs during drought conditions the traditional early-maturing varieties like Champakali sorghum, K851 green gram (moong), BRG-1 pigeon pea (tur) and foxtail millet (kangni) were cultivated for their suitability to local conditions and shorter growth periods. Thus, the selection and use of indigenous seed varieties as well as the adoption of early-maturing crop varieties are important strategies for climate change adaptation in agriculture.

Keywords: Adaptation, Agriculture, Climate Change, Crop varieties

Crop Disease Detection Using Advanced AI Technique

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In recent years, the agricultural sector has faced significant challenges due to crop diseases, which have led to substantial losses in yield and quality. Traditional methods of disease detection, often based on manual inspections, are labor-intensive, time-consuming, and prone to errors. With the advancement of artificial intelligence (AI) technologies, new opportunities have emerged to enhance the accuracy and speed of crop disease detection. This study explores the application of advanced AI techniques such as deep learning, machine learning, and computer vision in identifying and diagnosing crop diseases at early stages. By leveraging large datasets of diseased crop images and utilizing convolutional neural networks (CNNs), this research aims to automate the detection process, improving precision while minimizing human intervention. Additionally, the integration of AI with Internet of Things (IoT) devices for real-time monitoring and early warning systems offers a proactive approach to managing crop health. The results demonstrate that AI-based models can surpass traditional methods in terms of accuracy and scalability, providing farmers with an efficient tool to combat crop diseases and ensure food security.

CLIMATE SMART EXTENSION STRATEGIES FOR SUSTAINABLE AGRICULTURE

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Climate change presents a profound challenge to global agricultural productivity and food security, manifesting in increased frequencies of droughts, floods, and shifts in soil nutrients. These climatic disruptions impact both the natural environment and agricultural practices, highlighting the urgent need for effective mitigation strategies. The United Nations Framework Convention on Climate Change (UNFCCC) characterizes climate change as human-induced alterations in atmospheric composition, while the Intergovernmental Panel on Climate Change (IPCC) emphasizes the unprecedented rise in greenhouse gases driven by industrialization and population growth. In response to these challenges, Climate-Smart Agriculture (CSA) has emerged as a multifaceted approach aimed at addressing the intertwined issues of food security and climate change. By integrating innovative practices and technologies, CSA seeks to improve food quality, bolster nutritional security, and support sustainable farming methods. To bridge this gap, effective climate-smart extension strategies are essential. These strategies include a variety of approaches such as agriculture-based technologies such as new crop varieties, mixed cropping, integrated farming. Among the key technologies for climate change mitigation are precision farming, drip and sprinkler irrigation and organic farming. These technologies aim to enhance agricultural resilience, optimize resource use, and lower emissions, contributing to a more sustainable and secure food system. By implementing these strategies, the agricultural sector can better adapt to climate change, ensuring continued productivity and food security in face of climate change.

KEYWORDS: Adaptation, Climate change, Climate-Smart Agriculture.

ENHANCING ORGANIC FARMING THROUGH EXTENSION METHODS

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Extension services are pivotal in advancing organic farming by facilitating the exchange of knowledge, resources, and support between researchers and practitioners. This role encompasses a wide range of functions that collectively support the adoption and successful implementation of organic farming practices. Key contributions include education and training, where extension agents impart essential knowledge on organic principles, such as soil health, pest management, and crop rotation. Technical support is also a crucial aspect, with agents offering practical advice on implementing organic techniques and solving specific problems encountered in organic systems. Additionally, extension services at Krishi Vigyan Kendra (KVK), State Agricultural Universities (SAUs) and other line Departments assist in resource provision by helping farmers to access organic inputs like seeds, compost, and certified fertilizers. Different demonstrations methods use by extension agents serve as practical showcases, allowing farmers to observe and learn from successful organic farming methods. Extension services also play a significant role in disseminating research findings, translating complex data into actionable advice for farmers. Advocacy for supportive policies and programs further enhances the organic farming landscape, addressing barriers and promoting favourable conditions for organic agriculture. Overall, extension services act as a vital link in promoting organic farming, providing farmers with the necessary tools, knowledge, and support to transition to and excel in organic agriculture. By addressing both the practical and strategic aspects of organic farming, extension services contribute significantly to the growth and sustainability of this agricultural approach.

KEYWORDS: Extension, Farmers, Organic farming, Knowledge

PROBLEMS AND NEEDS OF BUS CONDUCTORS

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In India, many forms of public transportation are available for passengers. Among them, buses play a significant role. The transport sector has traditionally been seen as a man's domain up until 1980, women stayed away from this sector. In later years, women began to work as bus conductors in various regions of India. Karnataka state transportation becomes the first state to employ female bus conductors. The present study was conducted in North-West Karnataka Road Transport Corporation (NWKRTC) Hubli - Dharwad. The sample size comprised of 200 bus conductors (100 male and 100 female). In present study, problems and needs of male and female bus conductors was assessed by using self-structured questionnaire. The study revealed that Male and female bus conductors had problems like organization do not accept the demands and requests of bus conductors, waiting for long time to take ticket machine every day, sufficient incentives and rewards are not given for effective job performance, overtime duty in festival time, pressure to complete the work in time, over work load, repetitive work increase stress, quarreling passengers, air & sound pollution, bad road conditions, unrepaired buses, difficulty in doing long route because of extension of working hours, difficulty in doing local route duties because of over workload. Bus conductors needs are to create awareness on stress management techniques, hygienic bus depots, availability of canteen, pure drinking water, and medical facilities, regular free health checkup, psychological counseling, personal loans with low interest rate, health counseling, there is need to award and incentive scheme for best conductor performances in dept, availability of good rest rooms and quartos, they need respect from their officers and public, need of recreational facility, regular maintenance of buses, it is needed to arrange stress management workshops at every three months and career development programs for conductors, it is essential, to organize get-together programs, annual gathering, farewell parties, cultural programs among bus conductors with family. Hence, counseling, trainings, seminars and workshops need to be arranged.

Keywords: Needs, problems, male, female, conductors

Socio economic characteristics and livelihood status of fisherwomen involved in post-harvest activities of marine fisheries

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Fishing is the major source of livelihood for the people who are living along the coastal line. Women accounts 47.00 per cent of global fisheries work force. Active marine fishing was undertaken by men after the fish lands it is the women who will take care of the catch. Their involvement was more in post-harvest activities like grading, cutting, cleaning, drying, salting and marketing *etc.,* Involvement of women in these activities provide additional income to their families. Yet their involvement is unrecognized ad unorganised. Hence the present study was conducted to know the livelihood status of fisherwomen involved in marine fisheries. The study was conducted in Uttara Kannada district of Karnataka during 2023-24. 120 fisherwomen were selected through purposive random sampling method. Interview schedule was used to collect the data, frequency, percentage, mean, SD, indices were used to analyse the data. Study revealed that half (50.00 %) of the respondents belonged to young age, cent per cent of them belonged to backward caste, most of them were illiterates, vast majority (95.00%) were married and had nuclear families, two third of the respondents medium level of annual income. Medium level of mass media usage and organizational participation. Low extension participation. Great majority (95.00 %) of the respondents involved solely in fisheries activities, very few of them involved in business, wage labour, dairy and poultry activities along with fisheries. To measure the livelihood five capitals were considered, under each component sub-components were considered. Among these five financial capital indices was high with 67.69 followed by physical capital (66.57), human capital (61.04) and social capital (51.82). Less than half (40.83 %) of the respondents' families had medium level of livelihood followed by low level (37.50 %) and high level (21.67 %). Fisherwomen the study area solely depending on fisheries activities and less than half of them had medium level of livelihood so government and local extension official, department officials should encourage them to take up other livelihood activities along with fisheries and government should provide awareness about policies and various schemes.

Keywords: Livelihood status, socio economic characteristics, marine fisheries, fisherwomen

Variability amongst the *Fusarium* isolates causing wilt disease of chickpea

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Forty six isolates of *Fusarium* were isolated from 56 chickpea disease plants collected from different geographical regions of Maharashtra of which Fusarium was exhibited in 46 samples. Out of 46 isolates of *F. oxysporum* f. sp. *ciceri,* 44 isolates proved to be pathogenic and the isolates F_{19} and F_{45} were found non pathogenic to susceptible cv. JG-62. The isolates of *F. ciceri* were tentatively divided in five groups based on their pathogenic ability. In all purified isolates of *F. ciceri*, micro conidia were single celled, hyaline, ovoid to fusoid produced singly. The size of micro conidia was ranged from 10.5-5.37 x 2.98-2.29 µm (F_{43}) to 15.45-10.59 x 3.97-2.02 µm (F_{54}). The macro conidia were hyaline curved, falcate narrowing at both ends and differ in sepatation from 2-3 to 2-5 septa from single isolate. The chlymadospores produced terminally or intercalary in all isolates varies from 13.79-8.65 x 12.02-7.17 to 22.02-9.33 x 20.66-7.95 µm, except the isolate F_{26} which devoid of chlymadospore. Also, pathogenic reaction of 11 selected isolates of *F. ciceri* based on ten chickpea differentials, the isolates could be classified into five groups.

Keywords: Host differentials, *F. ciceri,* morphology, pathogenicity.

Influence of Various Preservative Solutions on the Bud Opening in Different Chrysanthemum Cultivars 'Solan Shringar' and 'Yellow Star'

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The present investigations entitled, "Influence of Various Preservative Solutions on the Bud Opening in Different Chrysanthemum Cultivars 'Solan Shringar' and 'Yellow Star'. The experiment on bud opening solution was conducted in a Completely Randomized Design (factorial). The details of experiment: Two Cultivars *i.e.* 'Solan Shringar' and 'Yellow Star', bud opening stages of flower bud i.e. at 40 mm, 60 mm diameter of flower bud and seven different preservative solutions i.e. T_1 - Control (distilled water), T_2 - Sucrose (4%)+8-HQC (50 ppm), T_3 – Sucrose (4%)+8-HQC (100 ppm), T_4 – Sucrose (4%)+8-HQC (150 ppm), T_5 – Sucrose (8%)+8-HQC (50 ppm), T_6 – Sucrose (8%)+8-HQC (100 ppm) and T_7 – Sucrose (8%)+8-HQC (150 ppm). Studies revealed that bud- cut flowers of cultivar 'Yellow Star' opened earliest when placed in preservative solution containing sucrose (8%) + 8-HQC (150 ppm) whereas, 'Solan Shringar' in sucrose (4%) + 8-HQC (150 ppm). However, maximum flower diameter, flower height and increase in weight of cut stems and amount of solution consumed by cut stems of both the cultivars was obtained when flowers were opened in sucrose (4%) + 8-HQC (150 ppm). Vase life, amount of distilled water consumed and appearance was maximum when harvested at fully opened stage. Among different bud opening solutions tested, T_4 (Sucrose (4%) + 8-HQC (150 ppm) was found to be best for the bud opening of both the cultivars 'Solan Shringar' and 'Yellow Star'. As regard bud size both sizes (40 and 60 mm) opened successfully. However, early opening of buds was observed in 60 mm bud size in cultivars 'Solan Shringar' and 'Yellow Star'.

AI-Driven Drones in Mining: A Comparative Analysis Focused on Accuracy, Efficiency, and Cost

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This research presents a comparative analysis of traditional surveying methods and AI-driven drones in mining operations, supported by a detailed case study. The research examines the impact of drone technology on critical aspects of mining, highlighting its superiority in accuracy, efficiency, and cost-effectiveness. The integration of artificial intelligence in mining has emerged as a transformative force, offering advanced capabilities such as predictive maintenance, optimized resource extraction, and enhanced safety measures through real-time monitoring and analysis.

AI-driven drones, in particular, automate data collection and analysis, facilitate precise geological exploration, and improve mineral identification and classification. The case study was strategically selected to explore the application of AI-based drones in a mining environment, addressing specific research objectives and comparing the outcomes with traditional methods. The findings reveal that drones significantly outperform conventional techniques in tasks such as mine planning, exploration, inspection, and surveying, delivering accurate and reliable results over large areas within a reduced timeframe while also enhancing safety protocols.

This research underscores the multiple advantages of integrating AI-powered drones into mining operations, demonstrating substantial time and cost savings, improved data accuracy, and enhanced operational efficiency. The results contribute to the growing body of knowledge supporting the adoption of drone technology in the mining industry, paving the way for greater productivity and sustainability.

Keywords- Mining, Mining Survey, Innovation, Artificial Intelligence, Drones, Inspection, Land Use, Photogrammetry, GIS, Cost Analysis, Efficiency, Accuracy.

Impact of Soil and Foliar application of Zinc and Iron on different Fractions of Zinc and Iron after harvest of Maize [*zea mays* L.]

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An investigation was carried out for two years (2018-19 to 2019-20) to study the response of maize to different soil and foliar application of zinc and iron under typic Haplustepts at Rajathan college of Agriculture, MPUAT, Udaipur under split plot design with seven level of soil application (control, 12.5 kg $ZnSO_4$ ha^{-1}, 25 kg $ZnSO_4$ ha^{-1}, 12.5 kg $FeSO_4$ ha^{-1}, 25 kg $FeSO_4$ ha^{-1}, 12.5 kg $ZnSO_4$ ha^{-1} + 12.5 kg $FeSO_4$ ha^{-1} and 25 kg $ZnSO_4$ ha^{-1} + 25 kg $FeSO_4$ ha^{-1}) in main plots and four level of foliar spray (control, 0.5% $ZnSO_4$ ha^{-1}, 0.5% $FeSO_4$ ha^{-1} and 0.5% $ZnSO_4$ ha^{-1} + 0.5% $FeSO_4$ ha^{-1}) sub plot and replicate threefold Different fractions of Zn and Fe found significantly highest under treatment 25 kg $ZnSO_4$ ha^{-1} + 25 kg $FeSO_4$ ha^{-1} during both the years and in pooled mean whereas significantly highest Zn and Fe were found with foliar application of 0.5% $ZnSO_4$ ha^{-1} + 0.5% $FeSO_4$ ha^{-1} (F_3) during 2018, 2019 and in pooled mean in sub plots.

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