

Abstract Book for

10th INTERNATIONAL CONFERENCE
ICAHESA-2025

**"AGRICULTURE, HORTICULTURE & FORESTRY:
PATHWAYS, EXTENSION STRATEGIES & APPROACHES"**

ORGANISED BY:

**DEPARTMENT OF AGRICULTURE,
VGU, JAIPUR (ICAR ACCREDITED)**

in collaboration with

**JUST AGRICULTURE COMMUNICATIONS GROUP
AEEFWS SOCIETY, CHANDIGARH**

on 18th-20th APRIL, 2025

**at VIVEKANANDA GLOBAL UNIVERSITY,
JAIPUR, RAJSTHAN**

Editors

Dr. SUSHILA HOODA

Dr. D.P.S BADWAL

Dr. PIYUSH CHOUDHARY

Dr. PARESH P. BAVISKAR

JUST AGRICULTURE PUBLICATIONS

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on
18th-20th April, 2025

at
Vivekanand Global University, Jaipur, Rajasthan

Editors:
Dr. Sushila Hooda
Dr. D. P. S. Badwal
Dr. Piyush Choudhary
Dr. Paresh P. Baviskar



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Head, Production (Higher Education and Professional) & Publishing Director

Dr. Paresh P. Baviskar

Product Manager

Dr. Utkarsha Gaware

Graphic Designer

Arya Maan

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VICE-CHANCELLOR SECRETARIAT
SRI KARAN NARENDRA AGRICULTURE UNIVERSITY
Jobner, District - Jaipur (Rajasthan) Pin303329
Phone: 01425-254039, 254555, Email : vc@sknau.ac.in

Prof. Balraj Singh
Vice-Chancellor



Message

I am delighted to extend my warmest greetings to all participants of the **10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches" (ICAHESA-2025)**, organized by the Department of Agriculture, Vivekanand Global University, Jaipur from 18th to 20th April, 2025.

Agriculture is not merely the backbone of our economy- it is the very foundation upon which human civilization has grown and thrived. In today's dynamic world, the agricultural sector stands at a pivotal juncture. The integration of innovation, sustainability and emerging technologies is redefining the way we grow, process and distribute food. With the global population steadily increasing and climate challenges becoming more pronounced, there is an urgent call to rethink agricultural systems to ensure both productivity and environmental harmony.

ICAHESA-2025 arrives at this critical moment, offering a dynamic platform for academicians, researchers, policymakers and industry leaders to come together, share knowledge and collaborate. With its thematic emphasis on sustainable agriculture, biotechnology, smart farming technologies, agricultural marketing, agri-tourism and Other recent advancements in agriculture, horticulture and forestry, this conference promises to stimulate impactful discussions and foster visionary strategies.

I firmly believe that such meaningful engagements will not only drive innovative solutions but also inspire the next generation to contribute to a resilient, inclusive and technology-driven agricultural future.

I commend **Vivekanand Global University** for spearheading this commendable initiative and creating a space where ideas translate into action and research informs real-world impact.

May the deliberations and outcomes of ICAHESA-2025 make a lasting contribution to the advancement of agriculture and serve the greater good of society.

Wishing all participants, a successful and enriching conference.


(Balraj Singh)

MESSAGE



Dr. K.R. Bagaria
Founder & Vice-Chairperson,
Former Member RPSC

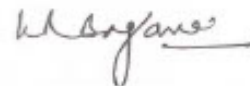
The 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches" offers a vital platform to unite experts, stakeholders, and thought leaders from across the agricultural spectrum to address one of the most pressing global priorities—ensuring food and nutritional security amidst evolving challenges.

As agriculture adapts to new realities, the dual task of boosting food production and enhancing nutritional outcomes has become more urgent than ever. The theme of this conference rightly emphasizes the importance of not just increasing yield, but also elevating the quality and nutritional value of our agricultural outputs. In the context of combating malnutrition, addressing the impacts of climate change, and managing finite natural resources, the discussions and strategies that will emerge from this event are both timely and essential.

I encourage all participants to engage fully in the deliberations, exchange innovative ideas, and collaborate towards developing practical solutions that can redefine and strengthen today's agricultural systems. Your insights and active participation will be instrumental in driving the success of this important initiative.

I extend my heartfelt appreciation to the organizing committee, the sponsors, and all participants for their dedication and hard work in making this conference possible. I am confident that the event will foster meaningful dialogue, inspire actionable strategies, and contribute significantly to building a resilient and nutrition-secure future.

I wish the conference tremendous success.



(Dr. K.R. Bagaria)

MESSAGE



Prof. (Dr.) D.V.S. Bhagavanulu
Pro-President (Research Affairs)

I am delighted to learn that the 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches" is being organized by Vivekananda Global University, Jaipur, from 18th to 20th April 2025.

The genetic improvement of crops, particularly the introduction of dwarf varieties of rice and wheat, along with advances in irrigation and fertilizer use, enabled India to achieve self-sufficiency in food grain production and emerge as a significant exporter. However, this remarkable agricultural growth, coupled with the excessive use of nutrients, groundwater, and natural resources, has placed tremendous pressure on our production systems. There is now a critical need to shift towards sustainable agricultural practices that prioritize both environmental conservation and human health.

In today's context of agricultural challenges and climate change, addressing the nutritional requirements of the population is of paramount importance. It is, therefore, timely and commendable that Vivekananda Global University, Jaipur, is organizing this important conference focused on how the new agriculture technologies reach to farmers through extension activities. I am confident that the discussions and deliberations during the conference will highlight vital issues and promote the adopting new agriculture technologies by the farmers.

I extend my best wishes to the organizers, delegates, and participants for the grand success of this important international conference. I look forward to the meaningful insights and recommendations that will emerge from this collaborative platform.



[Prof. (Dr.) D.V.S. Bhagavanulu]

MESSAGE



Prof. (Dr.) N.D. Mathur
President, VGU, Jaipur

It gives me great pleasure to learn that the Department of Agriculture at Vivekananda Global University, Jaipur, is hosting the 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches" from 18th to 20th April 2025.

Despite facing challenging climatic conditions, Rajasthan has been a remarkable contributor to India's food and nutrition security, notably through the cultivation of resilient crops such as millets. These traditional crops have played a crucial role in building India's self-reliance in food grain production while also ensuring the nutritional well-being of its people. Since independence, the relentless efforts of Rajasthan's farmers and agricultural scientists have been instrumental in transforming India from a food-deficient nation to a food-surplus one.

However, in recent decades, the area under minor millets has declined significantly due to limited awareness and the widespread adoption of high-yielding rice varieties. In today's context—marked by climate change, deteriorating soil health, and increasing nutrient deficiencies—there is an urgent need to revive and promote the cultivation of small millets. Their remarkable adaptability, thriving across diverse agro-climatic zones from sea level in the South to the high altitudes of the North, makes them a vital resource for securing both food and nutrition for future generations.

This International Conference arrives at a crucial juncture and promises to serve as an essential platform for dialogue among stakeholders nationwide. It will help address emerging challenges, propose innovative solutions, and chart a clear roadmap for enhancing agricultural sustainability and improving the nutritional status of our population.

I am confident that the deliberations during the conference will yield impactful insights and actionable recommendations for the future of Indian agriculture. I extend my heartfelt congratulations to the organizers and participants for their commitment and vision, and I wish the conference every success.



(Prof. N.D. Mathur)

MESSAGE



Prof (Dr.) Hoshiyar Singh
Convener & Dean, Agriculture

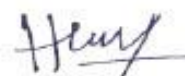
I am delighted to extend my heartfelt congratulations to the organizers, participants, and delegates of the 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches," being held from 18th to 20th April 2025 at Vivekananda Global University, Jaipur.

This conference is both timely and significant, as it brings together experts, researchers, policymakers, and stakeholders to deliberate on critical issues surrounding agricultural sustainability, food security, and nutritional well-being. In an era of climate change, resource depletion, and increasing global demand for food, the need for innovative and sustainable approaches to agriculture, horticulture, and forestry has never been more urgent.

By focusing on pathways, extension strategies, and scientific approaches, this conference promises to offer valuable insights into promoting resilient farming systems, advancing crop diversification, and strengthening food and nutrition security. Special emphasis on nutrient-rich crops, particularly millets, underscores the importance of aligning agricultural practices with the nutritional needs of our growing population.

I am confident that the exchange of knowledge and experiences during this event will lead to meaningful collaborations and innovative strategies that will contribute significantly to the future of Indian and global agriculture.

I commend the organizing team for their vision and dedication in bringing together such a diverse and distinguished group of participants. I wish the conference great success and look forward to the impactful outcomes and recommendations that will emerge from these deliberations.



[Prof. (Dr.) Hoshiyar Singh]

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 10th



International Conference on Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches (ICAHESA-2025) was planned by Just Agriculture Communications Group & AEEFWS Society in collaboration with Dept. of Agriculture, Vivekanand Global University, Jaipur (ICAR Accredited) during 18-20 April, 2025. The conference was embellished by the presence of Chief Guest, Prof. (Dr.) Balraj Singh, Vice- Chancellor, SKNAU, Jobner and Dr. Jagdish Rane, Director, ICAR-CIAH, Bikaner.

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 Communications Group

MESSAGE FROM SOCIETY PRESIDENT

It gives me immense pleasure to share that AEEFWS Society and Just Agriculture Communications Group in collaboration with Dept. of Agriculture, Vivekanand Global University, Jaipur (ICAR Accredited) have successfully organized the 10th International Conference on Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches (ICAHESA-2025) at Vivekanand Global University, Jaipur, Rajasthan during 18-20 April, 2025 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 10th International Conference (ICAHESA-2025). 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.

A handwritten signature in black ink, appearing to read 'Sushila Hooda'.

Dr. Sushila Hooda
Vice-President
Just Agriculture Communications Group

MESSAGE FROM CHIEF ORGANIZING SECRETARY

I am delighted to announce that Just Agriculture Communications Group and AEEFWS Society in collaboration with Dept. of Agriculture, Vivekanand Global University, Jaipur (ICAR Accredited) has successfully organized two days 10th International Conference on Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches (ICAHESA-2025) at Vivekanand Global University, Jaipur,



Rajasthan during 18-20 April, 2025. 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.

A handwritten signature in black ink, reading "Piyush".

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

MESSAGE FROM ORGANIZING SECRETARY

I am very glad that Just Agriculture Communications Group and AEEFWS Society in collaboration with Dept. of Agriculture, Vivekanand Global University, Jaipur (ICAR Accredited) has successfully organized three days 10th International Conference on Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches (ICAHESA-2025) at Vivekanand Global University, Jaipur, Rajasthan during 18-20 April, 2025 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. Paresh P. Baviskar
Vice- President (Branding & Marketing)
Just Agriculture Communications Group

MESSAGE



Mr. Raju Singh Jakhar
Co-convenor & Head, Agriculture

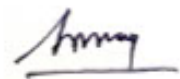
It gives me immense pleasure to extend a warm welcome to all delegates, researchers, academicians, and distinguished guests to the 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches," being jointly organized by the Department of Agriculture, Vivekananda Global University, Jaipur, in collaboration with Just Agriculture Education Group and AEEFWS Society, Chandigarh, from 18th to 20th April 2025.

This conference comes at a crucial time when the agricultural sector faces multifaceted challenges, including climate change, soil health degradation, nutritional deficiencies, and the urgent need for sustainable practices. Our goal through this event is to create a dynamic platform for knowledge exchange, innovative thinking, and collaborative research to address these critical issues.

I am confident that the insights, ideas, and research shared during this conference will inspire practical solutions and foster strong collaborations among stakeholders, researchers, and policy makers.

I sincerely thank our collaborators, sponsors, and all contributors for their support in making this event possible. I also extend my best wishes to all participants for engaging discussions, fruitful networking, and a highly enriching experience at VGU, Jaipur.

Let us together pave the way for a sustainable and nutrition-secure future through this collective endeavor.



(Mr. Raju Singh Jakhar)

MESSAGE



From the desk of Organizing Secretary

We extend our heartfelt gratitude to the esteemed luminaries from academia and industry who, despite their busy schedules and responsibilities, have traveled from across India to Jaipur to grace and elevate our 10th International Conference on "Agriculture, Horticulture & Forestry: Pathways, Extension Strategies & Approaches". We are honored to have with us several distinguished individuals, highly qualified and experts in their respective fields. Many of these dignitaries will also be sharing their knowledge and insights during the event, providing valuable inspiration to the scientific community.



(Dr. Abhinav)



(Mr. Mahipal Dudwal)



(Dr. R.C. Choudhary)

BOOK OF ABSTRACTS

**10th INTERNATIONAL CONFERENCE
on**

**AGRICULTURE, HORTICULTURE &
FORESTRY: PATHWAYS, EXTENSION
STRATEGIES & APPROACHES**

(ICAHESA-2025)

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Cytological Evaluation of Estrous Cycle for Optimal Breeding Time in a German Shepherd Female Dog: A Case Study

Ganga Devi , Sarjna Meena, Futarmal Longesha, Manju, Monika Karnani, Shweta Chaudhary

*Department of Veterinary Pathology
Post Graduate Institute of Veterinary Education and Research, Jaipur-302031*

Vaginal exfoliative cytology is a widely accepted, sensitive method for determining the stage of the estrous cycle in various species, reflecting the hormonal balance between estrogen and progesterone. It is particularly useful in diagnosing reproductive stages and detecting abnormalities during the periparturient and postpartum periods. Vaginal epithelial cells are classified based on their origin in the vaginal mucosa into parabasal, intermediate, superficial intermediate and superficial cells. This technique offers a rapid, inexpensive and reliable in-clinic method for evaluating the estrous cycle stages, especially in bitches. In the present case, a 3-year-old German Shepherd bitch was presented to the Teaching Veterinary Clinical Complex, PGIVER, Jaipur, with a 12-day history of frank, reddish-brown, non-fetid vaginal discharge and acceptance of a male, followed by cessation of discharge on the day of presentation. The owner sought guidance on the optimal window for mating. A vaginal cytology sample was collected from the cranial vagina using a swab gently rolled along the vaginal wall. The sample was then rolled onto a glass slide, fixed in ethanol, air-dried, and stained using Giemsa stain. Slides were examined under low (40×) and high (100×) magnification to identify specific cell types. Cytological evaluation was performed on alternate days over a three-day period. The smears showed approximately 80% cornified squamous epithelial cells, with more than 50% being anucleate, exhibiting folded borders and pyknotic nuclei characteristics consistent with late proestrus to early estrus. On subsequent smears, the transition to the diestrus phase was confirmed by the reappearance of parabasal cells and infiltration of neutrophils. Based on the clinical history and cytological findings, the bitch was determined to be in late proestrus to early estrus. The owner was advised to proceed with mating on three alternate days, beginning from the first day the vaginal smear showed a predominance of cornified epithelial cells, continuing until cytological signs of diestrus were observed.

Keywords: Exfoliative cytology, Estrous cycle, Parabasal cells.

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Role of Farmer Producer Organizations (FPOs) in Empowerment of Farmers

M.S. Anarase^{1*}, S. B. Raut² and G.K. Sasane³

1. Assistant Professor, Department of Agril. Extension Education, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar. Maharashtra 414 111
2. Associate Professor, Department of Plant Pathology and Agril. Microbiology, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar, Maharashtra 414 111
3. Director of Extension Education and Head, Department of Agril. Extension Education, MPKV, Rahuri, Ahilyanagar, Maharashtra 413722

**Corresponding author email: msanarase11@gmail.com*

Farmer Producer Organizations (FPOs) are vital in empowering farmers, fostering collective action, and improving the sustainability and profitability of the agricultural sector. Many small and marginal farmers face challenges due to limited resources and high transaction costs, which hinder their participation in modern agricultural markets. To tackle these issues and unlock the potential of smallholder farmers, FPOs have emerged as a promising institutional solution. These organizations, created and managed by farmers themselves, focus on collaborating in farming activities, increasing access to resources, enhancing bargaining power, and entering markets. Through democratic decision-making and inclusivity, FPOs enable farmers to combine their resources, knowledge, and expertise, allowing them to overcome individual limitations and work towards shared goals. Farmers' Producer Organizations (FPOs) serve as essential platforms where farmers can gather to discuss common challenges, share experiences, and learn from one another. These organizations play a crucial role in facilitating knowledge transfer, offering training initiatives, and conducting capacity-building activities that empower farmers with the necessary skills and information to adopt enhanced agricultural practices, boost productivity, and mitigate risks. By uniting smallholder farmers, FPOs aim to increase farm income through improved production, marketing, and local processing efforts. They actively seek out opportunities for value addition, establish direct connections with buyers, and advocate for fair trade practices. Additionally, FPOs significantly contribute to the sustainable management of natural resources, promoting climate-smart techniques and the responsible use of land and water. Government support and appropriate policy frameworks are vital for the establishment and functioning of FPOs. Financial assistance, technical support, and capacity-building programs from various governmental levels are instrumental in fostering the development of these organizations. Supportive policies, such as better access to credit and a favourable business climate, significantly enhance the success of Farmers' Producer Organizations (FPOs). By empowering farmers and improving their livelihoods while promoting sustainable practices, FPOs play a crucial role in transforming agriculture. They act as a bridge that brings together small-scale farmers, enabling them to tackle challenges collaboratively, increase their participation in markets, and contribute to the advancement of agriculture and the prosperity of rural communities.

Keywords: Farmer Producer Organizations (FPOs), Empowerment, Farmers.

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A Case Study of Feline Hepatic Jaundice: Clinical Presentation, Diagnosis and Therapeutic Response

Futarmal Longesha, Sarjna Meena, Ganga Devi, Manju, Monika Karnani, Shweta Chaudhary

*Department of Veterinary Pathology
Post Graduate Institute of Veterinary Education and Research, Jaipur-302031*

Jaundice or icterus, is characterized by elevated bilirubin levels in the blood (hyperbilirubinemia) and its subsequent deposition in body tissues, clinically identified by yellow discoloration of the mucous membranes, skin, sclera and internal organs. It becomes apparent when serum bilirubin levels rise to five to ten times the normal concentration (above 2 mg/dL). Jaundice can be classified as pre-hepatic, hepatic or post-hepatic based on the underlying pathology. In the present case study, a 2-year-old, 3.9 kg female persian breed cat was presented to the Veterinary Clinical Complex (VCC), PGIVER, Jaipur, with a history of yellow urine, yellowing of the eyes, anorexia, depression, vomiting, reduced water intake and marked dehydration. On the Clinical examination revealed hair loss, yellow discoloration of the mucous membranes, sclera and ear pinnae. Vital signs, including temperature, respiration and heart rate, were within normal limits. Haematological evaluation showed a slight increase in lymphocytes, while all other parameters remained within normal ranges. Serum biochemical analysis revealed elevated levels of bilirubin, alkaline phosphatase (ALP) and alanine aminotransferase (ALT), suggesting hepatic involvement. The cat was treated with amoxicillin @ 10 mg/kg (Inj. Moxin 500), silymarin @ 30 mg/kg (Cap. Silybin 140 mg), vitamin B-complex @ 1 ml/10 kg (Inj. V-Plex Vet), vitamin E @ 30 IU/kg (Cap. E-Cap 200) and 5% DNS fluid therapy @ 20 ml/kg for 7 days. Upon reevaluation after 15 days, the cat showed complete clinical recovery and haematological and biochemical parameters returned to normal levels. Based on the clinical history, physical examination and laboratory findings and good response to the treatment the case was diagnosed as hepatic jaundice.

Keywords: Icterus, Hyperbilirubinemia, Yellow discoloration

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Climate Services in Agriculture: A Strategic Approach to Mitigating Climate Change Impacts

G.K. Sasane ¹, S. B. Raut ² and M.S. Anarase^{3*}

1. Director of Extension Education and Head, Department of Agril. Extension Education, MPKV, Rahuri, Ahilyanagar, Maharashtra 413722
2. Associate Professor, Department of Plant Pathology and Agril. Microbiology, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar, Maharashtra 414 111
3. Assistant Professor, Department of Agril. Extension Education, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar. Maharashtra 414 111

*Corresponding author email: msanarase11@gmail.com

In the midst of increasing uncertainties, Climate Services (CS) are emerging as a transformative techno-social tool, capable of driving innovative adaptations to climate variability and change. As climate change continues to threaten agricultural productivity with erratic weather patterns, fluctuating temperatures, and extreme events, farmers are in dire need of timely and reliable data to make informed decisions. Climate Services play a crucial role in bridging the divide between scientific research and practical application by providing location-specific forecasts, early warning systems, and tailored crop advisories. With access to these services, farmers can gain valuable insights on optimal planting times, effective water management strategies, and resilient crop varieties, ultimately minimizing risks and enhancing their productivity. The integration of advanced technologies such as mobile applications, weather stations, and remote sensing tools ensures that even smallholder farmers can obtain actionable information. Moreover, Climate Services contribute to sustainable agriculture by improving resource management, decreasing crop losses, and bolstering resilience against future climatic challenges. In summary, Climate Services are vital for empowering farmers to navigate climate change, safeguard food security, and foster sustainable agricultural practices in an era of environmental uncertainty.

Keywords: Climate service, climate change, weather

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Pathological and Cyto-histopathological Investigation of Marek's Disease in Chickens: A Detailed Post Mortem Study

Futarmal Longesha, Sarjna Meena, Ganga Devi and Archita Mehra

Department of Veterinary Pathology

Post Graduate Institute of Veterinary Education and Research, Jaipur-302031

Marek's disease (MD) is a highly contagious viral infection caused by Marek's Disease Virus (MDV), a cell-associated alpha herpesvirus (double-stranded DNA, hexagonal enveloped virus) comprising three serotypes. MD poses a significant threat to the global poultry industry due to its impact on productivity and economic stability. In the present study, eight chickens aged 4–5 weeks, regardless of gender, were submitted for postmortem examination at the Department of Veterinary Pathology, PGIVER, Jaipur, with the history of reduced growth rate, inactivity, anorexia and showed clinical signs such as neurologic disorders, paralysis (lameness), blindness, swollen and closed eyes, nasal discharge, respiratory distress, emaciation and death. Gross pathological examination revealed lymphomatous lesions in multiple organs including the heart, ovary, spleen, liver, bursa, intestine, skin, proventriculus and skeletal muscles. The lungs were firm upon palpation. The liver appeared pale and granular due to diffuse nodular infiltration. Lymphomas presented as diffuse greyish-white growths, either nodular or focal in nature, varying in size. Ovaries had lost their typical floating appearance due to tumour enlargement. The myocardium was pale with pinpoint haemorrhages, indicative of diffuse nodular infiltration. The sciatic nerve exhibited greyish discoloration, oedema and loss of cross striations. Cyto-histopathological examination revealed infiltration of pleomorphic lymphoid cells, mononuclear cells and plasma cells in affected organs and peripheral nerves. Proliferative lymphoid infiltrations with marked pleomorphism were observed in the liver, kidney and heart. Necrotic changes were noted in the sciatic nerve. This study highlights the importance of comprehensive postmortem and histopathological examinations for the early and differential diagnosis of Marek's disease from other neoplastic conditions in poultry.

Keywords: Marek's disease, Lymphomatous lesions, Sciatic nerve

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Clinical and Cyto-histopathological Investigation of Transmissible Venereal Tumor in Dogs: A Case Study of Five Cases

Sarjna Meena, Futarmal Longesha, Ganga Dei

Department of Veterinary Pathology

Post Graduate Institute of Veterinary Education and Research, Jaipur-302031

Transmissible venereal tumor (TVT), also referred to as infectious sarcoma, venereal granuloma, or Sticker's tumor, is a neoplasm of the reticuloendothelial system predominantly affecting canines. It primarily involves the external genitalia, with occasional involvement of internal reproductive structures and skin. Transmission occurs chiefly through coitus and the condition is most frequently observed in young, sexually mature dogs. The present study reports five clinical cases of TVT presented at the Veterinary Clinical Complex, PGIVER, Jaipur, involving dogs of varying age, breed and sex. A higher incidence was noted in males, with local breeds showing greater susceptibility. The investigation focused on the clinical, cytological, hematobiochemical and histopathological features of the disease. Gross examination revealed characteristic proliferative, cauliflower-like masses located on the vulva, vagina, prepuce and penis. Haematological evaluation showed mild decreases in total erythrocyte count (TEC), haemoglobin (Hb) and packed cell volume (PCV) along with a notable increase in total leukocyte count (TLC). Serum biochemical analysis indicated elevated levels of alanine aminotransferase (ALT) and aspartate aminotransferase (AST), suggestive of hepatic involvement, while creatinine levels were monitored to assess renal function. Cytological evaluation of Giemsa-stained vaginal and penile swab smears demonstrated high cellularity with numerous round cells containing clear, punctate cytoplasmic vacuoles. Histopathological examination revealed densely packed sheets of uniform round to ovoid cells with hyperchromatic nuclei, central nucleoli, and dispersed chromatin—findings consistent with TVT. All affected animals were successfully treated with vincristine sulfate at a dose of 0.025 mg/kg body weight, administered intravenously at weekly intervals for four weeks. Complete clinical recovery was observed in all cases. Based on the clinical presentation, diagnostic findings and favorable response to therapy, the cases were conclusively diagnosed as transmissible venereal tumor.

Keywords: TVT, Cauliflower-like masses, Punctate cytoplasmic vacuoles, Vincristine.

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Plasmodium Infection in Domestic fowl – A Cytopathological Diagnostic Study

Sarjna Meena, Samita Saini, Manju, Futarmal Longesha, Ganga Devi

Department of Veterinary Pathology

Post Graduate Institute of Veterinary Education and Research, Jaipur-302031

Plasmodium Infection is a mosquito-borne disease caused by an avian malaria parasite (*Plasmodium spp*) in domestic chickens presents a major threat to the poultry industry because it causes economic losses in both the quality and quantity of meat and egg production. The most common avian malarial parasites are *Plasmodium gallinaceum*, *P. lophurae*, *P. elongatum*, *P. relictum* and *P. fallax*. Among all, *Plasmodium gallinaceum*, is an important species which causes more than 80% mortality in affected birds, if left untreated. In addition to causing blood pathology, these pathogens also responsible for organ pathology. The parasitic stages can be demonstrated in red blood cells that have been properly stained and impression smears from different organs. The aim of this study is to provide an early and rapid diagnosis which may help to prevent further transmissions of the disease in surviving flock. In current study, dead carcasses of domestic fowl, referred from organized as well as backyard poultry farms at particular intervals for the necropsy to Department of Veterinary Pathology, PGIVER, Jaipur, are discussed. On necropsy, most of carcasses exhibited marked anemia and yellow-green pasty droppings, smeared feathers around vent. The gross pathology revealed an enlarged spleen, swollen liver, and congested and edematous lungs. Touch-imprints were taken and processed with standard procedure of Giemsa's staining. Cytological features under microscope were consisted of numerous intraerythrocytic stages of *Plasmodium gallinaceum* as the trophozoites, giving the characteristic 'signet ring' appearance, meronts and gamonts. Infected cells also had dark pigment granules. Massive numbers of exoerythrocytic forms especially schizonts were evident. Meront produces 8–36 merozoites. These characteristic trophozoites, meronts with numerous merozoites and round gametocytes distinctive for *P. gallinaceum*. Thus, cases were diagnosed as Plasmodium Infection and treated with antimalarial drugs alongwith supportive treatment. After one week of treatment, blood smears re-examined for parasitic stages, no erythrocytic inclusions were found in the infected chickens medicated with antimalarial drugs.

Key Words: Plasmodium Infection, Cytodiagnosis, Trophozoites

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Incidence, Cytological and Histopathological Studies on Cutaneous Neoplasms of Dog (*Canis familiaris*) in Jaipur

Sarjna Meena, Sunil Jangid, Futarmal Longesha, Ganga Devi

Department of Veterinary Pathology

Post Graduate Institute of Veterinary Education and Research, Jaipur-302031

Nowadays, there is a global trend to search for a quick and affordable tumor diagnosis method. Cytology is a fast, cost-effective, less painful and easily repeatable method for diagnosing tumors with improving survival rates, importantly quality of life for pets undergoing treatment. This study was carried out at the Department of Veterinary Pathology, PGIVER, Jaipur, Rajasthan from August, 2020 to February, 2021, to determine the incidence, gross pathology, cytological and histopathological alterations of canine cutaneous tumors. In current investigation, both cytological and histopathological methods were used to diagnose the neoplastic masses. For soft and firm tumor masses, FNAC and impression smear were employed for cytodiagnosis. A total of 58 samples were collected from different breeds of dogs. Out of 58 cases, predominantly Epithelial cell tumour (25.86%), followed by Mesenchymal cell tumour (22.41%), Round cell tumour (13.79%) and Other types (32.76%) were recorded. In epithelial cell tumours, highest incidence of 33.33% was squamous cell carcinoma. Among mesenchymal cell tumour, the higher incidence recorded for fibrosarcoma at 23.08%. In round cell tumour 50% incidence were recorded of each, canine transmissible venereal tumour and mast cell tumour while in 'other' types higher incidence recorded for mammary gland tumours as 86.36%. Highest risk to development of various tumours observed at the age group of 9-12 years (37.93%). Regarding gender studied, higher number of tumours recorded in female dog (62.07%) than in male dog (37.93%). On breed-wise assessment, study revealed that non-descript or mongrel breed were having highest incidence of tumour (31.03%). However, second most common predisposed breed was Labrador retriever (24.14%). Furthermore, the diagnostic accuracy of cytology for the differentiation between malignant and benign canine tumours was concluded to be high. Most of findings were similar to other studies, however many differences have also been noted which are likely to be under the influence of nutritional status, breed variation, stress factor, management practices, hormonal changes, geographical and climatic variations and even lack of implementation of proper preventive and control measure. This report could pave the way for utilizing cytology as a more reliable and effective diagnostic tool for assessing neoplasms in small animal veterinary practice.

Key Words: Incidence, Cyto-histopathology, Cutaneous Neoplasms

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Influence of chemical treatment on fruit of guava (*Psidium guajava*) cv. Sardar

Pisal S. S.¹, Shinde V. N.², Gaikwad S. B.³, Janbandhu M.⁴

Ph.D. Scholar, Dr. P.D.K.V., Akola, Email- snehalpisal81@gmail.com

2) Assistance Professor, Department of Horticulture, College of Agriculture, Latur, V.N.M.K.V., Parbhani

3) Ph.D. Scholar, Dr. P.D.K.V., Akola

4) Ph.D. Scholar, Dr. P.D.K.V., Akola mohitjanbandhu17@gmail.com, Email: sujatagaikwad895@gmail.com

The current study was carried out during the winter of 2021–2022, at the college of agriculture, Latur. The research was carried out at the Instructional-cum-Research Farm, P.G. Laboratory, Department of Horticulture, College of Agriculture, Latur, V.N.M.K.V., Parbhani (M.S). The selected experimental guava (*Psidium guajava* L.) cv. Sardar field. During the Kharif season of 2021, fruit crops were chosen, and study was conducted using a Randomized Block Design (RBD) with three replications and nine treatments.

The experiment consisted of treatments with different concentrations involving CaCl_2 @ 1.0%, 1.5%), $\text{Ca}(\text{NO}_3)_2$ @ 1.0, 1.5%), SA @ 500ppm, 750ppm), Chel. Zn @ 0.5%, 1%) and water spray. Orchard trees foliar sprayed one month before harvesting of fruits with regards to treatment details. After one month fruits were harvested separately based on treatment and stored. Observation of stored fruits was done at 3rd, 6th and 9th day of storage. Study resulted that, treatment T4- calcium nitrate @1.5% found significant for shelf life parameters such as minimum PLW (13.30%) minimum Spoilage percentage (32.41%) and maximum Shelf life (8.33 days) at 9th day of storage, which was closely at par with CaCl_2 @ 1.5% application. Whereas, control treatment was inferior among all treatments at ambient storage condition.

Keywords: guava, $\text{Ca}(\text{NO}_3)_2$, CaCl_2 , shelf life.

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Actinobacteria: A promising Bioinoculant for drought tolerance and plant growth promotion

Mrugesh M. Patel*, N. K. Singh, RudraParmar, Bhavesh Joshi, Anurag Yadav,
Poonam Tapre, Yashvi Patel

*Ph. D. Microbiology, Department of Microbiology, C. P. College of Agriculture,
S. D. Agricultural University, Sardarkrushinagar- 385506

*Email: mrugesh1710@gmail.com, *Mo: 7359325189

One of the main reasons why agricultural yield and productivity are declining globally is drought. When plant growth-promoting actinobacteria are added to an agroecosystem, they enhance plant development; shield plants from water scarcity, and may be a better option for sustainable and organic farming. During this study, we isolated five actinobacterial strains from the datura and khejri's rhizosphere named RADM1 to RADM5 through *in-vitro* screening for abiotic stress tolerance against PEG8000 and tested to different temperatures, pH and NaCl concentrations. All the strains performed for *in-vitro* plant growth promoting abilities viz., IAA, siderophore, ammonia, HCN and exopolysaccharide production, phosphate, potassium and zinc solubilization and antagonistic against *Fusarium solani* (L.). In pot trial of mungbean, all the isolates showed better performance in bacterial treatments with an average increase in physiological parameters like, seedling's shoot length (52.70% and 9.62%), root length (35.63% and 17.25%), fresh weight (42.8% and 13.76%) dry weight (45.25% and 21.24%) in compared to uninoculated induced drought and watered treatments. Stress features of seedlings revealed significant increase in proline and chlorophyll contents whereas decrease in MDA contents than the untreated plants which indicates actinobacteria reduced water scarcity and damage of plant membrane. Morphology of the bacteria was same as typical actinobacterial species and for biochemical diversity stains were able to utilize carbohydrate through IMVIC test and enzymatic observation resulted positive for nitrate reduction and catalase production. PCR amplification and 16S *r*RNA gene sequencing in BlastN found maximum similarity of three species with *Streptomyces clavuligerus* and two species with *Rhodococcus erythropolis* and submitted to NCBI gene bank database.

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Optimizing Cultivation Media for Enhanced Cordycepin and Bioactive Compound Production in *Cordyceps militaris*: Recent Trends and Future Prospects

Aastha Dubey¹, Uzma Manzoor^{2*}, Chongtham Allaylay Devi³, Prasun Kumar Singh¹

¹Ph.D. Scholar, School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh -203201, India.

²Associate Professor, School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh - 203201, India.

³Assistant Professor, Amity Institute of Horticulture Studies and Research, Amity University, Noida, Uttar Pradesh, India

*Corresponding author: uzmamanzoor52@gmail.com

Cordyceps militaris, a valuable entomopathogenic medicinal fungus, has emerged as a promising bioresource for the production of pharmacologically active compounds such as cordycepin, polysaccharides, and nucleosides. With the increasing global demand for functional foods, nutraceuticals, and bio-pharmaceuticals, there is growing interest in developing optimized cultivation systems to enhance the yield and quality of these bioactive metabolites. This review critically examines recent trends and technological interventions in substrate and media optimization aimed at maximizing cordycepin and other therapeutic compound production in *C. militaris*. It highlights innovative cultivation strategies and explores future directions for sustainable, commercially viable production models. The review consolidates contemporary research findings on grain-based substrates, agro-industrial by-products, plant extract enrichments, and mineral supplementation and evaluates their influence on metabolite synthesis. Additionally, advancements in liquid static and submerged fermentation systems, the strategic use of elicitors, and the potential application of biotechnological interventions and AI-based growth monitoring systems are discussed. Recent evidence suggests that precision substrate formulation and media enrichment can significantly enhance cordycepin content and other bioactive metabolites in both solid-state and liquid cultivation systems. The integration of media engineering techniques and fermentation optimization holds high potential for scalable, cost-effective production. Furthermore, AI-driven environmental monitoring and precision cultivation models are emerging as promising tools to further improve yield consistency and metabolite profiles. The review concludes by emphasizing the critical role of media optimization and smart cultivation strategies in elevating the therapeutic, economic, and commercial value of *Cordyceps militaris*, positioning it as a high-value functional food, medicinal mushroom, and sustainable agri-biotech enterprise opportunity.

Keywords: *Cordyceps militaris*, Cordycepin, Functional Foods, Medicinal Mushroom, Precision Cultivation

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Nutritive Value and Medicinal Properties of Spine Gourd (*Momordica dioca* Roxb.)

Ramesh Chand Choudhary, Raju Singh Jakhar, Mahipal Dudwal, Arjun Lal Prajapat

Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan (303012)

Momordica dioca Roxb. is a perennial, dioecious climb creeper plant of the gourd family. It is commonly known as Spine gourd/Teasel gourd (English), Kantola (Hindi), Kankoda/Kankera (Rajasthan), Bhatkorola/Kankrol (Bengali), Kartoli (Marathi), Parora, Kakrol, Meetha Karela, Jungle Karela or small bitter gourd and Bhaat Karela. The origin place of kakrol is the indo Malaya region. It is widely grow in tropical and sub-tropical regions of India and cultivated in Maharashtra, West Bengal, Gujarat, Karnataka and Madhya Pradesh. Kantola grows wild in Jharkhand, Chattisgarh, and Odisha. The 100g fresh edible fruit of spine gourd contains 84.1% Moisture, 7.7 g Carbohydrate, 3.1 g Protein, 3.1 g Fat, 3.0 g Fiber, 4.63 mg potassium, 1.62 mg sodium, 7.37 mg calcium, 5.04 mg iron, 3.83 mg zinc and small quantities of ascorbic acid, carotene, thiamin, riboflavin and niacin. Apart from its fruits has high energy value 288.25 kcal, 9.1 % crude protein, 5.44 % crude lipid, 22.9 % crude fiber and 59.31% carbohydrate in 100 gm in dry weight. Kantola tender, Immature, small, spiny green fruits are used as vegetables. The spine gourd leaves have anti-helminthic, aphrodisiac, anti-hemorrhoidal, hepatoprotective, anti-bronchitic, anti-pyretic, anti-asthmatic, analgesic properties and its fruits have diuretic, laxative, hepatoprotective, anti-venomous, anti-hypertensive, anti-inflammatory, anti-asthmatic, anti-pyretic, anti-leprosy, anti-diabetic, anti-depressant properties. Its fruits have high demand in the market because its high nutritive value, therapeutic value, long shelf-life and suitable for long-distance transportation. Its fruit is closely related to bitter gourd in size, shape and taste.

Keywords: Spine Gourd, Medicinal Value, Vitamin, Mineral, Vegetable

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Effect of Canine Parvovirus on Cardiac Troponin T And Faecal Calprotectin in Dogs

Anuja¹, Brejesh Singh², Devendra Kumar Gupta³, Kshemankar Shrman⁴ and Kajal Jadav⁵

The present study was conducted to assess the effect of parvovirus on cardiac and intestinal functions in dogs. For this study, a total of 325 dogs with gastroenteritis presented at V.C.C., College of Veterinary Science and Animal Husbandry, Jabalpur, were screened from July-2023 to December-2023. On the basis of clinical signs pertaining to parvovirus infection, 125 dogs with haemorrhagic gastroenteritis were suspected. The faecal samples of 125 dogs with haemorrhagic gastroenteritis suspected for parvovirus infection, were subjected to PCR to amplify a fragment of VP2 gene (~580bp) using published primer. A total of 78 dogs (62.4%) were confirmed positive for parvovirus infection. The overall occurrence of parvovirus infection in dogs with gastroenteritis at VCC, Jabalpur was 24% while among dogs with haemorrhagic gastroenteritis, it was 62.4%. Age wise occurrence was significantly higher (79.06%) in dogs of 0-3 months. A significantly higher occurrence was observed among males (71.64%) than in the females (51.72%). Amongst different breeds, Non decript had the highest occurrence of 78.57%, followed by Labrador Retrievers (69.69%) and German Shepherd (68.75%). The most prevalent clinical signs observed in parvovirus infection were vomition (100%) and bloody diarrhoea (100%) followed by inappetence/anorexia (87.1%), severe dehydration (82.05%) and congested conjunctival mucous membrane (69.2%). The confirmed cases were subjected for the assessment of clinical and haemato-biochemical parameters, electrocardiography, cardiac markers (Troponin T), faecal markers (Calprotectin) and compared with control group of six healthy dogs. Among clinical parameters, mean body temperature was within normal physiological range, whereas, heart rate and respiration rate were higher. Among the haematological markers, haemoglobin (8.13 ± 0.89), TEC (3.98 ± 0.43) and TLC (6.73 ± 1.12) were significantly lower in dogs affected with parvovirus infection. Within the DLC count, neutrophils (56.8 ± 2.57) and lymphocytes (14.03 ± 0.26) decreased significantly as compared to normal healthy dogs. The serum AST (113.69 ± 20.4) was significantly higher and serum total protein (6.47 ± 0.424) did not vary significantly. Electrocardiographic tracings were predominantly recorded with low voltage QRS complex, reduced QT duration and sinus tachycardia. Cardiac troponin T values (0.15 ± 0.005) was significantly higher in dogs affected with parvovirus infection as compared to healthy control (0.01 ± 0.002). Cardiac troponin T values (0.18 ± 0.02) were significantly higher in dogs of 0-3 months of age group. Breed wise, Non descript, showed a significant increase in cardiac troponin T (0.16 ± 0.01). Whereas, there were no significant difference among male and females. Calprotectin (17.38 ± 2.38) showed a significant increase in dogs affected with parvovirus infection but there was no statistically significant difference in age, breed and sex.

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Effect of different sowing dates and genotypes on productivity of moong bean (*Vigna radiata* L.)

Tarun Dagar^{1*} and Dr Sucheta Dahiya²

¹PG Student at SGT University, Gurugram, ²Assistant Professor, Gurugram

^{1*}dagartarun35@gmail.com

A field experiment entitled “Effect of different sowing dates and genotypes on productivity of moong bean (*Vigna radiata* L.)” was conducted at Agronomy Farm, Faculty of Agricultural Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram, Haryana during the 2024 summer season. The study aimed to evaluate the impact of different treatments on moong bean and how they impact on their productivity. This experiment consisted of three moong bean varieties viz. V₁- MH-421, V₂- MH-1142, and V₃- PUSA-1431 sown on three different dates termed as treatments i.e. T₁- 15th March, T₂- 25th March and T₃- 5th April. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Observations were recorded for yield parameters including no. of pods, seed yield, stover yield and biological yield. Growth parameters showed a significant impact among all the treatments. The highest no. of pods per plant was observed in sowing dates 25th March (21.55) and among the genotypes MH-1142 has the highest mean no. of pods per plant (23.66). The lowest no. of pod per plant was observed in sowing dates 15th March (19.44) and among the genotypes PUSA-1431 has the least mean no. of pods per plant (18.11). In terms of seed yield, stover yield and biological yield MH-1142 show superiority among the genotypes (1182,3310,4492kg/ha) and among the sowing dates 25th March recorded highest seed yield (1024kg/ha), stover yield (2845kg/ha) and biological yield (3869kg/ha). The lowest seed yield, stover yield and biological yield obtained in 15th March (858,2383,3242kg/ha) and among the genotypes PUSA-1431 has the lowest seed yield (832kg/ha), stover yield (2163kg/ha) and biological yield (2996kg/ha).

Key words: Sowing date, genotypes, seed yield, biological yield, stover yield

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A Novel Electrochemical Biosensor based on g-C₃N₄@MXene for Trichlorfon Detection

NishulKhanna,Diksha,DivyaHudda, D. Kumar*

Department of Applied Chemistry, Delhi Technological University, Delhi – 110042, India

Email address- dkumar@dce.ac.in

Organophosphate pesticides are extremely harmful insecticides that are commonly utilized as combat chemicals. They can phosphorylate the AChE enzyme, which is responsible for nervous system function, leading to neurotoxic consequences in living creatures. Regular consumption of OPs, even in tiny amounts, can lead to major diseases such as Alzheimer's, Parkinson's, bone marrow, and nerve issues. Controlling OPs is crucial due to their harmful effects on food, water, and agricultural resources. An efficient method for detecting and quantifying OPs is necessary.

Recently, AChE-based biosensors have been widely explored for OP detection owing to their high selectivity and quick response. Hence, a novel electrochemical biosensor has been prepared using graphitic carbon (g-C₃N₄) decorated with MXene for trichlorfon detection. The electrostatic interaction of g-C₃N₄@MXene nanocomposites improves electron transport over the electrode surface, resulting in the immobilization of the AChE enzyme, enhancing the electrochemical sensing performance and potentiometric response was determined through differential pulse voltammetry (DPV). The fabricated biosensor demonstrated a broad linear range (0.1 pM-10 μM) and exhibited good selectivity, enhanced sensitivity, low detection limit (0.16 pM), accepted stability, and good reproducibility.

Keywords: Trichlorfon, Graphitic carbon nitride, MXene, Biosensor, Sensitivity.

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Examining the Impact of Climate Change on Agricultural Productivity

Fawad Momand

*¹ Department of Agricultural Economics and Development, Faculty of Agriculture, Farah Institute of Higher Education, Farah, Afghanistan
Email: fawadmomand81@gmail.com*

This research investigates the impact of climate change on agricultural productivity. To analyze this impact, factors such as farmers' awareness of climate change, sustainable farming methods, access to financial resources, and farmers' experience were examined. The statistical population of this research included farmers and agricultural experts in the target region, from whom 513 individuals were randomly selected. Statistical methods such as multiple linear regression, Cronbach's alpha test, Kolmogorov-Smirnov test, and t-tests and F-tests were used for data analysis. The results of the multiple linear regression showed that %8.16 of the changes in agricultural productivity are explained by the variables of awareness of climate change, the use of sustainable farming methods, access to financial resources, and farming experience ($R^2=2.81$). The F-statistic was 11.38 with a significance level of p-value = 2.222, indicating the significance of the regression model. The t-tests for awareness of climate change ($t = 1.123$, p-value = 2.222), sustainable farming methods ($t = 5.135$, p-value = 2.222), access to financial resources ($t = 5.881$, p-value = 2.221), and farmers' experience ($t = 1.28$, p-value = 2.23) showed that all these factors significantly affect agricultural productivity. Furthermore, the Cronbach's alpha test showed a value of 0.911, indicating high reliability of the research instrument. Overall, the findings of this research suggest that increasing farmers' awareness, using sustainable farming methods, providing access to financial resources, and leveraging farmers' experience can help improve agricultural productivity and reduce the negative effects of climate change. Consequently, to address the adverse impacts of climate change and enhance agricultural productivity, it is recommended that farmers benefit from more training, adequate financial resources, and modern technologies.

Keywords: Climate Change, Agricultural Productivity, Farmers' Awareness, Sustainable Farming Methods

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Influence of foliar spray of plant growth regulators and nutrients on physiological and biochemical parameters and yield of paddy at two situations

Kiran Amarshetti¹, Niranjan K² and Sapthagiri T V³

¹Ph.D. Scholar, Department of Crop Physiology, University of Agricultural Sciences, Dharwad 580 005, Karnataka, India

²Ph.D. Scholar, Department of Genetics and Plant Breeding, University of Agricultural Sciences, Dharwad 580 005, Karnataka, India

³Ph.D. Scholar, Department of Human Development and Family Studies, University of Agricultural Sciences, Dharwad 580 005, Karnataka, India

E-mail: amarshettikiran1996@gmail.com

A field experiment was conducted at Agricultural Research Station, Gangavati, UAS, Raichur, Karnataka, during kharif 2019 to study the physiological approaches to sustain the rice (*Oryza sativa* L.) productivity under late sown situation (var. RNR-15048). The experiment was laid out in factorial RCBD with three replications, where two dates of transplanting were taken i.e. D₁ (Normal) and D₂ (Late) and six treatments along with control viz., T₁: NPK-19:19:19 (20000 ppm), T₂: 6-BAP (20 ppm), T₃: salicylic acid (250 ppm), T₄: mepiquat chloride (1000 ppm), T₅: borax @ (10000 ppm) and T₆: control. The results of physiological parameters obtained at 65 DAT and biochemical parameters obtained at 55 DAT indicated that D₁ (Normal DOT) showed higher values as compare to D₂ (Late DOT) in all the treatments. Among different treatments, T₁ (NPK-19:19:19 @ 20000 ppm) recorded the significantly greater results of physiological parameters viz., photosynthetic rate (9.20 μ mol CO₂ m⁻² s⁻¹), transpiration rate (2.10 m mol H₂O m⁻² s⁻¹), SPAD value (28.42), NDVI value (28.42) and biochemical parameters such as chlorophyll content 'a' (2.64 mg g⁻¹ fr. wt.), 'b' (0.85 mg g⁻¹ fr. wt.) and total (3.49 mg g⁻¹ fr. wt.). Whereas the next best treatment was T₂ (6-BAP @ 20 ppm) over rest of the treatments. The highest grain yield plant⁻¹ (21.55) were recorded in T₁ (NPK-19:19:19 @ 20000 ppm) than other treatments. It was concluded that D₁ (Normal DOT) was the best situation and among foliar application of different agrochemicals T₁ (NPK-19:19:19 @ 2.0%) was found to be the best treatment, it was ideal and economically feasible at 35,45 DAT and at 55 DAT.

Keywords: Influence, regulators, physiological, biochemical, parameters, situation, Days after Transplanting (DAT) and Date of Sowing (DOT)

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Principal Component Analysis for Assessment of Variability in Yield and Yield Contributing Characters in French Bean (*Phaseolus vulgaris* L.) Genotypes

Himani Rana^{1*} and D.K. Rana²

1,2 Department of Horticulture, Hemwati Nandan Bahuguna Garhwal University, Srinagar (Garhwal), Uttarakhand, India. 246174.

A total of 51 French bean (*Phaseolus vulgaris* L.) genotypes were evaluated for pod yield and its contributing traits under a randomized block design and variability was assessed through principal component analysis (PCA). PCA concentrated variability in the first six principal components. The total variance explained with the first six PCs was 81.03%. Eigenvalues for significant PCs ranged from 8.44 (PC1) to 1.23 (PC6). The first two PCs used for constructing biplot graphs explained 52.73%. The first PC contributed 40.19% of the total variation mainly contributed by pod yield, pod weight, number of pods per plant, number of flowers per plant, pod length, and seed index. The second component explained 12.53% of variation contributed largely by days to first germination and days taken to 50% germination, while the third, fourth, fifth, and sixth components explained 9.41, 7.01, 6.05, and 5.84 % of variation respectively. In the present study, nine variables including pod yield/plant, pod yield/ plot, pod yield/ha, pod weight, number of flowers per plant, number of pods per plant, seed index, pod length, and days taken to first flower contributed above the expected average to the variability in PC1 and PC2. Based on the factor loading graph, pod yield per plant showed a strong correlation with the number of pods per plant, pod weight, number of flowers per plant, number of pods per cluster, pod setting percentage, seed index, pod length, and pod width while negatively correlated with days taken to first flower and number of pickings. The genotype grouping and pattern in the biplot revealed that all the local genotypes (LC-1 to LC-10), **Contender**, **IC-556461**, and **EC-531136** aligned with traits such as pod yield/plant, pod yield/plot, and other **yield-related traits**, which implies these genotypes could have desirable productivity traits, making them potentially valuable for breeding.

Key words: French bean, Randomized complete block design, Principal component analysis, Biplot

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Effect of Commonly Available Food Sources on Extension of Vase Life of Gladiolus (*Gladiolusgrandiflorus* L.) cv. Swarnima

Sowjanya, K. KaladharBabu, P. Prashanth, S. Praneeth Kumar

Sri KondaLaxmanTelangana Horticultural University, Telangana
asowjanya1512@gmail.com

Longevity of cut flowers is one of the main challenges of florists today. To enhance the vase life of cut gladiolus instead of using chemical preservatives commonly available food sources T₁ : Sugar - 10 g/l, T₂: Sugar - 20 g/l, T₃: Coconut Water - 25%, T₄ : Coconut Water - 50%, T₅ : Sprite - 50 ml/l, T₆: Sprite -100 ml/l, T₇: Honey - 5%, T₈ : Honey - 10%, T₉ : Control (Distilled water) were used. Among all the food sources used in study, sprite 100 ml was best in extending the vase life of gladiolus spikes. This treatment recorded best results in respect of high water uptake (22.62, 14.62, 11.29 g), transpirational loss of water (20.82, 13.00, 10.28 g), water balance (6.80, 6.41, 6.01 g), maximum per cent of fresh weight change (106.69, 98.73, 89.36 %), low optical density of vase solution (0.037, 0.042, 0.054 nm) on 2nd, 4th and 6th day of vase life, respectively and less number of days for first floret opening (1.69 days), greater diameter of basal floret (10.33 cm) and maximum longevity of basal floret (2.63 days), maximum number of florets opened on spike when basal floret is fresh (2.33) and maximum number of florets opened per spike at the end of vase life (10.89), highest vase life (9.33 days) and floret opening percentage (94.69 %) was registered in Sprite 100 ml. Whereas high benefit cost ratio was recorded in Sugar 20 g (3.30).

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Comparative Study of Enzymatic Hydrolysed Collagen Peptide from Fish Bone Using Conventional and Microwave Assisted Extraction

P.M Aiswarya , P.K. Binsi , Arshaya Rajesh , U Parvathy

ICAR - Central Institute of Fisheries Technology, Cochin

A large amount of fish by-products such as skin, scales, bones etc are obtained as apart of processing. Most commonly they are dumped into the sea thereby causing threat to the environment. Dealing out of these bones for hydrolyzed collagen extraction will helps in dropping the fish waste which is a major concern of the fish processing industries. This Study aims on the conventional and microwave assisted extraction of collagen peptide from fresh fish bone. Enzymatic hydrolysis was carried out using conventional system and microwave digester. Protease from *bacillus licheniformis* at 0.5% concentration was used for the enzymatic hydrolysis of collagen under controlled conditions. The influence of extraction method was analysed for different parameters. Conventional extraction was done in a water bath and microwave extraction was performed using a microwave digester. Outcomes suggest that microwave assisted enzymatic hydrolysis of collagen gives better yield than conventional extraction procedure, as it is less intensive and better yielding linear relationship is obtained between the degree of hydrolysis and concentration of protein in the final product. Therefore, in this study it is proved that enzymatic hydrolysis of collagen using microwave assisted method is more recommended than conventional procedure.

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Evaluation of Different Botanicals on *F. oxysporum* at Different Concentrations by Poison Food Technique

AyushGupta, Suresh Kumar Sahu and Rahul Sahu

Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya,
Raipur- 492012 (C.G), India. ayush56837@gmail.com

Fusarium oxysporum is a soil borne fungal pathogen responsible for significant losses in various crops worldwide. The present study was undertaken to evaluate the antifungal efficacy of different botanicals against *F. oxysporum* using the poison food technique at varying concentrations. In this method, ten botanicals were evaluated against *F. oxysporum* f. sp. *glycines* at three different concentrations viz., 5%, 10% and 15%. At 5 %, 10% and 15 % concentration, maximum inhibition per cent was recorded in rhizome of *Zingiber officinale* (40.00 %), (49.63 %) and (58.52 %) respectively whereas minimum inhibition per cent observed in *Ocimum* sp. (1.85 %), (4.82 %) and (10.37 %). The inhibitory effect increased with higher concentrations. This study highlights the potential of botanical extracts as eco-friendly alternatives to synthetic fungicides for managing *F. oxysporum* in agricultural systems.

Keywords: *Fusarium oxysporum*, botanicals, poison food technique, antifungal activity, eco-friendly disease management

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Evaluation of Kraft Black Liquor as an Eco-friendly Wood Preservative for *Populus deltoids*

Krishna Kant Shukla, Dr. Shailendra Kumar and Dr. Praveen Kumar Gupta

¹*PhD Scholar, (Wood Seasoning Discipline), Forest Products Division
Forest Research Institute, Dehradun*

²*Scientist-D, (Wood Seasoning Discipline) Forest Products Division
Forest Research Institute, Dehradun*

³*Scientist-G, (Cellulose and Pulp Discipline), Forest Products Division
Forest Research Institute, Dehradun*

This study investigates the potential of kraft black liquor, a by-product of the pulping industry, as an environmentally friendly wood preservative. Wood blocks of *Populus deltoides* were treated using two methods—dipping and vacuum pressure impregnation (VPI)—at 8.71% and 17.42% concentrations of black liquor. Physical properties such as weight percentage gain (WPG), bulking rate (BR), density increase, swelling coefficient, water absorption, and water uptake coefficient (WUC) were evaluated. The VPI method, especially at higher concentration, showed superior preservation performance, with enhanced chemical uptake and improved resistance to moisture. All treated samples outperformed untreated controls in dimensional stability and water repellency. These findings highlight black liquor's potential as a sustainable alternative to conventional wood preservatives.

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Seed Quality Dynamics in Drought-Tolerant and Susceptible Rice (*Oryza sativa* L.) Cultivars

Nand Lal Meena^{*a,b}, Rakesh Bhardwaj^b, Ajit Singh^a, Chirag Maheshwari^a, and Aruna Tyagi^a

^aDivision of Biochemistry, ICAR-Indian Agricultural Research Institute, New Delhi-110012, India

^bDivision of Germplasm Evaluation, ICAR-National Bureau of Plant Genetic Resources, New Delhi-110012, India; *Correspondence: nd.iari09@gmail.com

This study explored the effects of drought stress on the metabolome, proteome, and nutritional indices in the grain and bran of Nagina 22 (N22; drought-tolerant) and Indica rice 64 (IR64; drought-sensitive). Metabolomic profiling revealed that N22 grain and bran had more significantly upregulated metabolites than IR64 under drought. Secondary metabolites, such as phenols, flavonoids, and anthocyanins, were upregulated more in the bran of N22 and IR64 than their grain fractions. Protein profiling revealed upregulated proteins associated with glycolysis, starch, sucrose metabolism, and defence in N22. KEGG analysis showed carbohydrate metabolism-related proteins were prominent in grains of both genotypes. Genes associated with grain filling and sucrose transport (e.g., SUS, SUT, INV, SWEET, Snrk2) were significantly upregulated in N22 under drought. Except for carbohydrate and amylose content, bran had higher concentrations of proximate nutrients, minerals, and amino acids than grains in both genotypes. Protein content ranged from 9-11% in grain to 13-15% in bran, whereas amylose was higher in N22 grain (20.44%) compared to bran (4.84%) under drought. N22 accumulated significantly higher levels of amino acids and carbohydrates in bran and grain than IR64. Proline accumulated at a higher concentration (2.732 g/100g) than other amino acids in N22 under drought. Fatty acids, such as palmitic, linoleic, and oleic acids dominated, whereas myristic and linolenic acids had the lowest content in grain and bran of both genotypes. IR64 grain under drought exhibited the maximum concentration of micronutrients (Fe, Mn, Zn, and Cu). Macronutrients (Na, Ca, K, Mg, P) increased under drought in both genotypes. Phytohormones (ABA, IAA, Zeatin) increased under drought and the increase was more in N22 grain and bran than IR64. A strong interaction between starch-lipid-protein was observed under control, which loosened under drought in both grain and bran. Bran showed stronger starch-lipid interactions due to higher lipid content than grains. This study provides insights into drought-responsive compounds, proteins, and genes that can serve as molecular targets for breeding drought-tolerant nutritionally enhanced rice varieties, contributing to sustainable agriculture.

Keywords: Rice. Drought. Metabolites. Proteomics. Nutrition

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Climate Change and Simulation Impact on Agricultural Cereal and Pulse Crops of India

Dr. Aakriti Chauhan

Assistant Professor, Department of Agriculture

NRI Rd, V I T Campus, Sector-36, Karolan Ka Barh, Seesyawas, Jaipur, Rajasthan 303012

Climate change has emerged as a critical factor influencing agricultural productivity, particularly in a climate-sensitive country like India, where agriculture depends heavily on the monsoon and ambient temperature conditions. Over the past few decades, India has witnessed rising mean temperatures, erratic rainfall, increased frequency of extreme weather events, and shifts in agro-climatic zones, all of which have direct and indirect implications on crop yields. This study evaluates the impacts of climate change on India's major cereal crops (rice, wheat, maize) and pulse crops (chickpea, pigeon pea, lentil) using simulation-based approaches through established crop models such as DSSAT (Decision Support System for Agrotechnology Transfer) and APSIM (Agricultural Production Systems Simulator). Observational data from the past ten years (2013-2023) and future climate projections under RCP 4.5 and 8.5 scenarios were analyzed. Simulation outputs indicate that, Rice yields could decline by 6–12% by 2050 due to increased night temperatures and altered monsoon patterns. Wheat, particularly in northern India, is projected to suffer a 10-25% yield reduction under a 2°C warming scenario due to heat stress during grain filling. Maize yields may decrease by 15-20%, especially in rainfed areas, owing to both temperature rise and moisture stress. Among pulses, chickpea and lentil show significant yield declines (up to 20%) due to higher susceptibility to terminal heat and drought. Pigeon pea, while relatively drought-tolerant, also experiences yield reductions under extreme rainfall variability. Adaptation strategies tested in simulations-such as shifting sowing dates, using heat/drought-resilient crop varieties, and improving irrigation practices-have shown to partially offset yield losses by 10-30%, depending on the region and crop. The results underscore the urgent need for mainstreaming climate-resilient agriculture through precision farming, breeding programs, and region-specific adaptation planning. Simulation models serve as essential tools to forecast future vulnerabilities and guide policymakers in implementing evidence-based strategies to secure India's food and nutritional security under changing climate regimes.

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Enhancing Lemon Productivity and Quality: A comprehensive Study on Foliar Spray of Zinc, Boron and Magnesium in PAU Baramasi Lemon-1

Amanpreet Kaur^{1*}, Maninderjit Singh¹

Veerpartap Singh² Arshdeep Singh¹

¹P.G. Department of Agriculture (Horticulture), Khalsa College, Amritsar-143002, India

²Krishi Vigyan Kendra, Samrala, Punjab Agricultural University, Ludhiana-141004, India

*Corresponding author- ammupreetkaur2009@gmail.com

The present investigation entitled “Effect of foliar application of Zn, B and Mg on fruit yield and quality of lemon (*Citrus limon* Burm.) cv. PAU Baramasi Lemon-1” was carried out in the orchard, Department of Agriculture, Khalsa College Amritsar during the year 2022-2023. The experiment was designed in a randomized block design with ten treatments, each replicated three times, and the results were statistically analyzed at a 5% significance level ($p \leq 0.05$). The selected lemon plants were treated with different concentrations of micronutrients, including Borax (0.2%, 0.4%, and 0.6%), ZnSO₄ (0.2%, 0.4%, and 0.6%), and MgSO₄ (0.2%, 0.4%, and 0.6%), while the control was sprayed with water. Fruits were harvested from each treatment at color break stage, when the fruits attained a yellow blush. The harvested fruits were analyzed for both physical and biochemical attributes in terms of fruit yield and quality. The results indicated that the foliar application of Zn, B and Mg significantly influenced the yield and quality of PAU Baramasi Lemon-1. Among the treatments, the foliar application of 0.6% Borax proved to be most effective in enhancing fruit size (length and breadth), fruit weight, fruit volume, specific gravity, juice percentage, number of fruits per plant, and yield per plant. Additionally, the foliar application of 0.6% ZnSO₄ resulted in increased total soluble solids (TSS), TSS:TA ratio, and ascorbic acid content, while reducing the acidity and juice pH in the lemon fruits.

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Perception of Food Labelling Among Allergic and Non-Allergic Consumers

Harleen kaur¹ and Thukral Bhawana²

¹Student, department of nutrition and dietetics, UIAHS, Chandigarh university, Punjab.

²Faculty, department of nutrition and dietetics, UIAHS, Chandigarh university, Punjab
bhawana.e8633@cumail.in (B. Thukral) and leenkaur2001@gmail.com (H. Kaur)

Food processing industry has made a rapid growth in India today and the government has introduced several regulations such as the Food Safety and Standards Act, 2006, which requires labeling of all foods based on the Food Safety and Standards (Packaging and Labelling) Regulations, 2011. Labelling acts as an intermediary between producers and consumers. Labelling occasionally misguides consumers and may result in loss of time, interest, and awareness. FSSAI ensures that the food labelling remains up to date, uniform, and informative but there are quite a number of challenges the consumer has to confront. One of the most urgent concerns is the growing number of diet-related public health problems including obesity, high blood pressure, and diabetes, etc. Consumers require correct and transparent labelling information to enable them to make informed choices. Indian regulations are more lenient and not as elaborate as those in developed Western countries. The effort has been made to look at the approach of both allergic and non-allergic consumers as awareness increases and people in emerging economies look for more information. The government and other organizations have used various methods to create awareness, but the findings from this study indicates that respondents use social media and the internet for information dissemination. Consumers require correct and transparent labelling information to enable them to make informed choices. The effort has been made to look at the approach of both allergic and non-allergic consumers as awareness increases and people in emerging economies look for more information. The government and other organizations have used various methods to create awareness. Modified consumers make the manufacturing date, expiry date, and list of components their top priority. The media is not playing their role responsibly and neglecting their responsibility to bring before the people the right product quality with the right labelling information. This study also draws attention to the problems faced by allergic consumers and their sentiments on Indian food labels while buying food products in the market. It emphasizes the extent of allergy-friendliness of our food labeling and probes the problems facing allergic customers because of ambiguous and unclear food labels.

Key words- Allergic, Non- allergic, Food labelling, Food safety and standards, FSSAI

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Exploring Wild *Cicer* Accessions for Enhanced Cold Tolerance: A Screening Approach

Sarbjeet Kaur, Deeksha Padhiar, Harsh Nayyar

Department of Botany, Panjab University, Chandigarh, India

Ksarbjeet518@gmail.com; deekshu.prhr@gmail.com; harshnayyar@hotmail.com

Chickpea (*Cicer arietinum* L.) is a legume crop grown in semi-arid and temperate regions, yet it is highly sensitive to low-temperature stress, particularly during the early vegetative and reproductive stages. The narrow genetic base of cultivated chickpea has limited its adaptability to abiotic stresses, including cold. Wild *Cicer* species represent a rich reservoir of genetic diversity and have great potential to enhance climate resilience in chickpea breeding programs.

In this study, a comprehensive screening of wild *Cicer* accessions, encompassing species from the secondary and tertiary gene pools, was conducted to evaluate their cold stress tolerance. The accessions were subjected to low-temperature conditions during their reproductive stages under controlled environmental conditions. A combination of various growth and physiological parameters (chlorophyll content, stomatal conductance, relative leaf water content, electrolyte leakage, etc.), floral biology traits, biochemicals (cryoprotectants, antioxidant enzyme activity), yield parameters, and anatomical traits were assessed. Microscopic studies were also performed to examine leaves (trichome and stomatal density), male and female reproductive structures under cold stress.

Preliminary findings revealed substantial variation in cold tolerance among wild accessions. Cold-tolerant and cold-sensitive accessions of *Cicer* sp. exhibiting superior physiological and anatomical responses, including stable membrane function, higher antioxidant activity, and minimal tissue damage, were selected for further metabolic studies. These results indicate that wild *Cicer* species harbor adaptive traits that can be strategically introgressed into elite chickpea cultivars to enhance cold resilience. Therefore, this study highlights the importance of wild genetic resources in broadening the genetic base of chickpea and underscores their role in future pre-breeding and genetic improvement efforts aimed at mitigating the effects of climate change.

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Assessing Genotypic Variability in Chickpea (*Cicer arietinum*) Under Cold Stress: Insight into Biochemical and Reproductive Traits

Deeksha Padhiar, Sarbjeet Kaur, Harsh Nayyar

Department of Botany, Panjab University Chandigarh, India

deekshu.prhr@gmail.com, ksarbjeet518@gmail.com, harshnayyar@hotmail.com

Chickpeas are particularly vulnerable to cold stress during their reproductive stages, resulting in a marked decline in pod formation due to impaired reproductive success. This study focused on understanding the differential responses of reproductive organs to cold stress. Further, investigating the role of oxidative stress and antioxidant defense mechanisms, and elucidating how these factors impact reproductive function. Seeds of contrasting chickpea genotypes—cold-tolerant (ICC 17258, ICC 16349) and cold-sensitive (ICC 15567, GPF 2)—were sown outdoors in early November under favorable conditions (mean day/night temperatures of 25.5/15.4°C). At 50 days after sowing, plants were exposed to cold stress (13/7°C, 12 h light/dark) in walk-in growth chambers. Cold stress significantly increased membrane damage and reduced cellular viability in both anthers and ovules, with more severe effects observed in cold-sensitive (CS) genotypes. Anthers showed greater oxidative damage—particularly at the anthesis stage (stage 2)—as evidenced by elevated levels of malondialdehyde and hydrogen peroxide. Cold-tolerant (CT) genotypes exhibited enhanced antioxidant activity under stress, particularly at the pre-anthesis stage (stage 1), although responses varied among genotypes. Antioxidant activity also showed strong positive correlations with key reproductive parameters, such as pollen germination and ovule viability. Overall, the study revealed organ-specific and genotype-dependent responses of reproductive tissues to cold stress, offering critical insights into the underlying mechanisms of cold tolerance in chickpeas. These findings provide a valuable foundation for breeding strategies that aim to enhance reproductive resilience and yield stability under low-temperature stress.

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Gamma-Aminobutyric Acid profiling (GABA) and Standardization of *in-vitro* Regeneration protocol in Tomato (*Solanum lycopersicum* L.) Genotypes

D. Ram Babu^{1*}, Zakir Hussain¹, Praveen Kumar Singh¹, Suman Lata¹,
Alka joshi², Navinder Saini³ and T. S. Chaithra⁴

ICAR- Indian Agriculture Research Institute, New Delhi -110012, India

¹Division of Vegetable Science, ²Division of Post Harvest Technology, ³Department of Genetics and Plant Breeding, ⁴Division of Fruit Science.

Corresponding author email: yrams1717@gmail.com

This present study focused on assessing Gamma-aminobutyric acid (GABA) levels in seventy *kharif* tomato genotypes to highlight its importance in neurotransmission. The experiment was performed at ICAR- Indian Agricultural Research Institute, New Delhi during 2021-2022. The study showed stable GABA levels in 70 tomato genotypes throughout the ripening, interestingly yellow and orange tomato genotypes K-69 and K-70 showed stable GABA throughout the ripening stage. In this experiment, efforts were also made to *in-vitro* regeneration methods, emphasising proper sterilization technique, among the different sterilization techniques, NaOCl 2% for 10 min showed less contamination. Treatment T₇ (BAP 2 mg/l, NAA 1.5 mg/l, IBA 0.5 mg/l) proved best for callus induction while T₅ (BAP 1 mg/l, NAA 0.5 mg/l, IBA 2 mg/l) showed maximum shoot multiplication rate and average number of roots per shoot. Overall, the study revealed that critical factors including explant length and growth regulators in achieving successful tissue culture outcomes this will also contribute to the broader understanding of plant tissue culture techniques and their potential applications in improving crop traits and cultivar development and also emphasizing the health benefits associated with GABA in tomato.

Keywords: GABA, Different growth stages, Tomato fruits, *In-vitro*, Nodal explants, Callus

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Transformative Response of Combined Humic Acid and Seaweed Extract Foliar Applications on Custard apple Growth, Fruit setting and Yielding Attributes

Anju Yadav*, Rupa Ujjwal, Prerak Bhatnagar

Department of Fruit Science, College of Horticulture and Forestry Jhalawar (Raj)

Email: yadavaj109@gmail.com

This study aimed to evaluate the response of foliage application of different levels of humic acid at 1000 ppm, 2000 ppm, 3000 ppm and seaweed extract at 1000 ppm, 2000 ppm, 3000 ppm on plant growth, fruit setting and yield of custard apple cultivar Balanagar. Our result show a significant impact on number of nodes/shoot, number of shoots/branch, relative humidity, female flowers/branch, fruit set, fruit retention, yield/plant, fruit weight, vertical fruit diameter, TSS/Acid ratio and lowest count of stony fruits and rind weight was observed under HA @ 3000 ppm + SWE @ 2000 ppm treated plants. On the flip side the highest increase in canopy volume, horizontal fruit diameter, pulp weight, pulp %, pulp:seed ratio and lower rind % was noted in HA@3000 + SWE@ 1000 ppm treated plants. This finding demonstrates the potential of foliar application as a sustainable and effective approach to improve production and quality of fruits of custard apple.

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Preparation and Performance Evaluation of Liquid Hand Wash

Shilpa Channalli P.¹, Roopa Kurbett² and Dr. Veena S. Jadhav³ and ShilpaChannalli P.

*M.Sc. Department of Family Resource Management, College of Community Science,
University of Agricultural Sciences, Dharwad-580 005, Karnataka, India.
Email-shilpachannallip@gmail.com Ph. No.: 8792070523*

The study focused on the preparation and performance evaluation of liquid hand wash formulations (F-I and F-II) to develop effective, safe, and environmentally friendly hand hygiene solutions. Conducted during 2015–16 in Dharwad, Karnataka, the research involved the laboratory development of liquid hand wash, followed by quality characteristics assessment and antimicrobial analysis. The formulations were prepared using Sodium Lauryl Sulphate (83%) as the primary surfactant for effective foaming and cleaning, along with Ethylene Glycol Mono Sulphate (17%) as a secondary surfactant to enhance cleaning efficiency and skin-conditioning benefits. Perfume and color were added in sufficient quantities to improve sensory attributes.

Quality analysis revealed that both formulations exhibited favorable physical and chemical properties, including a neutral pH (7.0–7.2), good solubility in water and organic solvents, consistent surface tension (0.10 dynes), and stable foam height (0.25 cm), indicating effective cleansing and foaming capabilities. The stability tests showed that the formulations remained stable over three months, with no adverse effects observed under hard water conditions. Both formulations demonstrated good cleaning action and nil alcohol insoluble matter, confirming the absence of harmful residues.

Antimicrobial analysis highlighted the strong antibacterial properties of both formulations against common pathogens, *Staphylococcus aureus* and *Escherichia coli*. The minimum inhibitory concentrations (MICs) were 1.56 µl for *Staphylococcus aureus* and 6.25 µl for *Escherichia coli*, demonstrating effective microbial reduction. The study concluded that the developed liquid hand washes possess excellent quality characteristics and antimicrobial efficacy, making them suitable for daily hygiene use. These findings contribute to the advancement of safe, efficient, and sustainable hand hygiene products, addressing both health and environmental concerns.

Keywords: Liquid Hand Wash, Formulation, Antimicrobial Analysis, Sodium Lauryl Sulphate, Cleaning Action, Hygiene.

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Altitudinal Variations in Soil Physio-chemical Properties in Different Agroforestry Systems of Garhwal Himalaya, India

Ng Manitombi Devi^{a*}, Himshikha Gusain^b

^aPhD scholar ^bAssistant professor

*Department of Forestry, Hemvati Nandan Bahuguna Garhwal University Srinagar,
Pauri Garhwal, Uttarakhand 246174*

**Corresponding author e-mail: dmani4481@gmail.com*

Agroforestry systems significantly influence soil properties, which are important indicators of soil health. The study was carried out to assess soil properties viz., moisture content, water-holding capacity, soil texture, bulk density, and chemical properties like pH, SOC, SCS and SOM in three prominent agroforestry systems including agrihorticulture (scattered fruit crops), agrisilviculture (tree on bunds), and agrisilvihorticulture (homegarden) of Western Himalayas, Uttarakhand. Soil samples were collected from three elevations (800-1300m, 1300-1800m, and above 1800m) under agroforestry systems at two depths (0-15cm, 15-30cm). The results show that altitude significantly influences soil texture, with sand content increasing and clay content decreasing with elevation. Higher altitudes exhibited greater soil moisture and organic matter retention. The Agri-silvi-horticulture system, particularly at higher altitudes, demonstrated superior water-holding capacity, lower bulk density, and higher SOC and SOM, making it the most effective for improving soil quality. Conversely, the Agri-horticulture system at lower elevations had higher bulk density and lower organic carbon content. Soil organic carbon stock (SCS) declined with depth, with the highest values observed in the topsoil. This study emphasizes the potential benefits in enhancing soil fertility, moisture retention, and carbon sequestration, emphasizing the importance of selecting appropriate systems for adapting to climate change and promoting sustainable land management in the Himalayan region. The findings provide valuable insights for improving agroforestry practices in the region to promote soil health and agricultural productivity.

Keywords: Agroforestry, soil, physical chemical properties, carbon sequestration, climate change, sustainable management.

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Status of ornamental *Musa* species in Arunachal Pradesh, India

Walung Songthing^{*1}, Govinda Pangging¹ and S. Sureshkumar Singh²

¹Department of Forestry, North Eastern Regional Institute of Science and Technology (Deemed to be University), Arunachal Pradesh – 791109

2. Department of Botany, School of Life Sciences, Manipur University, Canchipur, Manipur – 795003

*Email: walungsongthing01@gmail.com

In Arunachal Pradesh, *Musa* species are widely distributed, and few species have been recognized as extinct while new species continue to occur. The main objective of this study was to revise and update the distribution and the occurrence of wild ornamental *Musa* species in Arunachal Pradesh. An in-depth literature review was conducted to determine the location of occurrence, and many field visits were conducted in different parts of Arunachal Pradesh. The findings recorded 13 wild ornamental *Musa* species, 4 varieties and 2 unidentified species from the state. An extinct species, namely *Musa sanguinea* Hook.f. was also rediscovered from the state. Specific locations with the place of occurrence were also documented. These findings suggest that Arunachal Pradesh is suitable for ornamental *Musa* occurrence and may be considered as one of the centers of *Musa* origin.

Keywords: *Musa* species, distribution, occurrence, unidentified, Arunachal Pradesh.

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Performance Evaluation of Plane Pipe, Finned Pipe and Air-Cooling Unit Type Evaporators For Potato Cold Storage

Nimai Das Bairagya^a, Dr. Manoj Kumar Chourasia^b

^aAssistant professor, Department of Agricultural Engineering, Haldia Institute of Technology, Haldia, West Bengal, India; Email: nimaidasbairagya@gmail.com

^bProfessor & Head in Department of Food Engineering, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India
Email: chaurasia.manoj.kr@bckv.edu.in

Potato is a semi-perishable agricultural commodity in nature. To extend their post-harvest availability, Proper post-harvest management is important to extend the marketable life of harvested commodity. In the refrigeration system, an evaporator, which acts as a heat exchanger, absorbed the heat from the outside or air side area (as a result of it refrigerant convert liquid to vapour) and decrease the temperature of commodity. In a typical Indian potato cold storage, three types, viz. plane pipe, finned pipe and air-cooling unit type evaporators are used. In the present work, a comparison based on performance evaluation of various heat transfer parameters, is done among the three types of evaporators. It was found that plane pipe evaporator required enormously larger length and hence, it is costliest. For the same capacity, attachment of fins over plane pipe increases the outside surface area and hence, needs a comparatively lesser length. It also decreases the total number of pipes required for a given application which also reduces overall equipment size. It was estimated that one finned pipe replaces six or more bare pipe at less than 1/3 the cost and 1/4 the volume. The minimum value of rating factor was calculated as 11.8 W/°C per meter length of finned pipe evaporator of having design parameters of 20 mm pipe diameter, 18 fins per foot of 15 mm fin height while it was maximum of 23.6 W/°C per meter length for 32 mm diameter pipe having 24 fins per foot of 25 mm height. A comparison of three types of evaporators for a 5,000 MT capacity cold storage also discovered the fact that the finned pipe evaporator seems to be more technoeconomically sound in comparison to plane pipe and air-cooling units for the potato cold storage.

Key word: Evaporator, Plane pipe evaporator, Finned pipe evaporator, Air cooling units, Ratingfactor, Finefficiency, Performance parameters.

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Challenges and Empowerment of Rural Women in the Dairy Sector

Himanshi^{1*} and Alka Yadav²

^{1,2}Research Scholar, Department of Extension Education and Communication Management
Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004

*Corresponding author's email: himanshi.verma2001@gmail.com

Women play a crucial role in the dairy industry, often dedicating significant time and effort without receiving much recognition for their work. This study aims to highlight the essential but often underappreciated role of women in dairy farming including both the challenges they face and the empowerment opportunities offered by the dairy sector. The role of rural women in dairy farming is very significant since it contributes as a primary source of income and women are mainly responsible for indoor activities like milking, feeding, and cleaning the shed. Despite accounting for approximately 64 per cent of total dairy labour, their participation in outdoor activities including fodder cutting and marketing of milk and milk products is low. Women face numerous barriers including social and cultural constraints, limited access to land & credit, skill & knowledge gaps, health risks due to intensive labour and exposure to zoonotic diseases. To boost rural women's involvement in dairy farming, it is essential to provide support through both public and private initiatives. Additionally, government initiatives like STEP (Support to Training and Employment Programme) and Women Dairy Cooperative Societies (WDCs) offer support. But there is a need for more targeted programs focusing on financial inclusion, training, and appropriate technology. The presence of women in dairy farming has yielded fruitful results in terms of economic benefits, social upliftment, improved nutrition and enhanced decision-making within households. To ensure meaningful empowerment, legal reforms, access to training, supportive involvement of men, and labour-saving technologies are essential. Ultimately, this study affirms how dairy farming can empower rural women, demand structural and policy changes to acknowledge their contributions and make access more equitable.

Keywords: Participation, Support, Decision-Making, Contributions, Equitable.

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Solid-solution Partitioning of Zinc in Soil at Different Growth Stages of Rice Under Integrated Nutrient Management-based Conservation Agriculture

Diksha^{1,2*}, Raj Mukhopadhyay²

¹CCS Haryana Agricultural University, Hisar-125004, Haryana

²ICAR-Central Soil Salinity Research Institute, Karnal-132001, Haryana

*Corresponding author: sarohadiksha1997@hau.ac.in

Zinc (Zn) is an essential micronutrient for humans, plants and animals. The soil solution and exchangeable Zn react with clay minerals, organic matter and metal oxides present in the soil system to form different fractions. These fractions vary in their mechanisms of formation which govern the solubility and bioavailability of Zn for plant uptake. The present study was carried out to understand the effects of integrated nutrient management and conservation agriculture practices in rice on the distribution of different fractions of Zn in surface soils (0-15 cm) at different growth stages of rice under different management scenarios during the third rice-wheat cropping cycle. The management scenarios include, conventional rice-wheat cropping (Sc-1), conventional + *in-situ* green manuring and residue management (Sc-2), T2 + 100 % organic nutrient management (Sc-3), T2 + organic (50%) and inorganic (50%) nutrient management (Sc-4), and conservation + inorganic nutrient management (Sc-5). The surface soil was silt clay loam, neutral with low organic carbon (0.49%) and optimum DTPA-extractable Zn concentration (3.15 mg kg⁻¹). The concentration of available, reducible, oxidizable and residual-Zn were found *at par* in surface soils among most of the growth stages of rice under all the scenarios indicating the non-significant ($p < 0.05$) effects of tillage, *in-situ* green manuring, residue incorporation and integrated nutrient management on Zn speciation under short-term. However, the basal Zn application before rice maintained the available-Zn fraction above the critical Zn concentration ($> 0.6 \text{ mg kg}^{-1}$) till the harvest of rice. Irrespective of the growth stages, the highest average concentration of available-Zn was found under Sc-3 ($12.70 \pm 1.35 \text{ mg kg}^{-1}$), reducible-Zn under Sc-5 ($29.44 \pm 2.94 \text{ mg kg}^{-1}$), oxidizable-Zn under Sc-4 ($9.36 \pm 5.07 \text{ mg kg}^{-1}$) and residual-Zn under Sc-1 ($61.87 \pm 6.03 \text{ mg kg}^{-1}$). Residual-Zn was dominated among all the fractions. The relatively higher proportion of reducible-Zn suggests the scavenging of Zn by the freshly precipitated hydrous oxides of iron released from the reduction of sesquioxides under submergence. The study suggests that long-term adoption of such management practices might cause significant changes in the distribution of Zn fractions as different scenarios favoured the accumulation of different fractions.

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Protective Role of Silibinin in A Lipopolysachharide-Induced Mouse Mastitis Model: Suppression of Oxidative Stress, Inflammation and Mitochondrial Dysfunction

Sonam SaritaBal, Geeta Devi Leishangthem andNittin Dev Singh

Department of Veterinary Pathology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India, 141004

Presenting author- Sonam Sarita Bal, Email- sonamsarita1996@gmail.com

Mastitis is a prevalent condition impacting dairy animals worldwide. Silibinin, a natural flavonolignan *and is known to* have potent antibacterial, antioxidant, anti-inflammatory properties. This study investigates the protective effects of silibinin in a mouse model of lipopolysaccharide (LPS)-induced mastitis. Thirty lactating mice were divided into five groups (Control, LPS, LPS + SIL @ 5 mg/kgbw, LPS + SIL @ 50 mg/kgbw, LPS + Dexamethasone (positive control)). Silibinin was administered via intraperitoneal route for 7 days before LPS administration and then LPS was administered via intramammary route to induce mastitis. Different parameters like hematological, biochemical indices, including myeloperoxidase (MPO) activity, markers of oxidative, nitrosative stress, antioxidant enzyme levels, inflammatory cytokines (TNF- α , IL-6, IL-10), the transcription factor NF- κ B, and mitochondrial function indicators (citrate synthase, cytochrome c oxidase activity and mitochondrial DNA content) were assessed. In-silico modelling along with histopathological and immunohistochemical analyses were performed. LPS administration significantly elevated transcription factor activation, pro-inflammatory cytokine levels, MPO activity, oxidative stress markers and iNOS expression, while suppressing antioxidant enzymes and mitochondrial function along with mitochondrial DNA content. Histopathologically, LPS induced neutrophilic infiltration and alveolar disruption in the mammary gland. Silibinin pretreatment mitigated these effects by reducing inflammation, oxidative stress and mitochondrial dysfunction and preserving tissue architecture. These findings suggested that silibinin effectively attenuates LPS-induced mastitis in mice through modulation of inflammation, oxidative stress and mitochondrial integrity.

Keywords: Silibinin, Lipopolysaccharide (LPS), Mastitis, Oxidative stress, Mitochondrial dysfunction, Inflammation.

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Assessment of Growth and Yield Attributes of Cucumber Grown Under Two Soilless Systems of Protected Farming

Suman kumari*, Sanjay yadav

Mail ID: sumankumarimsc@gmail.com, sanjaydei84@gmail.com

Many techniques, including hydroponics, vertical farming, aeroponics, aquaponics, and others are employed in contemporary protected horticulture. It is crucial to assess high-income crops using these techniques in order to optimize their yield and lower the possibility of crop failure brought on by environmental variables in open fields. Cucumber seeds were planted in portrays for the purpose of growing the seedlings in this study. After that, one-month-old seedlings were moved into two soilless systems i.e., NFT hydroponic and aeroponic hydroponic supplied with Hogland nutrient solution that were created in the polyhouse of the Department of Botany, Dayalbagh Educational Institute, located in District Agra of Uttar Pradesh, India. Results of the study showed that cucumber plants grown under NFT hydroponic systems gave positive response in terms of growth, and yield parameters over aeroponic hydroponic system. Growth analysis under both soil-less systems was found to be supportive in terms of average plant height (162.07 cm in NFT and 129.73 cm in aeroponic), fruit weight (110.44g in NFT and 108.33g in aeroponic) and fruit size (L X Dia) 12.36 X 2.9 cm in aeroponic and 13.5 X 3.9 cm in NFT system respectively. Overall maximum fruit production was observed under NFT (2991.68g/plant) as compared to aeroponic (2506.76g/plant). Highest SPAD value (78.17) and NDVI value (0.83) were recorded at the flowering stage of the plants grown under NFT system followed by aeroponic system. Overall, NFT was found to be best system to enhanced growth, and yield parameters compared to the other tested methods.

Key words: protected environment, aeroponic hydroponic system, NFT hydroponic system, growth and yield attributes.

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Therapeutic Efficacy of Andrographolide in Lipoteichoic Acid-Induced Mouse Mastitis: Targeting Inflammation, Oxidative Stress and Mitochondrial Dysfunction

Sonam SaritaBal, Geeta Devi Leishangthem andNittin Dev Singh

Department of Veterinary Pathology, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India, 141004

Presenting author- Sonam Sarita Bal, Email- sonamsarita1996@gmail.com

Mastitis remains a significant health concern in dairy animals globally. Andrographolide, a bioactive diterpene lactone, is recognized for its strong antioxidant, anti-inflammatory and anticancer properties. This study investigates the protective effect of andrographolide in a lipoteichoic acid (LTA) induced mouse mastitis model. Thirty lactating mice were divided into five experimental groups: Control, LTA, LTA + Andrographolide (1 mg/kg), LTA + Andrographolide (10 mg/kg), LTA + dexamethasone (positive control). LTA was administered via intramammary route to induce mastitis and andrographolide was administered via intraperitoneal route for 7 days before LTA administration. Different parameters studied were hematological indices, pro- and anti-inflammatory cytokines (TNF- α , IL-6, IL-10), biochemical markers such as myeloperoxidase (MPO), oxidative and nitrosative stress markers, antioxidant enzyme activities, transcription factor i.e. nuclear factor-kappa B (NF- κ B) activation and mitochondrial function indicators including citrate synthase activity, cytochrome c oxidase levels and mitochondrial DNA content. Histopathological and immunohistochemical analyses of the mammary tissue along with in-silico studies were also conducted. LTA exposure led to elevated expression of transcription factor i.e. NF- κ B, increased inflammatory cytokine production, lipid peroxidation, nitric oxide levels and iNOS expression and decreased antioxidant enzyme (SOD, catalase, GSH, GPx) activity. These changes were accompanied by increased MPO activity, impaired mitochondrial function along with mammary injury, including neutrophil infiltration and disruption of alveolar structure as observed in histopathological analysis. Pre-treatment with andrographolide showed reduced inflammatory responses, decreased oxidative stress, recovery of mitochondrial activity and preservation of normal mammary architecture. Overall, andrographolide demonstrated a protective effect against LTA-induced mastitis by modulating oxidative damage, inflammatory signaling, mitochondrial impairment and histological alterations.

Keywords: Andrographolide, Lipoteichoic acid (LTA), Mastitis, Oxidative stress, Mitochondrial dysfunction, Inflammation.

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Analysis of Genotype by Environment Interactions Using AMMI and GGE Biplot Methods for Soybean Germplasm Lines

Monika Soni^{1*}, Manoj Kumar Shrivastava¹ and Vikrant Khare¹

*¹Department of Genetics and Plant Breeding, Jawaharlal Nehru Krishi
Vishwa Vidyalaya, Jabalpur, Madhya Pradesh, India
Email: monikasoni4456@gmail.com**

Background: Soybean breeding program face challenges due to genotype-by-environment interaction (GEI), where genotypes exhibit varying performance across different environments, complicating the identification of stable, high-yield cultivars. This study aimed to elucidate GEI's impact on soybean yield and identify genotypes with superior adaptation and yield stability across diverse environments.

Methods: Fifty soybean genotypes were evaluated over three years in a randomized block design with three replications per environment, assessing yield components and other agronomic traits. Stability performance was analyzed using general linear methods, GGE biplot, AMMI analysis, and ASV rank analysis.

Results: The GGE biplot explained 75.10% of the total variation (PC1: 30.93%, PC2: 44.8%), while the AMMI model's first two interaction principal component axes (IPCA1: 59.3%, IPCA2: 40.7%) explained the GEI variation. AMMI analysis identified G26 (JS 22-88) and G39 (JS 22-101) as the most stable, high-performing genotypes, whereas GGE biplot analysis identified G9 (JS 22-71).

Keywords: Stability, AMMI, GGE, G X E interaction, IPCA.

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Role of Artificial Intelligence in Precision Farming

Dr. Garima Khaspuria

Dept. of Agriculture, VGU, Jaipur

Artificial Intelligence (AI) is revolutionizing the agricultural sector, particularly in the realm of precision farming, by enabling data-driven, timely, and site-specific decision-making. Precision farming focuses on optimizing agricultural inputs and outputs based on real-time field variability. The integration of AI technologies such as machine learning, computer vision, neural networks, and predictive analytics has significantly enhanced the efficiency, accuracy, and sustainability of farming practices.

This study explores the multifaceted role of AI in precision agriculture, emphasizing applications such as crop monitoring, pest and disease detection, yield prediction, irrigation management, soil health assessment, and autonomous machinery. AI-driven platforms analyze large datasets from satellites, drones, sensors, and IoT devices to provide actionable insights, allowing farmers to make informed decisions regarding resource allocation and crop management.

The findings suggest that AI has the potential to minimize input costs, reduce environmental impact, and improve overall productivity. However, challenges such as data availability, high costs of AI-enabled devices, lack of digital literacy among farmers, and limited infrastructure in rural areas hinder widespread adoption. Addressing these challenges requires a collaborative approach involving government policy support, capacity-building programs, private sector investment, and research institutions.

The study concludes that AI serves as a cornerstone technology in the future of agriculture, offering innovative solutions to meet the growing global demand for food amidst climate variability and resource constraints. The successful implementation of AI in precision farming can accelerate the transition towards more sustainable, resilient, and intelligent agricultural systems.

Keywords: Artificial Intelligence, Precision Farming, Smart Agriculture, Machine Learning, Crop Monitoring, Predictive Analytics, Sustainable Farming, Data-Driven Decision Making, Agri-Tech, Remote Sensing

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Effect of Sulphur, Hydrogel, *Azotobacter* and Bio-stimulants on Yield and Economics of Mustard (*Brassica juncea L.*)

Ashish Yadav^{1*} and Sucheta Dahiya²

¹PG Student at SGT University, Gurugram

²Assistant Professor at SGT University, Gurugram

^{1*}ashuyadav768@outlook.com

A field experiment titled “Study the Effect of Sulphur, Hydrogel, *Azotobacter* and Bio-stimulants on Growth, yield and Economics of Mustard (*Brassica juncea L.*)” was conducted at Agronomy Farm, Faculty of Agricultural Sciences, Shree Guru Gobind Singh Tricentenary University, Gurugram, Haryana during the *rabi* (2023- 2024) season. The study aimed to evaluate the impact of different treatments on mustard growth, yield and economics of mustard. The experiment was laid out in a randomized block design with nine treatments: T1 (Control), T2 (100% RDF), T3 (100% RDF + 40 kg/ha Sulphur + *Azotobacter*), T4 (100% RDF + Hydrogel 5 kg/ha + 40 kg/ha Sulphur + Humic acid 5 ml/l), T5 (75% RDF + Humic acid 5 ml/l + 40 kg/ha Sulphur), T6 (75% RDF + Seaweed extract granule + Seaweed extract spray 5 ml/l), T7 (75% RDF + Humic-fulvic-potassium acid 5 ml/l), T8 (75% RDF + Hydrogel @ sowing time 5 kg/ha), and T9 (75% RDF + 40 kg/ha Sulphur + *Azotobacter*). The treatments were replicated three times. Observation was recorded on yield attributes (number of siliquae per plant, test weight), seed yield, stover yield, biological yield and economics such as gross return, net return and benefit-cost ratio (B:C ratio). Yield attributes including the number of siliquae per plant and test weight were significantly influenced by treatments. The highest siliquae (113.33 per plant) and test weight (4.66g) were recorded in T3. Test weight among treatments T5, T6, T7, T8 and T9 was significantly at par. Seed yield and stover yield were also significantly impacted by the treatment. The highest seed yield (2,240 kg/ha) and stover yield (7,518.33 kg/ha) were recorded under T3, while the lowest yield was observed in control treatment. The grain yield reduction in other treatments varied between 2.36% and 6.56% compared to T3 except for the control which exhibited a drastic 63.16% reduction. Economic analysis revealed that T3 provided the highest net returns (89, 236 Rs. ha⁻¹) making it the most profitable treatments. Other treatments showed varying degree of economic feasibility but none outperformed T3 in terms of cost effectiveness and return on investment. The study demonstrated that application of 100% RDF + 40 kg/ha Sulphur + *Azotobacter* (T3) significantly improved yield attributes, seed yield and economic returns in mustard cultivation. Based on these finding, it is recommended that farmers in Southern Haryana adopt these treatments as part of their mustard cultivation package to maximize productivity and profitability. The inclusion of sulphur (40 kg/ha) and *Azotobacter* inoculation enhances nutrient availability resulting in superior crop performance and financial grains.

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Vertical farming and Organic Farming: Options for Ensuring Food Sustainability for Growing Population

Beerendra Singh^{1*} and Jitendra Singh²

¹Asst. Professor-cum-Jr. Scientist (Soil Science), IRS, Bikramganj (Rohtas)

²Asst. Professor-cum-Jr. Scientist (Soil Science), VKSCOA, Dumraon (Buxar)

Bihar Agricultural University, Sabour, Bhagalpur (Bihar)

*Corresponding author's Email- beerendrasoil@gmail.com

The most difficult task of agricultural science nowadays is to ensure continuous and sufficient food for the burgeoning population. Urban areas around the world have recorded significant population growth. This growth has led to growing concerns about changes in dietary habits and food quality. Here, food quality refers to the optimal food level used in the production of harvest and the minimization of chemicals (pesticides/fertilizers). Agriculture is also asked to restore environmental transport caused by the critical/in discriminatory use of chemicals in agriculture. Along with these issues, the growing demand for fuel is required to maintain a rapidly growing economy. The environmental threats of dependence on chemical fertilizers and pesticides to improve productivity or pest control are important limitations affecting global food production. These trends suggest that new innovations in agriculture are inevitably needed and that these innovations should be integrated into mainstay agriculture. Vertical agriculture can generally be defined as a system of commercial agriculture in which plants; animals, fungi, and other living organisms are grown by stacking them vertically for food, fuel, fiber, or other products or services. Vertical farming is a large-scale agriculture in urban high-rise structures. Vertical and organic farming are areas of research to combat these limitations. Vertical farming uses vertical stacks of farms. Furthermore, the technology is suitable for a rapidly growing global urban population, as the requirements for food supply from cities can be met and the transportation costs and environmental degradation caused by fuel can be reduced. Organic farming, on the other hand, is environmentally friendly as it is based on the principle of minimizing chemical inputs in agriculture. Therefore, these technologies can be used to improve production and productivity to meet growing demand for food. Thus, in conclusion changing demographic trends and technological advancements are delivering new innovations in the field of agriculture. These emerging technologies are needed to be used judiciously to meet the growing demands of modern agriculture. These farming systems can be adopted as the viable options for the traditional agriculture to meet the changing demands and needs of human beings.

Keywords: Agricultural science, urban agriculture, vertical farming, organic farming, sustainability, urban population

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Agroforestry in Agriculture: Building a Sustainable Forestry Pathway

Babulal Choudhary and Arjun Lal Choudhary

Assistant Professor, Department of Agriculture, Vivekananda Global University, Jaipur

Shifting cultivation, an ancient and widespread agroforestry practice, integrates trees with herbaceous crops over time, historically maintaining ecological stability. However, population pressures and competing land and labor demands have driven traditional swidden systems toward predictable intensification processes. As an indigenous agroforestry method, shifting cultivation isn't replaced by scientific agroforestry but is systematically restructured into more intensive, sustainable, and politically feasible land-use forms when traditional systems require adaptation. Various agroforestry options emerge at different intensification stages of swidden systems. Analyzing evolutionary patterns of shifting cultivation provides a framework for identifying suitable agroforestry interventions and development pathways. Proposed technologies focus on high-potential agroforestry practices for 'main sequence' swidden systems, including 'integral taungya,' enhanced fallows with economic and biological benefits, alley cropping variations, and tree crop alternatives to annual cropping. Examples and quantitative data support the key hypotheses underlying these recommendations. As a polyculture system, an agroforestry system can produce timber and wood products, fruits, nuts, other edible plant products, edible mushrooms, medicinal plants, ornamental plants, animals and animal products, and other products from both domesticated and wild species. Agroforestry can be practiced for economic, environmental, and social benefits, and can be part of sustainable agriculture. Apart from production, benefits from agroforestry include improved farm productivity, healthier environments, reduction of risk for farmers, beauty and aesthetics, increased farm profits, reduced soil erosion, creating wildlife habitat, less pollution, managing animal waste, increased biodiversity, improved soil structure, and carbon sequestration.

Key words: agroforestry, horticulture, sustainable agriculture practices framework and pathway.

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Innovative Extension Strategies and Approaches in Agriculture, Horticulture, and Forestry: A Focus on Agricultural Entomology

Dr. Arjun Lal Choudhary

Department of Agriculture, Vivekananda Global University, Jaipur

Agricultural productivity and sustainability are heavily influenced by effective pest management, which makes Agricultural Entomology a critical discipline across the sectors of agriculture, horticulture, and forestry. This paper explores innovative extension strategies and approaches that can enhance the dissemination of entomological knowledge to farmers, extension workers, and forest managers. Emphasis is placed on participatory approaches, ICT-based tools, integrated pest management (IPM) campaigns, and community-led monitoring systems. The integration of mobile applications, digital pest identification tools, and farmer field schools has shown significant promise in building local capacity and promoting eco-friendly pest control practices. Furthermore, customized training modules and multi-stakeholder platforms have improved knowledge transfer in rural and tribal regions. The paper highlights case studies demonstrating successful collaborations between entomologists, extension professionals, and farming communities. The findings underscore the need for adaptive, inclusive, and technology-driven extension frameworks that bridge scientific research and practical application, ultimately enhancing ecological resilience and agricultural productivity.

Keywords: Agricultural Entomology, Extension Strategies, Integrated Pest Management, ICT in Agriculture, Ecological, Forestry, Farmer Field Schools, Sustainable Pest Control

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Effect of Organic Manures and Micronutrients on Root Yield of Carrot (*Daucus carota* L.)

Asha Dhaka¹, Pooja Dhaka² and Pawan Saini³

Affiliations: ¹Sri Karan Narendra Agriculture University, Jobner- Jaipur

²Swami Keshwanand Rajasthan Agricultural University, Bikaner

³Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior

*For correspondence: asha1998dhaka@gmail.com

Carrot (*Daucus carota* L.) is a nutritionally rich root vegetable grown worldwide, valued for its high content of beta-carotene, vitamins (A, C, K), minerals, dietary fiber, and antioxidants. Soil fertility and balanced nutrient management strongly influence its yield and quality. A field experiment was conducted during the *Rabi* season of 2021–22 at the Horticulture Farm, S.K.N. College of Agriculture, Jobner (Rajasthan), to evaluate the effect of organic manures and micronutrients on carrot root. The study evaluated various treatment combinations using a factorial randomized block design. Different organic manures were used, including farmyard manure (FYM) at 10 tons per hectare, vermicompost at 3.5 tons per hectare, and poultry manure at 2.5 tons per hectare. In addition, foliar sprays of micronutrients like iron sulfate (FeSO₄), borax, and zinc sulfate (ZnSO₄) were applied, each at a concentration of 0.5%. The findings revealed that among the organic manures, poultry manure applied at 2.5 t/ha significantly enhanced plant height, chlorophyll content, root length and diameter, core diameter, average root weight, shoot-to-root ratio, total root yield (q/ha), carotene and sugar content, net returns (₹334,519/ha), and benefit-cost ratio (3.22). Among the foliar micronutrient treatments, FeSO₄ at 0.5% was the most effective overall and performed similarly to borax at 0.5% for most traits. However, FeSO₄ outperformed borax in reducing sugar content, net returns, and benefit-cost ratio.

Key words: Carrot, Antioxidants, Chlorophyll, Fertility, Foliar spray, Carotene, Factorial.

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Assessment of Variability and Effect of Cold-moist Stratification on Seed and Seedling parameters of *Quercus robur* L. in Srinagar District of Kashmir Valley

Asnain Khateeb^{1*}, P. A Khan¹, Ashfaq Ahmad Mir¹, Sabeena Nabi¹, Nageena Nazir², J. A. Mugloo³, M. Iqbal Jeelani¹, Midhat Bilal¹

¹Division of Forest Biology and Tree Improvement, Faculty of Forestry, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Benhama, Ganderbal-191201, India

²Division of Agricultural Statistics, Faculty of Horticulture, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Shalimar, Srinagar-190025, India

³Krishi Vigyan Kendra Malangpora/ETC, Pulwama Jammu & Kashmir – 192301, India

*Corresponding author Email: asnainkhateeb@skuastkashmir.ac.in

The present investigation titled "Assessment of Variability and Effect of Cold-moist Stratification on Seed and Seedling Parameters of *Quercus robur* L. in Srinagar District of Kashmir Valley" was conducted to evaluate the influence of tree genotype and cold-moist stratification on seed germination and seedling vigor. Seeds were collected from eighteen mother trees located at two ecologically distinct sites: Rajbagh and Lalchowk. Significant genotypic variation was observed among the trees in terms of germination and seedling characteristics. Seeds from tree T6 in Rajbagh exhibited superior performance, recording the highest mean daily germination (2.33), peak value (2.72), germination speed (15.54), total seedling length (49.72 cm), number of leaves per plant (12.91), and leaf area per plant (236.20 cm²). In contrast, seeds from T1 in Lalchowk consistently showed the lowest values across these parameters.

Cold-moist stratification treatments revealed that both stratification period and temperature significantly affected seed and seedling traits. A stratification duration of 60 days resulted in the highest germination speed (13.56), seedling length (44.99 cm), leaf area (234.21 cm²), and number of leaves per plant (13.82). Similarly, outdoor stratification at 6±1°C outperformed indoor conditions, enhancing germination and seedling growth. The results indicate that stratification breaks seed dormancy by activating enzymatic systems and enhancing the availability of soluble nutrients, ultimately improving seedling vigor. The study underscores the importance of genetic selection and optimal stratification treatments in improving propagation success for *Quercus robur* L., offering valuable insights for conservation and afforestation efforts in temperate regions.

Key words: *Quercus robur* L., Genotypic variation, Cold-moist stratification, stratification period, stratification temperature

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Local Pig farming in Baster Division of Chhattisgarh

**Dr. Jagriti Krishan, Dr. Ashutosh Tiwari, Dr. Deepti Kiran Bara, Dr. Rajni Flora
Kujur, Dr. Vandana Bhagat, Dr. Bharti Sahu**

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Chhattisgarh has been divided into three different agro climatic zone such as Northern hills, Baster Plateau & Central Plain Zone. Among these three zones pig population were higher in Baster Plateau. As per 20th livestock census Chhattisgarh holds a population of 5.26 lakhs pigs with majority of nondescript one. The present study was undertaken to discover the basic management habits practices adopted by villagers was carried out in Districts Narayanpur, Kondagaon, Baster, of Baster Division, Chhattisgarh with specific questionnaire. The study indicated that In the Baster division, the meat of local pig is more preferred therefore the population of local pigs more. Due to the poor economic condition of the farmers feed the leftover food of the house to the pigs and a traditional pig house is built with wooden wall and its floor is made of mud. The floor made of mud protects them from the animals in summers. Pig farming in the baster division is of semi-intensive type. The pigs are left in the morning and they return home in the evening. The traditional feeding system was adopted by the animal like grazing followed by crop residue feeding and supplementing with house hole agriculture byproducts. In proper care a sow can give 8 to 10 offspring's in a single furrowing and furrowed twice in a year. Due to the big litter size it becomes economically beneficial for pig farmers. Farmers in Bastar do not need to invest extra money for feed or shelter for local pigs. Despite the region's harsh environmental conditions, these pigs have a remarkable ability to survive, and their mortality rate remains low. Given the consistent demand among local communities and the minimal cost of management, local pig farming emerges as a highly viable option for farmers in the region. If farmers adopt scientific methods for rearing local pigs, their economic conditions are likely to improve significantly. Moreover, the promotion of these indigenous pigs will contribute to the conservation of local breeds, thereby preserving the unique biodiversity of the Bastar division.

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In vitro* Bioefficacy of Biocontrol Agents Against Maize Banded Leaf and Sheath Blight, Caused by *Rhizoctonia solani* f. sp. *sasakii

S. N. Banne¹, A. P. Suryawanshi², S. S. Kadam³, K. A. Burgute⁴ and A. S. Kumbhar⁵

¹Assistant Professor, Department of Plant Pathology, College of Agriculture, Jainapur (M.S), India.

²Ex. Professor (Plant Pathology) and Principal, College of Agriculture, Udgir (M.S.), India.

³Assistant Professor, Department of Plant Pathology, College of Agriculture, Pune (M.S), India.

^{4, 5}Research Scholar, Department of Plant Pathology, VNMKV, Parbhani (M.S), India.

*Corresponding author: shridharbannel1@gmail.com

Biotic and abiotic stresses are major obstacles in the cultivation and production of maize. Among biotic stresses excluding bacterial and viral diseases, many fungal diseases are of economic importance. Banded leaf and sheath blight (BLSB) appears to be most important and devastating disease of maize. Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* f. sp. *sasakii*, being soil borne is the major threat to successful cultivation and growing of maize. Therefore, various potential biocontrol agents were evaluated *in vitro* against the pathogen *R. solani* f. sp. *sasakii*, at the Department of Plant Pathology, VNMKV, Parbhani. Though all test bioagents were found antagonistic to the test pathogen, but most efficient were, *Trichoderma asperellum*, which resulted with significant highest mycelial growth inhibition (87.42 %), of the test pathogen, followed by *T. harzianum* (86.17 %), *T. virens* (66.36 %) and *Aspergillus niger* (65.16 %).

Keywords: Bioagents, *Rhizoctonia solani*, Banded leaf and sheath blight, *In vitro*, Inhibition.

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Reconnaissance of Botanical Species on Traditional and Modern medicinal Values from Valley of Flower, Chamoli District of Uttarakhand

Monika Basotra¹, Anuradha Jayaraman^{2*}

¹*Research scholar, Nims Institute of Allied Medical Science and Technology, Nims University Rajasthan, Jaipur – 303121*

^{2*}*Assistant professor, Nims Institute of Engineering and Technology, NIMS University Rajasthan, Jaipur – 303121*

**Corresponding author: Dr.J.Anuradha*

**Email: j.anuradha@nimsuniversity.org, ¹Email: sharmamonika999222@gmail.com*

Uttarakhand, in the Indian Himalaya, has a rich diversity of medicinal plants which is being used by the local inhabitants in their primary health care system. Since time immemorial, there has been an immense and urgent need to document the medicinal values of these plants as it is very much vulnerable to its extinction. Present study is aimed to look into the diversity of plant resources that are used by the local inhabitants of district Chamoli, Uttarakhand, India for curing their various ailments. The study also focuses on the questionnaire surveys, oral participation of the local folks and the renowned 'vaidyas', as these are the eminent and knowledgeable people who are able to identify and collect them from the wild and use them for curing various ailments when needed. Most of the plants used in traditional healthcare in the region are harvested from wild. The prevalent practice of herbal medicinal remedies has been put forward by the ancestors to their younger generations so that they can cure the health ailments from the simple one like cough, cold, body-ache to the complex one like malaria, diabetes etc. Apart from the cure in the human ailment, traditional and modern medicinal values have step in to the ailment of animal husbandry and ethnic veterinary medicine.

Key words: Medicinal value, ethnomedicinal uses, primary healthcare, traditional knowledge, conservation.

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Optimizing Direct Shoot and Root Regeneration Protocols through PGR Combinations and Nodal Explants in Cumin (*Cuminum cyminum* L.)

Mamta Saini*, Dr.Vasundhar Sharma, Swetesh John

ICAR-National Research Centre on Seed Spice, Tabiji, Ajmer

**Ph.D. Scholar, Amity University, Gurugram. email:sainimamta318@gmail.com*

Cumin belongs to the Umbelliferae family and is one of the oldest and most economically important spices. In general, there is little information on the in vitro culture of *Cuminum cyminum*. In the present study, a simple method for direct regeneration of cumin shoots and roots was developed. With this method, a large number of shoots can be obtained in a short period of time (40-45 days). The effect of different combinations of plant growth regulators (PGRs) on shoot and root regeneration was studied. Effects of different concentrations of 6-Benzylaminopurine (BAP), alpha-Naphthaleneacetic Acid (NAA) and Indole-3-kcetic Acid (IAA) on MS medium of node cultures as well as subculture with 06 treatments and 6 replications per treatment were studied in detail. BAP (cytokinin) and NAA (auxin) showed an inhibitory effect on the induction of direct root organogenesis, while a low concentration of BAP had a positive effect on the direct shoot and root proliferation pathway from the node explant. Plants transferred in rooting media i.e. IBA and half strength MS media after 15 days of sub culturing was the best for root elongation. This study supports the feasibility of combined protocols for direct regeneration of cumin nodal part in genetic material conservation through in vitro cloning and genetic improvement programs.

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Online Platforms and Apps for Knowledge Sharing and Information Exchange

Palav Joshi¹, Dr. S.S. Lakhawat²

¹M.Sc. Horticulture (Fruit Science), ²Professor, Dept. of Horticulture
Rajasthan College of Agriculture, Maharana Pratap University of Agriculture
and Technology, Udaipur
Email: palavjoshi218@gmail.com

The fast growth of digital platforms and mobile apps has changed how farmers share knowledge and get information. These tools help solve problems like lack of expert advice, market prices, and ways to farm sustainably. For example, peer-to-peer networks like WeFarm and Farmers Business Network let farmers talk to each other and share tips. Apps that use artificial intelligence, such as Plantix and AgriApp, help farmers identify plant diseases and offer advice on what to do. Other platforms collect data from many users to give useful, real-time updates. Farmers can also learn through online training, such as the videos and lessons provided by Digital Green. These tools help small farmers get important knowledge without needing to rely too much on middlemen. Some programs run by governments, like e-Choupal in India and Esoko in Africa, use internet kiosks and mobile text messages to reach rural farmers who don't have smartphones or strong internet connections. However, there are still some problems. Many areas have poor internet, and not all farmers know how to use digital tools. Also, content needs to be in local languages and suited to their culture. New ideas like voice-based apps and AI chatbots are helping non-literate users. Blockchain tools, such as IBM Food Trust, are being used to track food through the supply chain, which builds trust and reduces cheating. To make these tools work for more farmers, we need public and private groups to work together and create affordable, locally relevant solutions. When farmers, experts, and governments team up through these digital tools, they can help farming become fairer, more climate-ready, and improve food for everyone. To succeed, we must focus on making these tools easy to use and invest in good internet and training.

Keywords: digital platforms, AgriApp, Digital Green, AI chatbots, e-Choupal.

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Digital Tools and Technologies for Enhancing Productivity and Efficiency in Agriculture

Palav Joshi¹, Dr. S.S. Lakhawat²

¹M.Sc. Horticulture (Fruit Science), ²Professor, Dept. of Horticulture
Rajasthan College of Agriculture, Maharana Pratap University of Agriculture
and Technology, Udaipur
Email: palavjoshi218@gmail.com

Modern agriculture is facing big challenges like the growing demand for food, changing climate and limited resources. To deal with these issues, digital tools and technologies are becoming powerful solutions that can improve how farming is done. This article talks about several new technologies such as IoT (Internet of Things) sensors, artificial intelligence (AI), drones, smart machines, and blockchain. These tools help farmers grow crops more accurately, monitor their fields in real time, and make better decisions using data. For example, IoT devices can check soil moisture and crop health, helping farmers use water and fertilizers more wisely. Drones and satellite images help spot pests early and predict harvests. AI can study large amounts of data to forecast weather and suggest the best time to plant crops. Robots are being used for jobs like harvesting, which saves time and labor. Blockchain technology helps track food from the farm to the customer, which increases trust and safety. Computer vision, another AI tool, scans images of crops to find mold, insects, or diseases. With alert systems, farmers can quickly respond to these problems and stop them from spreading. Even though these tools are helpful, there are still problems. Many farmers can't afford them, some don't know how to use them, and rural areas often lack good internet or electricity. To fix this, there should be more policy support, education for farmers, and easier access to affordable technology. In India, a customized plan is needed to make digital farming successful. This includes low-cost tools, portable devices, equipment sharing options, support from universities, better internet networks, digital literacy programs, training camps, and government support for agri-tech startups. By using these technologies and solving the current challenges, agriculture can become more productive, eco-friendly, and ready for the future.

Keywords: digital farming, IoT, artificial intelligence, digital literacy, agri-tech startups, eco-friendly.

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Fourier Transform Infrared (FTIR) Spectroscopic Study of Gelatin Extracted from Fresh and Dried Bones of Dolphin Fish (Coryphaenahippurus) Using Microwave-Assisted and Conventional Extraction

^{1,2}Aiswarya P M, ¹Binsi P K

¹ ICAR-Central Institute of Fisheries Technology, Matsyapuri, Cochin, Kerala, India

² Kerala University of Fisheries and Ocean Studies

Email: aiswarya843@gmail.com , binsipillai@gmail.com

Corresponding author: Binsi P K

Email: aiswarya843@gmail.com, binsipillai@gmail.com

This study investigates the structural characteristics of gelatin extracted from Dolphin fish (Coryphaenahippurus) bones using conventional and microwave-assisted methods, with bones processed in fresh and dried states. Fourier Transform Infrared (FTIR) spectroscopy was used to analyze molecular interactions and secondary structures. Gelatin from fresh bones showed distinct amide I, II, and III bands, indicating better preservation of the triple-helix structure and stronger hydrogen bonding. In contrast, gelatin from dried bones exhibited reduced amide I and II intensities, with the amide III band absent in conventionally extracted samples, suggesting collagen denaturation. The broadening of the amide A band in fresh bone gelatin indicated enhanced intermolecular interactions. Variations in the amide I region suggested that fresh bone gelatin retained more secondary structures, while dried bone samples had more random coils and β -turns. The findings highlight how raw material condition and extraction method significantly affect gelatin structure, offering insights to improve gelatin production quality.

Keywords: Collagen, Fish processing by products, Extraction method, Protein structure, Molecular interactions, Functional properties

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Geographical Influence on *Quercus robur* L.: Evaluating Tree and Seed Traits for Superior Genetic Propagation

Asnain Khateeb^{1*}, P. A Khan¹, Ashfaq Ahmad Mir¹, Sabeena Nabi¹, Nageena Nazir²,
J. A. Mugloo³, M. Iqbal Jeelani¹, Midhat Bilal¹

¹Division of Forest Biology and Tree Improvement, Faculty of Forestry, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Benhama, Ganderbal-191201, India

²Division of Agricultural Statistics, Faculty of Horticulture, Sher-e-Kashmir University of Agricultural Science and Technology of Kashmir, Shalimar, Srinagar-190025, India

³Krishi Vigyan Kendra Malangpora/ETC, Pulwama Jammu & Kashmir – 192301, India

*Corresponding author Email: khateeb.m.asnain@gmail.com

The study titled “Geographical influence on *Quercus robur* L.: evaluating tree and seed traits for superior genetic propagation” was conducted during 2022-23. It aimed to evaluate the influence of location on key tree and seed morphological traits viz: tree height, diameter at breast height (DBH), crown height, crown width, seed aspect ratio (seed length:seed diameter), average seed weight, and average kernel weight with an emphasis on identifying superior plant genetics for propagation. Eighteen randomly selected trees were analyzed, with Rajbagh showing the most promising results. The tallest tree (T6) from Rajbagh reached 26 m, while the shortest (T1) measured 23 m. DBH ranged from 82.3 cm (T1) to 88.5 cm (T6), with T6 also exhibiting the largest crown height (2.5 m) and crown width (11.5 m). The highest seed aspect ratio (2.42) was recorded in T2, while T9 exhibited the lowest (1.94). The greatest average seed weight was observed in T6 (9.05 g), followed by T4 (8.85 g), whereas the lowest occurred in T1 (7.86 g). Kernel weight followed a similar trend, peaking in T6 (7.95 g) and reaching a minimum in T1 (5.63 g). Across all traits, the phenotypic coefficient of variation (PCV) exceeded the genotypic coefficient of variation (GCV), with kernel weight demonstrating the highest PCV (10.75) and GCV (9.61), followed by aspect ratio (PCV: 8.84; GCV: 7.78). The lowest PCV (6.11) and GCV (5.10) were also recorded for kernel weight. The close correspondence between PCV and GCV values suggests strong genetic control with limited environmental influence. Overall, trees from Rajbagh consistently displayed superior phenotypic traits, indicating their potential for use in future genetic improvement programs.

Key words: *Quercus robur*, Phenotypic variation, Genotypic control, Tree morphometric traits, seed and kernel quality, Genetic improvement

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Impact of Weather Variables on Rice (*Oryza sativa* L.) Yield Varies During Different Phenophases

Chaukha Ram*, Ajithkumar B., Latha A., Sajitha V.M., Vysakh A., P. Lincy Davis and Riya K.R

Department of Agricultural Meteorology, Kerala Agricultural University, Thrissur, Kerala

** Corresponding Email: c.ram4298@gmail.com*

The impact of weather variables on the yield of rice crops was investigated through a field experiment conducted during the *kharif* season at the Agricultural Research Station, Mannuthy. A split-plot design was employed, with the main plot treatments consisting of five different planting dates: June 5th, June 20th, July 5th, July 20th, and August 5th. Subplot treatments involved two short-duration rice varieties, *Jyothi* and *Manu Ratna*. Weather data was collected from the Principal Agromet observatory, Vellanikkara to analyse its effects. This study aims to examine how weather factors influence rice production throughout the various growth stages of rice cultivation in the central region of Kerala, for the period of 2022. The statistical tool *i.e* Statistical Package of Social Science (SPSS) are employed to assess the influence of weather variables on the production of rice. Results show that maximum and minimum temperature (°C) positively affects rice yield during panicle initiation to booting (P3) stage while minimum temperature (°C) has negative impact on rice yield during the stage of 50% flowering to physiological maturity (P6). Rainfall (mm) adversely affects rice production from the heading to 50% flowering (P5) to physiological maturity (P6) stage, whereas the number of rainy days negatively influences rice yield from the 50% flowering to physiological maturity (P6) stage for both varieties *Jyothi* and *Manu Ratna*.

Keywords: Phenophase, *Kharif* season, SPSS and split plot design

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Brown Planthopper (*Nilaparvatalugens*) Damage Estimation in Rice Using Hyperspectral Signatures

Eere Vidya Madhuri¹, Rajna S^{1*}, Subhash Chander³, Rupali J S¹ and Rabi N Sahoo²

¹*Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi, India*

²*Division of Agricultural Physics, ICAR-Indian Agricultural Research Institute, New Delhi, India*

³*ICAR- National Centre for Integrated Pest Management, New Delhi, India*

**Corresponding and presenting Author: rajnasalim@gmail.com*

Remote sensing is being increasingly used in agricultural stress management, offering real-time analysis of crop stress beyond what can be observed visually alone. Hopper burn, induced by brown planthopper (BPH), *Nilaparvathalugens* is a significant challenge to rice production in India. Remote sensing study through glasshouse experiments revealed brown planthopper (BPH), *Nilaparvatalugens* infested rice plants to have higher reflectance in the visible (VIS) region and lower reflectance in the near-infrared (NIR) region in comparison to un-infested plants. Correlation coefficients (r) estimation between rice plant reflectance and number of BPH/tiller resulted in the identification of sensitive bands for all rice varieties at 20 and 40 days after infestation with BPH. Based on rice plant reflectance values corresponding to the sensitive wavelengths from glasshouse experiments, the BPH damage depicted a positive relationship with five spectral indices, viz., SIPI (Structure-insensitive pigment index), PSND CHL B (Pigment Specific Normalized Difference for Chlorophyll B), AIR1 (Anthocyanin Reflectance Index 1), PSSR A (Pigment Specific Simple Ratio for chlorophyll A), and PSSR B (Pigment Specific Simple Ratio for chlorophyll B). The Red edge value (REV) which is a highly sensitive wavelength region from 670-770 nm showed a high correlation with BPH severity in all the varieties studied. Different biochemical parameters such as chlorophyll, carotenoid, protein, flavonoid, and relative water content were also estimated at a differential infestation of BPH in all varieties. The data generated were used for developing different models viz., spectral data Vs population model, spectral data Vs biochemical parameter model, and vegetative indices Vs population severity models for predicting BPH severity. The Partial Least Square Regression (PLSR) models were satisfactorily validated using the spectral and biochemical data collected from the field. Among the evaluated models, the Random Forest (RF) algorithm demonstrated superior performance, attaining the highest predictive accuracy ($R^2 = 0.92$) in associating vegetation indices with Brown Planthopper (BPH) severity. Partial Least Squares Regression (PLSR) also showed notable effectiveness, revealing strong relationships between spectral data and BPH severity ($R^2 = 0.62$), and accurately estimating key biochemical parameters, including chlorophyll ($R^2 = 0.84$), carotenoids ($R^2 = 0.77$), protein ($R^2 = 0.84$), and flavonoids ($R^2 = 0.34$). Field validation further supported the robustness of the models, particularly in correlating vegetation indices with BPH population severity ($R^2 = 0.72-0.86$). Additionally, relationships between spectral data and population severity yielded an R^2 value of 0.59, while correlations between spectral data and biochemical parameters ranged from $R^2 = 0.46$ to 0.80. The models developed in this study demonstrate the potential of spectral signatures for accurately assessing BPH severity and associated biochemical changes.

Keywords: Spectral signatures, hyperspectral remote sensing, vegetative indices, pest detection, biochemical parameters.

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***In vitro Bambusa balcooa* Cultivation for Ecological and Economic Impacts**

Akanksha Lakra and Dr. Zenu Jha

*Department of Plant Molecular Biology and Biotechnology
College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur-492012 (C.G.)
Contact No. 9516810415 Email ID: akanksha351997@gmail.com*

Bambusa balcooa, known for its rapid growth, wide ranging commercial and medicinal applications, offers great potential for sustainable development. There are diverse bamboo uses- in construction, handicrafts, paper and traditional medicine- this biotechnological advancement aligns with both environmental sustainability and rural growth. Economically, it supports farmer livelihoods by providing quality planting material high value bamboo cultivation. However conventional propagation methods like seed germination and rhizome division are often inefficient, season dependent and slow. This study aims to standardize a non-conventional protocol for somatic embryogenesis in bamboo using different explants cultured on Murashige and Skoog (MS) media with various concentration combination of 2,4-D, Kinetin and BAP. The optimized protocol led to successful callus induction and somatic embryo formation, demonstrating that *in vitro* methods are faster, more reliable and scalable compared to traditional approaches. The developed protocol enables large production of uniform, disease-free plantlets, essential for meeting commercial demands and restoring bamboo populations. This technique plays a vital role in mitigating deforestation, offering an alternative source of raw material and aiding in reforestation and carbon sequestration. Overall, the study highlights the effectiveness of somatic embryogenesis as a superior alternative to conventional methods with strong potential for ecological and socio-economic impact.

Keywords: Somatic embryogenesis, Murashige and Skoog (MS) media, Somatic embryo, Callus, Reforestation

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Construction and Validation of a Standardized Scale to Measure the Attitude of Livestock Farmers Towards the Conservation of Indigenous Cattle: A Methodological Approach

Salam Prabex¹, Saidur Rahman^{2*}

¹Ph.D. Scholar, Division of Extension Education, ICAR-Indian Veterinary Research Institute, Izatnagar-243122, Uttar Pradesh, India

²Professor, Department of Veterinary and Animal Husbandry Extension Education, College of Veterinary Sciences and Animal Husbandry, CAU, Selesih, Aizawl, Mizoram, India
Email id- prabexsalam99@gmail.com

The scale was constructed in Bareilly district of Uttar Pradesh to measure the attitude of farmers towards the conservation of indigenous cattle. Initially, 55 items were formulated and subjected to expert evaluation for content relevance. Based on their feedback, 36 items were shortlisted for item analysis. These items were then administered to 42 respondents outside the original study area. Item analysis was conducted using Likert's summated rating scale, and *t*-values were calculated for each item. Subsequently, 20 items exhibiting significant discriminatory power were retained. The scale was standardized by assessing its reliability through the split-half method and its validity through content validity measures. The overall reliability coefficient (calculated using the Spearman-Brown formula), Cronbach's alpha, and the content validity index were found to be 0.791, 0.829, and 0.930 respectively. These values indicate that the scale possesses acceptable reliability and strong content validity, confirming its consistency and precision in measuring the intended construct. This standardized scale provides a valuable tool for researchers to assess farmers' attitudes toward indigenous cattle conservation and supports the formulation of evidence-based extension strategies and sustainable livestock management programs.

Keywords: Cronbach's alpha, Mean relevancy score, Native cattle, Relevancy weightage, Reliability, Spearman brown, Validity

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Combining Ability Analysis for Yield and Nutrient Uptake Traits in Wheat (*Triticum aestivum* L.) Grown Under Normal and Salinity Conditions

Dhayal^{*1}, L.S. and Sastry², E.V.D

¹Professor, Department of Genetics and Plant Breeding, School of Agriculture,
Suresh Gyan Vihar University Jaipur

²Professor, Department of Genetics and Plant Breeding, Jaipur National University Jaipur

* Corresponding author: laxman.dhayal@mygyanvihar.com

Breeding for salt tolerance in wheat primarily depends on intensive hybridization programme using salt tolerant donors and high yielding commercial cultivars. The present investigation was designed to generate the information on the genetics of yield and nutrient uptake traits and their inheritance in wheat grown under normal and salinity conditions as the N, P, K, Na⁺ and Ca⁺ content in grain and straw and their ratios have been found to be suitable parameters to judge the relative salinity tolerance in wheat. The ten varieties/genotypes of wheat (*Triticum aestivum* L.) which are selected on the basis of salt tolerance and ecogeographic origin with phenotypic diversity for yield and other attributes were crossed in diallel fashion excluding reciprocals. The parents and 45 F₁'s were evaluated under two sets of environment in Randomized block design with three replications during *rabi* 2023-24 at Agriculture Farm, Suresh Gyan Vihar University Jaipur. The first set was irrigated with rain water collected in a pond having ECe 0.80 dSm⁻¹ (Normal condition). The second set was irrigated with saline water of tubewell having ECe 15.5 dSm⁻¹ (Salinity condition). The analysis of data revealed that grain yield was decreased whereas the nutrient uptake of N, Na⁺ and Ca⁺ were increased in salinity as compare to normal condition. The Magnitude of increase was more in Na⁺ uptake, ratio of Na⁺/K and Na⁺/Ca⁺. Na⁺ uptake which is toxic under salinity was lower in K-65 followed by KRL 19. The combining ability analysis indicated the importance of additive as well as non additive gene action however preponderance of non-additive gene action was observed for most of the characters. Parents K-65 followed by KRL19 were found best general combiner for most of the traits indicating their supremacy in the nutrient uptake. Therefore; these parents can be used as a donor parent for the development of salt tolerant varieties.

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Enhancing Green Consumption Practices Among School Students Using Fogg Behavior Model

***Swati Garbyal¹-Ritu Mittal Gupta²-Preeti Sharma³**

**Subject Matter Specialist, Home science/Community science, Krishi Vigyan Kendra, Pithoragarh, G.B.P.U.A&T Pantnagar, Uttarakhand, India 262530*

Mobile no. 7037163651 Corresponding email-id swatigarbyal341@gmail.com

²Senior Scientist, Department of Extension education and communication management, College of community science, Punjab Agricultural University, Ludhiana, Punjab, India 141004

Email-id rituhsee@pau.edu

³Assistant professor, Department of Extension education and communication management, College of community science, Punjab Agricultural University, Ludhiana, Punjab, India 141004

Email-id preetisharmahsee@pau.edu

Green consumption interchangeably known as ethical consumption, responsible and sustainable consumption is a form of consumption that is attuned with the safeguard of the environment for the present and future generations. Green consumption practices consisted of four parameters: green seeking credibility (information seeking behavior), prosumption practices (producing the things at home and using old things rather buying new from outside), procurement practices (engaging in activities like reduce, reuse, recycle refuse etc), green whispering (sharing information regarding green practices and to whom they are convincing to buy green products. In this context, the present study was conducted in Ludhiana district of Punjab, data was collected from three rural and three urban government schools in Ludhiana District making a total six schools. Two schools from each area served as experimental groups while one school was control group. Fifty students from each school were selected with a total of 300 students from grades ninth to twelfth. Action-cum-experimental research design was used in the study. Intervention was designed based on B.J. Fogg Behavior Model which include three components of behavior change i.e. Motivation, Ability and Prompt/Trigger. The intervention was validated for content validity by 20 experts. Similar intervention was implemented in all four experimental group schools focusing on green consumption practices (GCP). Pre-and post-data was collected from all the schools. The study revealed several key findings about green consumption behavior. After the intervention, green consumption practices significantly improved in both urban and rural experimental groups. However, the control groups in both areas showed no significant changes during the post-test phase. These results underscore the effectiveness of interventions based on the Fogg Behavior Model in promoting sustainable consumption habits among school students. Comparatively, the urban experimental group demonstrated greater improvement, with a mean score of 3.20, an increase of 0.86, whereas the rural group's mean score rose to 2.90, reflecting a smaller gain of 0.57 post-intervention.

Keywords: Green consumption practices, prosumption, procurement, green whispers, motivation, ability, prompt/trigger

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Formulation and Evaluation of Nutri-Bar Incorporating Millet

K. Meera & Bhawana Thukral

¹PG Scholar , Department of Nutrition & Dietetics, Chandigarh University

²Faculty , Department of Nutrition & Dietetics, Chandigarh University

Email – meera.200301@gmail.com; Bhawana.E8633@cumail.in

The purpose of this study with the combination of Ragi (finger millet), peanuts, chia seeds, flaxseeds, poppy seeds, oats, fig and jaggery are constituents of the health-conscious, convenient-to-eat Millet Nutri Bar. This innovation blends the time-tested ingredients with modern-day convenience to answer the increasing call for healthy, natural, and beneficial snacks. Ragi is mainly grown in Karnataka and Tamil Nadu and its scientific name is *ELEUSINE CORACANA*. This bar contains a lot of calcium, fiber, protein, omega-3 fatty acids, and antioxidants compared to other snack bars, which use artificial additives, sugars, and low-fiber grains. Ragi is the primary grain and supports bone strength and blood sugar control, whereas jaggery is used as a natural sweetener and as a source of nutrients. Super seeds are added for increasing satiety and promoting gut health. The millet nutri bar was formulated in four variations along with the control sample. The acceptability of the bars was conducted using 9 point hedonic scale among 10 expert panellists. The overall acceptability of the bars show that the T3 sample (7.8 ± 0.35) with 75% of ragi flour and 25% of wheat flour has highest acceptability than the other three formulated bar that is T1 sample (7.2 ± 0.29) with 25% of ragi flour and 75% of wheat flour . T2 sample (7.4 ± 0.30) with 50% of ragi flour and 50% of wheat flour and T4 sample (7.6 ± 0.37) containing 100% ragi flour . In this study nutritional analysis revealed that the T3 sample has better nutritional composition then the control sample . The T3 sample showed that it contained 441kcal of energy , 51.10g of protein , 16.88g of fibre , 142.40mg of calcium , 2.67mg of iron , 14.70g of fat , 72 IU of vitamin A and the control sample showed that it contained 399 kcal of energy , 13.92g of protein , 6.97g of fibre , 98.20mg of calcium , 0.47mg of iron , 18.60g of fat , 0.7 IU of vitamin A . In conclusion, Millet Nutri Bar is a thoughtfully made blend of traditional nutrition and modern medical needs. With the synergy of millet and super seeds, this blend offers a healthier alternative to traditional snacks in a convenient, preservative-free package. In addition to promoting a healthier lifestyle, it supports sustainable farming practices and the repurposing of leftover grains. The Millet Nutri Bar is an intelligent, considerate, and forward-looking alternative for consumers nowadays due to its natural ingredients and practical benefits.

Keywords: Millet nutribar, Nutritional composition, Ragi (fingermillet), Natural Sweetener.

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Integrated Nutrient Management in Sweet Corn and its Residual Effect on Green Gram in Mid-central Table Land Zone of Odisha

¹K.A. Patra, ²M. Prusty, ³N. Panda, ⁴S.K. Sahoo, ⁵A. K. Dash, and ⁶N. Mishra

^{1,2,3,4,5}Department of Soil Science & Agril. Chemistry, OUAT, Bhubaneswar 751 003, Odisha

⁶Department of Vegetable Science, OUAT, Bhubaneswar, 751 003, Odisha, India

Judicious use of plant nutrients is a key for higher productivity and sustainability. Though increased use of inorganic fertilizers improved the levels of production but later it may lead to deterioration in soil health besides pollution problems. So in addition to agricultural productivity maintaining and improving soil quality is very crucial for sustainable agriculture. Therefore, integrated nutrient management including appropriate fertilizers application combined with organic manures, biofertilizers has developed not only to meet the growing need for nutrients under intensive cultivation but also helps in maintaining good physico-chemical characteristics and fertility of soils. So a study was conducted on Integrated Nutrient Management in sweet corn and its residual effect on green gram in Mid- Central Table Land Zone of Odisha. Experimental results revealed that integrated application of STD (NPK) + FYM @ 5 t/ha + Borax @ 10 kg /ha + ZnSo₄ @ 25 kg/ha + Bio fertilizer (Consortia @ 12 kg /ha) significantly augmented the sweet corn yield attributes along with sweet corn (2.37 t/ha) and green forage (29.85 t/ ha) yield. The conjunctive use of STD (NPK) + FYM @ 5 t/ha + Borax @ 10 kg /ha + ZnSo₄ @ 25 kg/ha + Bio fertilizer (Consortia @ 12 kg /ha) applied to preceding sweet corn recorded the maximum seed yield (920 kg/ha) in green gram which was at par with residual effect of STD (NPK) + FYM @ 5 t/ha + Bio fertilizer (Consortia @ 12 kg /ha). The system yield was enhanced with application of STD (NPK) + FYM @ 5 t/ha + Borax @ 10 kg /ha + ZnSo₄ @ 25 kg/ha + Bio fertilizer (Consortia @ 12 kg /ha) applied to sweet corn producing highest yield (8.9 t/ha) followed by STD (NPK) + FYM @ 5 t/ha + Bio fertilizer (Consortia @ 12 kg /ha). Application of STD (NPK) + FYM @ 5 t/ha + Borax @ 10 kg /ha + ZnSo₄ @ 25 kg/ha + Bio fertilizer (Consortia @ 12 kg /ha) registered the highest net return (Rs. 1,98,400/ha) and benefit cost ratio (3.10) in sweet corn- green gram system when green gram was grown under residual fertility condition. The post-harvest soil properties were also found to be improved in the same treatment after harvest of green gram.

Keywords: bio fertilizer, economics, post-harvest soil properties

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Bioprospecting and Characterization of Drought Tolerant Plant Growth Promoting Actinobacteria

Patel Mrugesh M.*, Singh N. K., Parmar Rudra, Joshi Bhavesh, Patel Yashvi and Tapre Poonam

*Department of Microbiology, C. P. College of Agriculture, S. D. Agricultural Univesity, Sardarkrushinagar- 385506; Email: mrugesh1710@gmail.com; Mo. No.: 7359325189

Drought is a major cause for decreasing in agricultural productivity and yield around the globe. The application of plant growth promoting actinobacteria to agroecosystem improves plant growth and protect them from water scarcity and they can be better alternative for natural farming and sustainable agriculture. Herein, isolated five actinobacterial strains from the datura and khejri's rhizosphere named RADM1 to RADM5 through *in-vitro* screening for abiotic stress tolerance against PEG8000 and tested to different temperatures, pH and NaCl concentrations. All the strains performed for *in-vitro* plant growth promoting abilities viz., IAA, siderophore, ammonia, HCN and exopolysaccharide production, phosphate, potassium and zinc solubilization and antagonistic against *Fusarium solani* (L.). In pot trial of mungbean, all the isolates showed better performance in bacterial treatments with an average increase in physiological parameters like, seedling's shoot length (52.70% and 9.62%), root length (35.63% and 17.25%), fresh weight (42.8% and 13.76%) dry weight (45.25% and 21.24%) in compared to uninoculated induced drought and watered treatments. Stress features of seedlings revealed significant increase in proline and chlorophyll contents whereas decrease in MDA contents than the untreated plants which indicates actinobacteria reduced water scarcity and damage of plant membrane. Morphology of the bacteria was same as typical actinobacterial species and biochemically able to utilize carbohydrate through IMVIC test and enzymatic observation resulted positive for nitrate reduction and catalase production. PCR amplification and 16S rRNA gene sequencing found maximum similarity of three species with *Streptomyces clavuligerus* and two species with *Rhodococcus erythropolis* and submitted to NCBI gene bank database.

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Anthocyanin Profiling in Red Cabbage and Their Industrial Uses

Nayan Deep

PhD Research Scholar, Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni Solan, Himachal Pradesh, India (173 230)

Red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*) is a rich source of anthocyanins, a group of water-soluble flavonoid pigments responsible for its distinctive purplish-red coloration. These pigments contribute to the nutritional qualities of red cabbage along with its antioxidant, anti-inflammatory, and anti-carcinogenic properties. The profiling of anthocyanins in red cabbage involves the identification and quantification of various anthocyanin derivatives, predominantly cyanidin-based compounds, using advanced chromatographic and spectrophotometric techniques such as HPLC-DAD and LC-MS/MS. The composition and concentration of anthocyanins can vary significantly among genotypes, developmental stages, and growing conditions, influencing both the nutritional values and potential industrial applications. In the present study conducted at Dr YS Parmar University of Horticulture and Forestry, Nauni Solan, Himachal Pradesh, India twenty-eight exotic genotypes of red cabbage were used for anthocyanin estimation, out of which three genotypes viz., EC 890013 (90.26 mg/100g), EC 890012 (89.69 mg/100g) and EC 890011 (89.32 mg/100g) had maximum anthocyanin content. In recent years, anthocyanins extracted from red cabbage have garnered substantial attention for their versatile industrial uses. In the food industry, they are widely used as natural colorants (E163), offering a safe and health-promoting alternative to synthetic dyes. Their pH-sensitive color-changing properties make them suitable for use in intelligent packaging and pH indicators. In the pharmaceutical and nutraceutical industries, red cabbage anthocyanins are being explored for their therapeutic potential in combating oxidative stress-related disorders. Furthermore, the cosmetic industry utilizes these pigments for their antioxidant benefits in skincare formulations. Therefore, it can be inferred that understanding the anthocyanin profile of red cabbage not only enhances its commercial value but also supports the development of functional foods and eco-friendly products.

Keywords: Anthocyanins, Antioxidants, Flavonoids, Industrial usage, Red cabbage

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Butterfly Diversity as an Indicator of Landscape Alterations: A Case Study in ‘Moist Deciduous Sal Forests’ in the Shiwalik ranges of Northern India

Ankita Singh Sajwan*¹ & Arun Pratap Singh¹

*Forest Entomology Branch, Forest Protection Division, ICFRE-Forest Research Institute
(Deemed to be) University, P.O. New Forest, Dehradun, Uttarakhand, INDIA 248006*

**Presenting author: sajwan.ankitasingh@gmail.com; ranoteaps@gmail.com*

The forest ecosystems of the lower Western Himalayas are today facing increasing pressure from urbanization, commercial development, and resource overexploitation, resulting in habitat fragmentation, degradation, and biodiversity loss. Butterflies, being sensitive to environmental changes, act as effective bioindicators for monitoring ecological disturbances associated with land use changes. This study examines butterfly diversity across 12 sites representing four distinct land uses—urban blocks, agroforestry plantations, cantonments, and natural and native sal forests in the Dehradun Valley, Uttarakhand, India. Over two years (March 2022–March 2024), 576 standardized sampling hours using the Pollard Walk method yielded 145 butterfly species belonging to six families. Species richness peaked in the spring and post-monsoon seasons. Cantonments recorded the highest diversity (121 species), followed by natural forests (113), urban blocks (83), and agroforestry plantations (73). While natural forests and cantonments supported distinct butterfly communities, urban and agroforestry areas exhibited more significant overlap. Notably, 61 species, including 35 sal forest specialists, were identified as urban avoiders, making them effective bioindicators of habitat disturbance. Conversely, 14 species were categorized as urban exploiters, while 34 were deemed ubiquitous. These findings highlight the cantonment as transitional habitats located at intermediate levels of disturbance that support butterflies of both native forest and urban exploiters. This study emphasizes the importance of butterflies as sensitive indicators of ecological change and the urgent need to preserve native forests and semi-natural land uses amidst accelerating urban expansion in the lower Himalayas.

Keywords: Land use changes, urbanization, habitat degradation, indicator, butterfly diversity

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Influence of Different Growing Conditions on Growth, Yield and Quality Attributes of Coriander (*Coriandrum sativum* L.)

Jaspreet Kaur^{1*} and Dr. Navjot Singh Dhillon¹

*P.G. Department of Agriculture, Division of Horticulture (Vegetable science),
Khalsa College Amritsar; *jk679449@gmail.com*

Coriander is an annual herb belongs to family Umbelliferae from the Mediterranean and Middle East, known for its medicinal value. A study at Khalsa College, Amritsar (2023–2025), evaluated coriander under shade net and open field conditions. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. In the present experiment, locally available variety of coriander were evaluated under Green net (G1), White net (G2), shade net condition (G3) and Open environment conditions (G4) and different months of sowing viz., from August 1 (D1), August 15 (D2), September 1 (D3), September 15 (D4). with three replications, making total 36 treatment combinations. Biometric and quality traits were observed at different cuttings to assess the effect of shade nets on growth, yield, and quality. Coriander leaves have strong antioxidants like carotenoids and phenolics along with minerals, vitamins, flavonoids, sterols, and essential oils. Shade nets help by reducing stress, improving yield, and modifying microclimate. Coloured nets filter sunlight and trigger positive growth responses. Sowing time also plays a key role in yield parameters of crop. The findings of the present research suggests farmers and agricultural researchers to consider the date of sowing which appears to be a challenging task in the context of global climatic scenario. shade net house condition is useful for the farmers to improve the yield as well the income. Also, it has proven that, cultivation under shade net house condition can improve the production of leafy coriander which is beneficial for farmers to double their income.

Keywords: Coriander, Shade net, Open field, Sowing dates, Growth, Yield and quality parameters

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Comparative Economic Analysis of Novel Insecticides and Biorationals Against Thrips Infestation in Chilli in Prayagraj District

Reguri Divya¹, Dr. Anoorag R. Tayde²

Reguri Divya, Ph.D scholar, Department of Entomology, Sam Higginbottom University of
Agriculture, Technology and Sciences

Dr. Anoorag R. Tayde, Assistant Professor, Department of Entomology, Sam Higginbottom University
of Agriculture, Technology and Sciences
divyareddy4@gmail.com

The field experiments were undertaken during the *Kharif* seasons of 2023 and 2024 at the Central Research Farm (CRF), Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, located in Prayagraj, Uttar Pradesh, India. Significant variations in yield were observed among the treatments during the *Kharif* seasons of 2023 and 2024. The highest yield was recorded in Cyantraniliprole 10.26% OD (125 q/ha) (124 q/ha) followed by Imidacloprid 17.8% SL (116 q/ha) (114 q/ha), Acetamiprid 20% SP (104 q/ha) (110 q/ha), Broflanilide 30% SC (98 q/ha) (105 q/ha), Fipronil 5% SC (90 q/ha) (97 q/ha), Spinosad 45% SC (82 q/ha) (90 q/ha), Among these biorationals Azadirachtin 3% (75 q/ha) (84 q/ha), Pongamia oil 5% (70 q/ha) (80 q/ha), NSKE 5% (65 q/ha) (76 q/ha), *Lecanicillium lecanii* (2×10^8) CFU/g (56 q/ha) (74 q/ha), and *Beauveria bassiana* (2×10^8) CFU/g (50 q/ha) (70 q/ha) as compared to T0 control (40 q/ha) (52 q/ha). When the benefit cost ratio was worked out, interesting results were achieved. Among the treatment studied the best and most economical treatment was Cyantraniliprole 10.26% OD (1:7.62) (1:6.37), Imidacloprid 17.8% SL (1:7.45) (1:6.16), Acetamiprid 20% SP (1:6.74) (1:5.99), Broflanilide 30% SC (1:6.28) (1:5.66), Fipronil 5% SC (1:5.77) (1:5.23), Spinosad 45% SC (1:5.01) (1:4.63), Azadirachtin 3% (1:4.66) (1:4.40), Pongamia oil 5% (1:4.41) (1:4.20), NSKE 5% (1:4.19) (1:4.12), *Lecanicillium lecanii* (2×10^8) CFU/g (1:3.46) (1:3.85) and *Beauveria bassiana* (2×10^8) CFU/g (1:3.07) (1:3.62) as compared to control T0 (1:2.64) (1:2.89).

Keywords: Biorationals, *Capsicum annuum*, Economic analysis, Novel insecticides, *Kharif* season

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Role of Organic Agriculture in Sustainable Development (Case Study: Farah Province)

Noor Mohammad Kakar^{1*} Fawad Momand Omarzai²

¹ Department of Agronomy, ² Department of Agricultural Economics and extension
Faculty of Agriculture, Farah Higher Education Institute

Organic agriculture, as a sustainable production method, has garnered significant attention in recent years. This research investigates the role of organic agriculture in sustainable development by evaluating its impacts on the conservation of natural resources, reduction in chemical inputs, and improvement in the quality of agricultural products. A linear regression method was employed to analyze the data collected from a statistical population of 583 farmers actively involved in organic agriculture. The results indicate that the adoption of organic farming methods and the conservation of natural resources are significantly correlated with sustainable development. The coefficient for the adoption of organic farming methods was 0.53, and the coefficient for the conservation of natural resources was 0.533, demonstrating a positive and substantial influence of these factors on sustainable development. Furthermore, the use of natural fertilizers showed a significant impact on sustainable development with a coefficient of 0.50. In contrast, the reduction in pesticide use had a minimal and statistically insignificant impact on sustainable development (coefficient of 0.53). The ANOVA test revealed that the regression model is statistically significant overall, explaining 55.6% of the variance in sustainable development. Based on these findings, organic agriculture, through the conservation of natural resources, reduction in chemical use, and improvement in product quality, can play a crucial role in achieving sustainable development goals.

Keywords: Organic Agriculture, Sustainable Development, Natural Resources, Natural Fertilizers, Reduction in Pesticide Use.

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Effect of Shade Management and Agronomic Management Including Soil Types, Fertigation Levels and Intervals on Yield and Biochemical-Quality Parameters of Ginger

S. M. Shende¹, U. S. Surve², M. R. Patil³, V. S. Patil⁴ and P. S. Bodake⁵

Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India

¹*Ph. D. Scholar, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India*

²*Professor, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India*

³*Associate Professor, Department of Statistics, Post Graduate Institute, and University Librarian, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India*

⁴*Soil Chemist, AICRP on STCR, Department of Soil Science and Agril. Chemistry, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India*

⁵*Head, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra - 413 722 India*

Email: sudarshanshende77@gmail.com

Ginger (*Zingiber officinale*), a globally valued spice and medicinal crop, exhibits significant variability in growth, yield, and quality depending on environmental and agronomic conditions. This review synthesizes current research on the effects of shade levels, soil types, and fertigation practices on ginger cultivation. Moderate shade (20–40%) enhances physiological parameters, such as photosynthetic efficiency and dry matter accumulation, leading to improved rhizome yield and higher volatile oil content, while excessive shade may reduce crude fiber and curing efficiency. Soil characteristics, particularly texture, pH, bulk density, and organic matter content, play a pivotal role in determining yield and bioactive compound profiles, with well-drained sandy loams and loamy laterites proving most favorable. Fertigation strategies, including 100–125% of the recommended dose of fertilizers (RDF) integrated with organic inputs, improve nutrient uptake, growth traits, and quality attributes like essential oils, oleoresins, and gingerols. Stage-specific and frequent fertigation intervals further optimize nutrient utilization, enhancing both productivity and crop quality. The findings highlight that integrated management of shade, soil, and fertigation offers a sustainable and high-return approach to ginger cultivation.

Keywords: Agronomy of ginger: Review, yield, quality & biochemical parameters, shade management, soil types, fertigation levels & intervals.

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Weed Management Strategies and Their Impact on Nutrient Uptake in Okra

¹Sadhana kongala, ²M. Venkateswara Reddy, ³Veena Joshi, ⁴M. Madhavi, ⁵T. Ram Prakash

Corresponding author: Sadhana Kongala, Department of Vegetable science, Phd scholar, PGIHS, Mulugu, Siddipet, Telangana, India; E-Mail:Kongalasadhana14@gmail.com

A field experiment was conducted during kharif season at the Postgraduate Research Block, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad. The primary objective was to identify the most effective weed control methods for okra cultivation. Utilizing a randomized block design, the study included twelve different treatment combinations, each replicated three times. Weed interference is a major constraint in okra due to the crop's slow early development and wide row spacing, which creates favorable conditions for weed proliferation. This intense competition often results in significant nutrient depletion from the soil, adversely affecting okra growth. To counter this, the study assessed the influence of various weed management practices including pre- and post-emergence herbicides, mulching techniques, and both manual and mechanical weeding on nutrient uptake by okra and nutrient depletion by weeds. Results indicated that nutrient uptake (N, P, and K) by the crop was significantly higher when black polyethylene mulch was applied at 30 and 60 days after sowing (DAS), whereas the highest uptake at 90 DAS was observed in the weed-free treatment. Conversely, the maximum nutrient removal by weeds at 15, 30, 60, and 90 DAS was found in the unweeded control.

Key words: Okra, Black polythene mulch, nutrient uptake, nutrient removal, crop, weeds

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Effect of Weed Management Practices on Quality and Yield of Okra (*Abelmoschus esculentus*) under Field Conditions

¹Sadhana kongala, ²M. Venkateswara Reddy, ³Veena Joshi, ⁴M. Madhavi,
⁵T. Ram Prakash

*Corresponding author: Sadhana Kongala, Department of Vegetable science, Phd scholar, PGIHS,
Mulugu, Siddipet, Telangana, India; EMail:Kongalasadhana14@gmail.com*

A field experiment was conducted at PG research block, College of Horticulture, SKLTGHU, Rajendranagar, Hyderabad. The experiment was laid out in Randomized block design with twelve treatments and replicated thrice. Different pre and post emergence herbicides, different mulches, hand and mechanical weedings were used during the research. The results indicated that the quality parameters like fiber content and relative chlorophyll content in pods and leaves were significantly influenced by black polythene sheet. Due to usage of different herbicides there was phytotoxicity effect on crop growth which effected quality and yield. Among the different weed management practices, black polythene sheet recorded significantly the higher values for quality attributes like crude fiber and relative chlorophyll content and phytotoxicity effects were minimum when compared to other treatments. B:C values were recorded highest in black polythene mulching. These were on par with mechanical weeding (inter row) followed by hand weeding (intra row) at 30 and 60 DAS (weed free check). The lowest values were recorded with unweeded control plot. This study suggests that farmers should grow okra under black polythene mulch instead of using different herbicides to produce good quality and yield with higher returns.

Key words: Okra, quality, Black polythene mulch, phytotoxicity, Economics

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Review of Literature on Impact of Climate Change on Plant Biodiversity

Dheeraj, Pooja Kumari and Shikha Kadyan

dhirusondha0916@gmail.com; bot2022pooja9@kuk.ac.in; Kadians338@gmail.com

Changes in the atmosphere and oceans can profoundly change the biosphere, the thin living film of life on Earth that is intrinsically coupled to the atmosphere and hydrosphere and provides the nourishing fabric within which human societies exist. Hence, degradation or restoration of parts of the biosphere are likely to have regional or planetary consequences. Anthropogenic greenhouse gas emissions, which drive both climate change and ocean acidification, increasingly threaten the viability and resilience of natural ecosystems, and the human societies that depend upon them. The effects of these threats can be profound and, in recent years, have become increasingly observable. Already, Earth is committed to a substantially warmed climate, with expectations of further warming into the future, unless carbon emissions trajectories change dramatically.

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Farmer Producer Organizations, NGOs, SHGs and Cooperatives involved in Agriculture & Horticulture

Ram Gopal

*M.Sc. Scholar, Department of Horticulture (Vegetable Science),
Sam Higginbottom University of Agriculture, Technology and Sciences,
Prayagraj - 211007 (U.P), India
Email: ramgopalchoudhary78956@gmail.com | Mobile: 9145845171*

The agriculture and horticulture sectors in India face numerous challenges, especially for small and marginal farmers. To address these challenges, collective institutions such as Farmer Producer Organizations (FPOs), Non-Governmental Organizations (NGOs), Self Help Groups (SHGs), and Cooperatives have emerged as vital entities in enhancing agricultural productivity and farmer welfare. FPOs serve as a platform for farmers to pool resources, gain better access to inputs, credit, and markets, and improve their bargaining power. NGOs play a complementary role by implementing field-level programs, creating awareness, and offering capacity-building support. SHGs, especially those led by rural women, contribute significantly to the rural economy by promoting income-generating activities, self-employment, and financial inclusion through microfinance initiatives. Cooperatives, being among the oldest institutional frameworks in the Indian rural economy, continue to support input distribution, credit delivery, processing, and marketing. Collectively, these organizations play a crucial role in value chain development, reducing exploitation by middlemen, and fostering inclusive rural development. However, challenges such as inadequate training, limited financial literacy, weak governance structures, and lack of consistent policy support hinder their growth. Strengthening linkages among these groups, ensuring access to capacity-building programs, and enhancing institutional support mechanisms are essential for their long-term sustainability. This paper highlights the contributions, operational models, and challenges of FPOs, NGOs, SHGs, and Cooperatives in agriculture and horticulture, and suggests measures to amplify their impact in rural transformation.

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Safety and Standards in Edible Packaging: A Framework for Regulatory Alignment and Consumer Protection

Disha Bongarde¹, Vaibhav Asane¹, Dr. G.M. Solanke^{2*}, Dr. I.S. Udachan³

¹ Scholar, B. Tech., Food Technology, Department of Technology, Shivaji University, Kolhapur-416004, Maharashtra, (INDIA).

² Assistant Professor, B. Tech. Food Technology, Department of Technology, Shivaji University, Kolhapur-416004, Maharashtra, (INDIA).

³ Head of Department, B. Tech. Food Technology, Department of Technology, Shivaji University, Kolhapur-416004, Maharashtra, (INDIA).

Corresponding author: gopalsolanke456@gmail.com

Edible packaging, a sustainable substitute for traditional plastic packaging that has been developed to reduce environmental pollution. However, the efficient use of these advancements has been hampered by concerns about food safety and the lack of a defined framework. The review compiles the compositions and the functional properties of biopolymer-based edible packaging materials incorporating active additives. It also identifies some of the possible safety hazards microbial contamination, chemical migration, and allergenicity. The current regulatory regimes around the world are discussed with emphasis on the need for alignment in standards that are meant to protect consumers and ensure product effectiveness. It touches on issues of large-scale production, standards of labeling, and public acceptance as well as advances with nanotechnology and biodegradable sensors. One way forward is creating strategic interventions for standardization of safety protocols, as well as for promoting sustainable practices, so that edible packaging can be developed and adopted faster, thus aiding environmental conservation and food safety.

Keywords: Edible packaging, Food Safety, Regulatory Framework, Nanotechnology, Sustainable packaging, Environmental Conservation, Consumer Protection, Label Standards

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Evaluating the Impact of Haryana's Edible Oil Plant Resources on Human Health

Shweta Goswami, Deepak Kumar, Shikha Kadyan, Ankit Goswami and Pooja Kumari

Oil is odorless compound of herbs and spices and has been used for centuries to flavor and preserve foods, medicines and perfumes. There are many aromatic plant species in the Lamiaceae and Apiaceae plant families. Edible oils are produced in Haryana and is used for its beneficial effects on human health. The most common crops include peanuts, mustard, sunflower seeds, sesame seeds, soyabeans, wheat (rice bran), sunflower, cotton, flaxseeds, etc. Takes place. Essential oils have many health benefits. The oil contains antioxidants. Vitamin E, plant sterols and polyunsaturated fatty acids (PUFA), which can lower cholesterol and prevent chronic diseases such as heart disease, diabetes and cancer. Fatty oils are divided into three types: drying and semi-drying oil, non-drying oil, and vegetable oil. The refined grades of drying and semi-drying oils are used to make edible oils, while the poorer grades are used to make soaps, varnishes, paints, candles, and other similar products. Oils contain a variety of bioactive chemicals (e.g., terpenoids), which have most biological effects and qualities in addition to their scent and flavor. Antibacterial, antifungal, antioxidant, insecticide, anthelmintic, acaricidal, larvicidal, anthelmintic, anti-inflammatory, cytotoxic, antibacterial, antiseptic, and local anaesthetic are just few of them. Oil compounds, such as geraniol, have recently demonstrated potential anticancer actions in cancer cells, triggering growth inhibition and death.

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Role of Biofertilizers in Sustainable Agriculture

Sarita Choudhary

Assistant Professor, Vivekananda Global University, Jaipur
Email: sarita.choudhary@vgu.ac.in

Soil health is fundamental to sustainable agriculture, influencing plant growth, nutrient availability, and ecosystem stability. However, the overuse of chemical fertilizers, monoculture practices, and soil erosion have led to a significant decline in soil fertility, necessitating the exploration of alternative agricultural practices. In this context, biofertilizers—formulated with living microorganisms—have emerged as effective microbial solutions to enhance soil health. They work by promoting nutrient availability, stimulating plant growth, and improving soil structure. This review explores the various types of biofertilizers, such as nitrogen-fixing bacteria, phosphatesolubilizing microorganisms, and mycorrhizal fungi, detailing their mechanisms of action and specific applications in agriculture. Furthermore, the review highlights the numerous benefits of biofertilizers, including their role in reducing chemical fertilizer dependence, enhancing crop yields, and fostering sustainable agricultural practices. Despite their potential, several challenges hinder the widespread adoption of biofertilizers, including limited awareness among farmers, quality control issues, and the need for effective application techniques. By addressing these challenges, biofertilizers can significantly contribute to environmentally friendly farming practices, underscoring their importance in achieving sustainable agricultural systems and promoting long-term soil health.

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Advances in Weaning Food Formulation and Nutritional Guidelines

Divya Jyoti Sharma¹, Kusum Lata²

1-Student, Department of Nutrition and Dietetics, UIAHS, Chandigarh University, Punjab, India.

2-Faculty, Department of Nutrition and Dietetics, UIAHS, Chandigarh University, Punjab, India

Email address: divyaasharama@gmail.com, kusum.E8683@cuchd.in

Weaning is a crucial developmental stage in an infant's life, marking the transition from exclusive breastfeeding or formula feeding to the introduction of complementary solid foods. This period is essential for establishing the foundation for long-term health, growth, and cognitive development. The quality and nutritional composition of weaning foods directly impact an infant's overall well-being, emphasizing the need for nutritionally balanced, safe, and digestible formulations tailored to their metabolic requirements. In recent years, significant advancements have been made in weaning food formulations to meet diverse dietary needs. Fortification with essential micronutrients such as iron, calcium, and vitamins has been widely adopted to support brain development and immune function. Additionally, the incorporation of natural and plant-based ingredients has gained prominence due to their high digestibility and reduced allergenic potential. Addressing food allergies and sensitivities has led to the development of hypoallergenic formulations, ensuring inclusivity for infants with dietary restrictions. Technological innovations, including freeze-drying and advanced blending techniques, have improved nutrient retention while enhancing convenience for caregivers. Furthermore, sustainable and eco-friendly packaging is gaining importance in promoting both environmental sustainability and infant health. This review synthesizes recent advancements in weaning food formulation based on studies retrieved from PubMed, Google Scholar, and Web of Science, focusing on nutritional enhancement, technological innovations, and sustainable practices. It highlights key nutritional guidelines essential for promoting optimal growth and development during this critical phase while exploring the intersection of nutrition, food technology, and sustainability in shaping the future of complementary feeding.

Keywords: Infant nutrition, nutrient fortification, nutrition guidelines, weaning foods.

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Integrated management of Nutrient, Weed, Diseases and Pest Management Integrated Crop Management: A Way Towards Sustainable Agriculture

Rakesh Gurjar

Senior Research Fellow, NICRA project, Krishi Vigyan Kendra, Athiyasan, Nagaur-I

**Correspondence author email id: rakeshgurja95@gmail.com*

The world vision of no hunger target, food security, and zero poverty followed by raising standards of living of rural people through agricultural transformation is the greatest challenges faced by the agricultural planners worldwide. Due to the alarming state of population growth and cultivable land scarcity, change in agronomic practices which could bring a significant effect on crop production and productivity is urgently needed. The main components of INM, IWM&IPM include using organic materials such as manure and crop residues, applying chemical fertilizers thoughtfully, and incorporating biofertilizers. Regular soil testing is important to guide nutrient application, and practices like crop rotation also play a role in maintaining soil health. By combining these elements, we can create a nutrient management plan that supports healthy plant growth and minimizes environmental impact. The importance of Integrated Weed Management (IWM) means not relying on just one method, like herbicides, but instead using a mix of different techniques tailored to the specific situation. This can include things like choosing the right crops, rotating them, tilling the soil, and sometimes using biological controls or herbicides in a strategic way to minimize negative impacts. This means using a combination of methods, such as choosing disease-resistant plant varieties, implementing good cultural practices like crop rotation and sanitation, utilizing biological controls, and applying chemical treatments when necessary. The specific strategies need to be adapted to the particular crop and the diseases it faces. Biological control uses natural predators and other organisms to keep pest populations in check. Chemical control involves pesticides, which need to be used carefully to avoid resistance and environmental harm. Cultural methods modify farming practices to make the environment less appealing to pests, such as rotating crops and choosing resistant varieties. IPM emphasizes a balanced approach, using different strategies in a way that minimizes risks and maximizes effectiveness.

Key words: Sustainable agriculture IPM, INM, IDM

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One Health Approaches: For Prevention and Control of Diseases in Livestock and Poultry

Vikas

*M.Sc. Scholar, Department of Animal Husbandry and Dairying, Sam Higginbottom University of
Agriculture, Technology and Sciences, Prayagraj - 211007 (U.P), India
Mobile: 7665859093 | Email: vikasmahriya1@gmail.com*

The emergence and re-emergence of zoonotic diseases have highlighted the intricate interconnection between human, animal, and environmental health. The One Health approach, which emphasizes interdisciplinary collaboration, offers a comprehensive framework for the prevention and control of diseases in livestock and poultry. This paper explores the relevance and implementation of One Health strategies in addressing infectious disease challenges across animal populations, with a focus on minimizing zoonotic spillover and ensuring food safety and security. Key components such as integrated surveillance systems, biosecurity measures, antimicrobial resistance (AMR) mitigation, and coordinated response mechanisms are discussed. Case studies involving avian influenza, brucellosis, and other high-impact diseases demonstrate the effectiveness of a One Health paradigm in early detection, rapid containment, and sustainable disease management. The abstract concludes by emphasizing the need for policy support, intersectoral cooperation, and capacity building at grassroots levels to fully operationalize the One Health approach in the livestock and poultry sectors of India.

Keywords: One Health, zoonotic diseases, livestock, poultry, biosecurity, antimicrobial resistance, disease surveillance, intersectoral collaboration.

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Smart Foliar Nutrition with Nanolized Chitosan: Modulating Nitrogen Dynamics and Yield Attributes in Wheat (*Triticum aestivum* L.)

Kinjal Mondal^{1*} and Vinod Saharan¹

¹Nano-Research Facility Laboratory, Department of molecular Biology and Biotechnology

Rajasthan College of Agriculture and Technology, Udaipur-313001 (Raj.), India

*Corresponding author: kinjalmondal.cskhpkv2017@gmail.com

Effective nitrogen (N) management remains a cornerstone of sustainable wheat production, yet conventional fertilization practices often suffer from inefficiencies, leading to nutrient losses and environmental degradation. This study evaluates the efficacy of nanolized chitosan (nCS) biopolymer as an advanced foliar nutrient delivery system to enhance nitrogen assimilation, utilization efficiency, and yield performance in winter wheat (*Triticum aestivum* L.). Chitosan, a cationic biopolymer derived from chitin, exhibits high bio-adhesion, biocompatibility, and encapsulation capabilities, making it suitable for nanoscale nutrient delivery. In this study, nCS particles were synthesized *via* oxidative hydrolysis followed by surface functionalization with different nitrogenous compounds (urea and nitrate salts), resulting in nanocomposites with desirable physicochemical properties—particle sizes ranging from 80–120 nm, zeta potential of +42 mV, and low viscosity (5.8 cps). Foliar application was conducted at two critical growth stages—crown root initiation and booting—enhancing total nitrogen accumulation in both vegetative and reproductive tissues. Biochemical analysis revealed significant upregulation of key nitrogen assimilation enzymes, particularly nitrate reductase (NR) and glutamine synthetase (GS). Elevated leaf nitrogen levels were associated with increased chlorophyll content, photosynthetic efficiency, and improved canopy vigor. Agronomically, nCS-treated plants exhibited higher spikelet fertility, enhanced grain filling, and greater thousand grain weight, culminating in improved harvest index and overall grain yield. The use of nanolized chitosan enabled precise and sustained nutrient release, significantly improving nitrogen use efficiency (NUE). These findings highlight the potential of nCS as a smart, sustainable foliar input that can revolutionize nitrogen management and boost crop performance within precision agriculture systems.

Keywords: nanolized chitosan, surface functionalization, zeta potential, nitrogen use efficiency

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Varietal Development in Cotton (*Gossypium hirsutum* L.) by Exploiting Heterotic Groups

Nikhila¹ and S. S. Patil²

¹Ph.D. (Scholar), University of Agricultural Sciences, Dharwad
Department of Genetics and Plant Breeding

²Emeritus scientist, University of Agricultural Sciences, Dharwad
Department of Genetics and Plant Breeding
Email ID: nikhilasdm@rediff.com

The diversity between parents is must for both varietal and hybrid development. Complementation of diverse parents for creation of useful variability is a prerequisite even for varietal development. For the creation of useful variability required for varietal development, it is important to understand how to select parents to create such variability. Parents are mainly selected based on the distribution of desirable yield contributing characters (complementing) between them. It is important to ensure that parents are elite combiners and blend desirable characteristics distributed among them. Heterotic groups are the group involving diverse genotypes with desirable character distributed among them. The crossing between the two heterotic groups which lead to recombination in population in turn leads to greater genotypic diversity. In the same way multiple parents can be used to create variability to a greater extent, which can be used for the varietal development. In cross pollinated crop like maize, equilibrium populations are released as variety. In self and cross-pollinated crops multiparent based populations were used to develop varieties (Sahana, Abhadita in cotton). In the studies carried out in cotton at Dharwad, initially, attempts were made to utilize genetically diverse heterotic groups and make both within and between group crosses and create useful variability. These studies showed that four parent-based crosses made between heterotic groups revealed greater variability than crosses made within the heterotic group. This study clearly demonstrated the usefulness of broad-based populations derived from diverse heterotic groups in varietal development. Apart from four parent-based populations many 8 parent-based populations were also developed and advanced through initial segregating generations. Here, attempts were made to develop 8 parent-based populations, between the heterotic group crosses involving 4 parents (elite combiners) from each group revealed higher useful variability as compared to within 4 parent-based crosses.

Key words: Complementation, elite combiners, heterotic groups, recombination, variability, varietal development.

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Soma-Germ Cell Crosstalk in Plants

Nikhila¹, Jyoti P. Jirankali², Sowjanya¹

¹PhD (Scholar), University of Agricultural Sciences, Dharwad
Department of Genetics and Plant breeding

²PhD (Scholar), University of Agricultural Sciences, GKVK, Bangalore
Department of Genetics and Plant breeding
Email ID: nikhilasdm@rediff.com

In plants alternation of two generations occur *i.e.*, one haploid and the other diploid. In flowering plants the main plant body is a sporophytic generation in which the developed male and female gametes are gametophytic generation. Male gametophyte constitutes the bi or tricellular pollen grain it is released from the parent plant but the multicellular embryo sac is insitu. The plant reproductive cell lineage commences in the sporophyte when the cells in the male and female sex organs, stamens and carpels enter meiosis and terminates with the formation of the gametes.

Formation of meiocytes, gametophytes and gametes require active presence of neighboring helper cells. There is two way nature of interaction between reproductive cell lines and somatic helper populations and the viability of the gametes depends on this interaction. Depending on their sex and the stage of development, plant reproductive cell lineages are associated with different supporting cell populations. In male, meiotic cells are supported by tapetal cells which are essential for the postmeiotic development and at the later stages supported by the companion cells. In female, megaspore mother cell is supported by nucellar layer. As like in pollen, the gametophytic central cell acts as a companion cell to the egg within the gametophyte and subsequently after fertilization it gives rise to endosperm. The plant reproductive lineage is supported by different somatic cells. Different transcriptional factors, epigenetic factors help in the interaction between the gametic and somatic cells. Recent studies have provided insights into the genetic basis and regulatory programs underlying cell specification and the acquisition of reproductive fate during sexual reproduction.

Key words: Embryo, Gametophyte, Meiocytes and Tricellular.

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Comparative Evaluation of Agricultural Metrics in Medicinal and Aromatic Plant Cultivation: A Case Study of Dehradun, Haridwar and Tehri Garhwal, Uttarakhand

Pramod Kumar Chourasia¹, Dr. Charan Singh²

*1Ph.D Scholar, Forest Extension Division, Forest Research Institute (Deemed to be) University, Dehradun. Email: pramodkrcfri@gmail.com (Corresponding author) 2Scientist-F, Forest Extension Division, Forest Research Institute, Dehradun
Email: charans@icfre.org*

This study presents a comparative analysis of key agricultural metrics related to the cultivation of Medicinal and Aromatic plants (MAPs) in three prominent districts of Uttarakhand: Dehradun, Haridwar and Tehri Garhwal. This research examines the cultivation ecosystem of MAPs by evaluating parameters such as land allocation, production mode, awareness, training, support mechanism, access to knowledge and price realization. Utilizing secondary data and classification-based interpretation, the study identifies district-wise trends and disparities shaped by geographical features, institutional presence, market accessibility and community engagement. The findings reveal significant regional variations, with Dehradun showing institutional strength, Haridwar exhibiting industrial integration and Tehri Garhwal demonstrating high-altitude cultivation potential grounded in traditional practices. These metrics offer insights into the socio-economic and institutional dynamics influencing MAP farming across ecologically distinct regions. The research not only identifies region-specific strengths and gaps but also reflects variations influenced by ecological, economic and institutional factors. This research provides a metric-based understanding of MAP cultivation and highlights interventions to enhance sustainability, farmer engagement and economic viability. *Keywords:* medicinal and aromatic plants, agricultural metrics, value chain, MAPs cultivation, Dehradun, Haridwar, Tehri Garhwal, Sustainable agriculture, traditional knowledge.

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Footprint of Agricultural Crop Production – Anew Trend in Agricultural Research

Amit A. Shahane

*Assistant Professor (Agronomy), College of Agriculture (Central Agricultural University, Imphal),
Kyrdemkulai, Meghalaya – 793 105.*

Agriculture and allied activities are the non-replaceable and alone sector of generating provisional services for mankind and its establishment. With increase in human population, increase in understanding about production process involved, availability of modern technologies in agriculture and increased need of good and services, the agricultural production system modified to a great extent make it completely distinct from natural ecosystem. This modern technologies based agro-ecosystem had distinct effect on the natural resources and ecology which not same as natural ecosystem. Due to commercialization of agricultural activities, economics has more highlighted than ecology leading to concern of sustainability as the footprint of agricultural activities. These footprints are having huge and degrading impact on natural resources which is beyond the buffering capacity and resilience. The effect of footprint on natural resources reduces their productivity and carrying capacity which is reflected in less response to applied inputs in agro-ecosystem. Besides that, practices such as tillage, irrigation and nutrient management responsible to have footprints also losing their significant in economic gain in crop production. Therefore, development of additional practices with low footprint and more economic gain over regular practice were important research theme in crops production. These practices and technologies were tested for their footprint and compared with earlier practices for their yielding ability and footprint production potential. This attachment of economy and ecology hand in hand leads increased emphasis of study of footprint in research related with crop production. The climate changes/ greenhouse gas (GHG) related study involving identification of GHG production potential of different crops/ cropping systems or component/ input applied in crops/cropping system is the forerunner in study of footprint in crop production. The footprint in crop production were studied for water use, tillage practice, energy use, nutrient management, soil organic carbon degradation and soil fertility index; while crops/ cropping systems involving rice, wheat, maize, cotton, sugarcane, potato, soybean, mustard, groundnut are the some crops in which footprint study was well reported in India and abroad. The major practice for reducing footprint were conservation tillage over conventional tillage, use of organic sources of nutrition to partly substitute the chemical fertilizers over use of chemical fertilizers alone, aerobic rice cultivation over puddled cultivation and increasing soil organic carbon content. Besides that, organic farming, natural farming and agroforestry also reported to having great potential for reducing the footprint of crop production practices. Therefore considering the degraded natural resource base, increasing demand of provisional and ecological services from the same natural resource base and increasing prices of energy and purchased input are important facts for increasing need for research on footprints of crop production in agriculture.

Keywords: conservation agriculture, aerobic rice, greenhouse gases, soil organic carbon.

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Voices from the Field: Profile, Challenges, and Insights of Women Agriculture Officers in Andhra Pradesh

Mrs. Shaik Shama¹, Dr. M. Rama Devy² and Dr. M. Srinivasa Rao³

¹Assistant Professor, VFSTR, Vadlamudi, Guntur, Andhra Pradesh, India shamashaik711@gmail.com

²Professor, Department of Agricultural Extension, Agricultural College, Bapatla, ANGRAU, Guntur, Andhra Pradesh, India

³Professor, Department of Agricultural Extension, Agricultural College, Bapatla, ANGRAU, Guntur, Andhra Pradesh, India.

The study was conducted to study the Profile and Constraints perceived by the Women Agriculture Officers in Andhra Pradesh. *Ex Post-Facto* research design was followed for the study. The study was conducted in all the thirteen districts of Andhra Pradesh during the year 2020-21. From each of the selected district ten Women Agriculture Officers were selected as respondents by following simple random sampling procedure. The sample constituted to a total of 130 respondents. The data was collected with the help of a Questionnaire through google forms, personal interview method and data obtained was analyzed. The detailed analysis of profile of Women Agriculture Officers revealed that majority of WAOs were middle age, completed B.Sc. (Ag.), medium experience, rural background, medium distance travelled from the residence, medium number of trainings undergone, medium number of subordinates working, business person as spouse and using own vehicle for office duties. The problems faced by Women Agriculture Officers while performing their duties and suggestions given by them to overcome their constraints were elicited.

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Efficacy of the Entomopathogenic Fungi *Beauveria bassiana* (Balsamo) Vuillemin and *Metarhizium anisopliae* (Metschnikoff) Sorokin, in the Management of Leaf Roller *Haritalodes derogata* Fab. under Field Conditions

M. Parvathi*, O. P. Reji Rani

Department of Agricultural Entomology, College of Agriculture, Vellayani, Thiruvananthapuram – 695522, Kerala, India

**Corresponding author E-mail: parvathimaloth13@gmail.com*

A new formulations of *B. bassiana* and *M. anisopliae* were tested for their efficacy against leaf roller, and it was revealed that *Metarhizium* @ 2 L⁻¹ and *Beauveria* capsules @ 3 L⁻¹ were found to be the best treatment causing 96.38 and 85.80 per cent reduction in population of *H. derogata* F., while it was 80.23 per cent with *Metarhizium* capsules @ 3 L⁻¹. Population reduction ranged from 41.35 - 68.72 per cent in the lower doses of capsule 1 L⁻¹. The highest reduction in the population of *H. derogata* was observed with spore suspensions of *Beauveria* and *Metarhizium* @ 10⁸ mL⁻¹ (100 per cent). Percentage reduction in chlorantraniliprole 18.5 % SC was 93.41. Moreover, both the bio formulations applied as treatments were safe to natural enemies present in bhendi ecosystem. The yield obtained from different treatments did not vary significantly. This study projects the prospect of utilizing *B. bassiana* and *M. anisopliae* and their capsule formulations as an effective biocontrol agent against bhendi leaf roller, one of the significant pests of bhendi.

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Meta-Transcriptomic Analysis Reveals Key Genes and Networks Involved in Salinity Stress Tolerance in Chickpea (*Cicer arietinum*)

Nisha Boora and Navjeet Ahalawat*

*Department of Bioinformatics & Computational Biology, CCS Haryana Agricultural University,
Hisar-125004, Haryana (India)*

Email address: nishboora@gmail.com (Nisha Boora), navjeetahalwat@gmail.com (Navjeet Ahalawat)

**Corresponding author*

Salinity is a major abiotic stress causing significant agricultural losses worldwide. Chickpea (*Cicer arietinum*), an essential legume crop, is particularly sensitive to salt stress. As the second most important cool-season grain legume, chickpea is cultivated primarily in arid and semi-arid regions and belongs to the Fabaceae family. Renowned for its high protein content and rich nutrient profile, it also enhances soil fertility through nitrogen fixation. However, abiotic stress factors, especially salinity stress, severely constrain chickpea production by disrupting key processes such as photosynthesis and metabolism, ultimately impairing plant growth and reproduction. This study aimed to identify key genes associated with salinity stress tolerance through meta-analysis of transcriptomics data. A total of 1,294 million reads were collected from root and shoot samples of seven genotypes from the NCBI SRA database to identify differentially expressed genes. Analysis revealed 5,057 DEGs linked to critical metabolic pathways, including hormone signaling, photosynthesis, lipid and carbohydrate metabolism, and cell wall biogenesis. Gene set enrichment analysis (GSEA) and functional annotation confirmed the involvement of these gene groups in biological processes relevant to salt stress adaptation, such as cell wall organization, root development, and ion transport regulation. Additionally, a Weighted Gene Co-expression Network Analysis (WGCNA) was performed to explore gene modules associated with salinity tolerance in chickpea. Within module, intramodular connectivity analysis identified key hub genes, including ABR-18, ERF (Ethylene Response Factor), and EPR1. These genes are known regulators of root growth, stress signalling, and ion homeostasis, underscoring their potential roles in modulating plant responses to saline conditions.

Keywords: Differential gene expression; Salinity; Transcriptomics; Weighted Gene Co-expression Network Analysis

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Trait association and Cluster Analysis in Wheat (*Triticum aestivum* L.) Genotypes under Drought Conditions

G. Nikhil¹, Mukesh Kumar¹ and Vikram Singh¹

¹Department of Genetics and Plant Breeding

CCS Haryana Agricultural University, Hisar-125004 (Haryana)

E-mail: nikhilgniki97@hau.ac.in Mobile No: 9986494762

Wheat (*Triticum aestivum* L.) is one of the world's most important food crop, whose production has been threatened by changing climatic conditions. There is a need to develop climate resilient wheat varieties to ensure food security. In the present study, 50 bread wheat genotypes were evaluated under timely sown and restricted irrigation (drought) conditions during 2022-23 and 2023-24 *Rabi* seasons. Correlation analysis revealed strong positive correlation of grain yield plot⁻¹ with biological yield plot⁻¹ (0.642), harvest index (0.458), grain weight spike⁻¹ (0.405), grains spike⁻¹ (0.400), number of tillers meter⁻¹ (0.375) and spike weight (0.351). Among physiological traits, chlorophyll content at grain filling stage (0.510), normalised difference vegetation index (NDVI) at vegetative (0.465) and grain filling stage (0.429) showed positive correlation with grain yield. These results emphasize the importance of these traits for indirect selection of grain yield under drought stress conditions. The genotypes were grouped into six clusters using a hierarchical classification approach based on 25 morpho-physiological traits. The highest number of genotypes were grouped in cluster III (13) and cluster V (13), followed by cluster I (9), cluster IV (7), Cluster II (6) and cluster VI (2). The maximum intra-cluster distance was recorded for cluster II (1002.34), followed by cluster IV (979.39) and cluster III (849.75). The maximum inter-cluster distance was observed between cluster II and cluster V (1417.05), closely followed by cluster IV and cluster V (1410.58). Cluster IV recorded highest cluster means for grain yield plot⁻¹, number of spikelets spike⁻¹, peduncle length, flag leaf length and NDVI at vegetative and grain filling stage. Cluster II had highest cluster means for biological yield plot⁻¹, thousand grain weight, grain weight spike⁻¹, grains spike⁻¹, spike weight, spike length, number of productive tillers meter⁻¹ and membrane stability index. These results indicate that the genotypes present in cluster II and cluster V are genetically diverse and crossing between them may produce superior heterotic combinations.

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Role of Nanotechnology in Prevention Post-Harvest Losses and Extend Shelf Life of Tomato (*Solanum lycopersicum* L.)

Akash Saini¹, Mahendra Meena¹, Sagar Saini², Arjun Lal Yadav¹

¹Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India

²Department of Horticulture, Rajasthan Agricultural Research Institute (Sri Karan Narendra Agriculture University, Jobner-303329), Durgapura, Jaipur, Rajasthan, India
Email Id: -akashsainibr@gmail.com

Tomato (*Solanum lycopersicum* L.), a climacteric fruit of global economic and nutritional significance, is highly perishable and prone to substantial post-harvest losses due to its soft texture, high respiration rate, and susceptibility to microbial decay. These losses, which can range between 25–40% in developing countries, significantly impact the agricultural economy, food security, and sustainability. The integration of nanotechnology in post-harvest management has emerged as a transformative approach to mitigate these losses and extend the shelf life of tomatoes through innovative materials and intelligent packaging solutions. Nanotechnology, defined as the manipulation and application of materials at the nanoscale (1–100 nm), offers unique physicochemical properties such as increased surface area, enhanced reactivity, and controlled release capabilities. These properties have been exploited in the development of nano-based coatings, and nanocomposite packaging materials, all of which contribute to improved preservation and quality retention of tomatoes post-harvest. Minimizing the post-harvest losses in fruits and vegetables is one of the challenging tasks in agriculture. Previous studies reported that nano-net of Cu-chitosan nanoparticles (Cu-chitosan NPs) which has the ability to extend the shelf-life of stored tomato. One of the most promising applications is edible nano-coatings, typically formulated with natural bio-polymers such as chitosan. Nano-coatings act as semipermeable barriers to gases, and slowing down respiration and ethylene production. Moreover, the antimicrobial activity of embedded nanoparticles reduces microbial spoilage and extending their shelf life.

Key words: Nanotechnology, Chitosan, Edible nano-coatings, post-harvest losses

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Integrating Eco-Friendly Wood Protection and Plant Defence Mechanisms in Sustainable Forest Management for Enhanced Ecosystem Resilience

Ankita Semwal¹, Hukum Singh², Ranjana Yadav¹

¹Forest product Division, ²Plant Physiology discipline, Genetics and Tree improvement Division
Forest Research Institute, PO New Forest, Dehradun – Uttarakhand, 248006, India
Corresponding Author: *anki.semwal99947@gmail.com, ranjanay7@gmail.com

Nanoparticles have demonstrated significant potential in addressing complex challenges across multiple scientific and technological domains, including the field of wood science. Among these, metal nanoparticles are particularly valued for their efficacy in enhancing wood protection due to their antimicrobial properties and ability to improve material durability. However, conventional synthesis of these nanoparticles is predominantly chemical in nature, often involving high production costs and the generation of environmentally hazardous by-products. As global population growth drives increased demand for timber, the importance of effective and sustainable wood preservation has become paramount within modern forestry practices. Conventional preservatives and stress management methods pose threats to both the environment and human health. Green synthesis of metal nanoparticles via plant-based approaches presents a superior alternative.

Green synthesis methods employ natural sources such as plant extracts, microorganisms, and biomolecules to fabricate nanoparticles in a cost-effective and scalable manner. These approaches leverage the inherent abundance and renewability of biological materials, offering a sustainable substitute to conventional chemical treatments. Furthermore, such bio-inspired synthesis routes enable precise control over key nanoparticle parameters—including size, morphology, and composition—thereby enhancing their functional performance in wood protection applications. In addition, plant-derived nanoparticles exhibit intrinsic biocompatibility and biodegradability, significantly reducing the ecological and health-related concerns commonly associated with synthetic nanoparticles. This environmentally conscious aspect is particularly advantageous in addressing the pressing issues of toxicity and sustainability in contemporary wood preservation technologies. The integration of plant-based nanoparticle synthesis into wood protection strategies represents an innovative and sustainable advancement in forest product technology. By enhancing the durability and biological resistance of wood-based materials, this approach contributes to the long-term resilience of forest ecosystems and aligns with the broader goals of sustainable forest management.

Keywords: Green synthesis, metal nanoparticles, plant defense mechanisms, plant extract, wood preservatives.

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Post-Harvest Management: A Key to Ending Hunger and Enhancing Nutrition

Anoop Kumar

Department of Agriculture, Vivekananda global university, Jaipur Rajasthan, India

Corresponding author email: Pvanoop.kumar04@gmail.com

The need of good post-harvest technologies to attain food security. Post-harvest technology plays a crucial role in reducing food losses, maintaining quality, and enhancing the market value of agricultural products. The current research explores various post-harvest techniques such as cleaning, sorting, grading, processing, storage, and transportation, which help extend the shelf life of fruits and vegetable. Improper storage leads to significant losses, which could be avoided. Enhancements to storage methods, such as controlled atmosphere storage and refrigeration, have improved food preservation. Additionally, innovative packaging solutions and efficient transportation systems help maintain freshness and reduce contamination. The adoption of improved post-harvest practices can enhance food security, increase farmers' income, and ensure better quality products for consumers. Further research and technological advancements in this field are necessary to minimize losses and improve food security and stability. The need for post-harvest technology is very high due to rapid increase in population and the decline in horticultural production. Post-harvest technologies are primarily used in large-scale production farmers, while small-scale farmers struggle to afford expensive solutions such as cold storage. To ensure wider adoption, it is essential to develop more affordable and cost-effective technologies that small farmers can access and utilize efficiently. Additionally, government support and initiatives for small and marginal farmers play a crucial role in making these technologies more accessible and sustainable. Basis of this reason the farmers getting less price so the turn back from the organic farming to the backward from the organic farming.

Key words: post-harvest technology, food security, small scale farmer and organic farming.

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Nanotechnology: A Solution of Current Horticulture Challenges

Arjun Lal Yadav¹, Mahendra Meena¹, Sagar Saini², Akash Saini¹

¹Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India

²Department of Horticulture, Rajasthan Agricultural Research Institute (Sri Karan Narendra Agriculture University, Jobner-303329), Durgapura, Jaipur, Rajasthan, India

Email Id: -yadavarjun070707@gmail.com

Nanotechnology, the manipulation of matter on an atomic or molecular scale, is revolutionizing various industries, including agriculture and horticulture. This interdisciplinary field combines principles from physics, chemistry, biology, and engineering to create nanoscale materials, devices, and systems that can offer innovative solutions to current challenges faced in horticulture. In the context of horticulture, nanotechnology provides tools for improving crop yield, enhancing pest and disease resistance, optimizing water usage, and reducing the environmental impact of traditional farming practices (Lu *et al.*, 2010). The role of nanotechnology in horticulture is multifaceted. Nano-enabled tools such as nanopesticides, nanofertilizers, and nano sensors can be used to monitor plant health, detect diseases early, and deliver nutrients and pesticides more efficiently, minimizing waste and harmful runoff (Sogvaret *et al.*, 2016). Additionally, nanomaterials like nanocapsules can be used for controlled release of fertilizers and pesticides, ensuring that these resources are utilized more effectively and sustainably. These properties have been exploited in the development of nano-based coatings, and nanocomposite packaging materials, all of which contribute to improved preservation and quality retention of tomatoes post-harvest. Minimizing the post-harvest losses in fruits and vegetables is one of the challenging tasks in agriculture (Ranjbar *et al.*, 2018).

Keywords: Nanotechnology, coatings, postharvest

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Poplar: A Climate-Resilient Species for Enhanced Carbon Sequestration and Sustainable Applications

Arsh Kumar^{1*} and Antony Joseph Raj²

¹*Department of Forest Products and Utilization, College of Horticulture and Forestry, CAU(I),
Pasighat-791102, Arunachal Pradesh, India*

²*College of Forestry, Sam Higginbottom University of Agriculture, Technology and Sciences,
Prayagraj-211007, Uttar Pradesh, India*

**Corresponding author Email ID: itsarshkumar@gmail.com*

Poplar trees have emerged as a top candidate for climate change mitigation because of their fast growth, high biomass production, and many uses within sustainable and bioeconomy frameworks. Known for their rapid growth, light yet strong wood, and ability to adapt to various soils and water conditions—including marginal lands and wetlands—poplars serve many roles. They provide raw materials for engineered wood products, bioenergy, bioplastics, urban greening, and even modern eco-design such as 3D printing. Their hardiness also makes them valuable for phytoremediation projects, where they help clean contaminated soils and waters. Genetically improved hybrid varieties further boost their potential in reforestation and carbon farming initiatives. In addition to these industrial and environmental benefits, poplar trees have a long history of medicinal use. Extracts from their bark and leaves offer natural anti-inflammatory and antimicrobial properties, making them useful in treating minor infections and skin conditions. This added medicinal value increases the importance of poplar trees in both ecological and human health contexts. The research investigated the carbon sequestration potential of poplar by measuring individual tree performance across nine diameter-at-breast-height (DBH) classes and eight height classes. The results were encouraging. Poplar trees with a DBH greater than 40.1 cm showed an average total biomass of 849.29 kg per tree, sequestered 514.92 kg of carbon per tree, and accumulated 1884.62 kg of CO₂ per tree. When analyzed based on height, trees taller than 35 meters recorded an average total biomass of 560.30 kg per tree, stored 339.71 kg of carbon, and accumulated 1243.24 kg of CO₂ per tree. These findings clearly show that larger, more mature trees capture more carbon, playing a critical role in reducing atmospheric CO₂. This study supports the idea that incorporating poplar trees into agroforestry, urban reforestation, and carbon farming projects can be highly effective. Policy makers and stakeholders may consider using poplar plantations not only for their fast biomass accumulation and versatile industrial applications but also for their role in phytoremediation and medicinal uses. This integrated approach can help meet carbon neutrality targets while ensuring long-term ecological, economic, and public health benefits in the fight against climate change.

Keywords: Poplar Trees, Climate Resilience, Carbon Sequestration, Fast Growth & Biomass Production, Sustainable Applications, Phytoremediation, Medicinal Uses.

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Artificial Intelligence in Climate Change Mitigation

Sandiponi Tasha

Department of Extension Education and Communication Management, Faculty of Community Science, Assam Agricultural University, Jorhat-785013, Assam; sandiponitasha05assam@gmail.com

Climate change continues to pose an escalating global threat, demanding innovative and data-driven approaches to mitigation. Artificial Intelligence (AI) has emerged as a transformative technology capable of addressing climate-related challenges across various sectors. This paper explores the intersection of AI and climate change mitigation, highlighting how AI technologies such as machine learning, deep learning, natural language processing, and remote sensing contribute to monitoring emissions, forecasting weather, optimizing energy systems, and supporting sustainable agriculture. The paper also discusses AI's role in disaster risk management by enabling rapid data analysis and decision-making during emergencies. Despite its immense potential, the deployment of AI in climate action faces several challenges, including high energy consumption, data scarcity, ethical concerns, and infrastructure limitations—particularly in under-resourced regions. Nevertheless, advancements in energy-efficient AI models, integration with IoT and satellite systems, and developments in decentralized learning techniques present significant opportunities for the future. This paper concludes that while AI is not a standalone solution, it is a critical component in the global climate mitigation strategy. With responsible implementation and cross-sector collaboration, AI can accelerate progress toward a more sustainable and climate-resilient future.

Keywords: Artificial Intelligence, Climate Change Mitigation, Machine Learning, Renewable Energy, Sustainable Agriculture

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Artificial Intelligence in Precision Agriculture: Transforming the Future of Farming

Prof. Atul Bengeri¹ and Suyash Gaikwad²

¹MIT Vishwaprayag University, Solapur

²B.Sc Agri and MBA, MIT Vishwaprayag University, Solapur

AI is reshaping the agricultural landscape by providing intelligent tools for precision farming. From enhancing resource efficiency to enabling real-time decision-making, AI supports sustainable agriculture that can meet the food demands of the future. By fostering a collaborative and supportive ecosystem, stakeholders can ensure that AI technologies drive a resilient, productive, and sustainable future for agriculture. Artificial Intelligence (AI) is revolutionizing the agricultural industry by enhancing productivity, optimizing resource usage, and addressing sustainability concerns. This chapter explores the integration of AI into precision agriculture, showcasing its potential to reshape modern farming through data-driven decision-making, advanced crop monitoring, automation, and resource management. The chapter also highlights the challenges, ethical considerations, and future directions for AI-powered agriculture, advocating for inclusive innovation and policy development.

Artificial Intelligence (AI) is rapidly transforming the agricultural landscape by delivering intelligent, data-driven tools for precision farming. These technologies enable a shift from reactive to proactive decision-making, allowing farmers to anticipate problems, optimize inputs, and increase output with greater precision. AI helps streamline processes such as crop monitoring, pest detection, irrigation, and soil management—all of which contribute significantly to sustainability goals. By improving operational efficiency and reducing waste, AI not only enhances agricultural productivity but also minimizes the environmental impact of farming activities. In particular, AI empowers farmers with **real-time insights and recommendations**, enabling them to make evidence-based decisions about when to sow, irrigate, fertilize, or harvest. This dynamic support system enhances responsiveness to changing climatic and market conditions, creating a more resilient agricultural model. Furthermore, automation technologies powered by AI—such as autonomous tractors, robotic harvesters, and drone surveillance—are addressing long-standing labor challenges while ensuring consistency and quality in operations.

Crucially, the future of AI in agriculture hinges on **collaborative ecosystems** that bring together farmers, technologists, agronomists, policymakers, and institutions. When supported by robust digital infrastructure, inclusive policies, and skill development programs, AI can serve as a powerful equalizer—bridging knowledge gaps, increasing profitability, and promoting food security on a global scale.

Keywords: Artificial Intelligence, Precision Agriculture, Farming Technologies, Smart Farming

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Impact of the Different Casing Material on the Yield of Button Mushroom in Polyethylene Bag and Bed System

**Pushpendra Singh Chaudhary¹, Muhilan Mahendhiran², Shikha Yadav³
and Hoshiyar Singh⁴**

*Assistant professor¹, Faculty of Agriculture, Vivekananda Global University, Jaipur
HOD & Associate Professor², Faculty of Agriculture, Vivekananda Global University, Jaipur
Assistant professor³, Faculty of Agriculture, Vivekananda Global University, Jaipur
Dean & Prof.⁴ Faculty of Agriculture, Vivekananda Global University, Jaipur*

Button mushroom (*Agaricus bisporus*) is renowned for its nutritional value, extended shelf life, and ability to thrive in warm, humid climates. A crucial factor influencing its productivity is the casing layer, which supports the development of fruiting bodies by maintaining appropriate moisture levels, enhancing aeration, and fostering beneficial microbial activity. The impact of different casing materials such as peat moss, farmyard manure (FYM) with soil, coir pith, vermin compost, and spent mushroom substrate on the yield of button mushrooms cultivated under two systems: polyethylene (PE) bag and bed systems. These casing materials were sterilized using following three methods: formalin treatment, tunnel pasteurization, and autoclaving. In the PE bag system, peat moss-based casings, especially when amended with lime or vermincompost, delivered the highest yields. Since these materials offered superior moisture retention, structural stability, and microbial balance, ideal for the confined conditions of the bag system. In contrast, the bed system favored casing mixtures rich in organic matter, such as FYM with soil or vermicompost, which enhanced aeration and nutrient availability, promoting better pinning and higher biological efficiency. Therefore, selecting the appropriate casing composition based on the system used is essential to optimize yield. These findings provide practical insights for mushroom growers aiming to enhance productivity and adopt more efficient and sustainable cultivation practices.

The results clearly demonstrate that the effectiveness of casing materials varies with the cultivation system. Therefore, selecting the appropriate casing composition based on the system used is essential to optimize yield. These findings provide practical insights for mushroom growers aiming to enhance productivity and adopt more efficient and sustainable cultivation practices.

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Advancements in Biotech and AI for Enhancing Soil Health and Pest Management in Organic Farming

Ayandip Maity

Department of Agriculture, Brainware University, 398 Ramkrishnapur Road, Barasat

Kolkata 700125

Email: *maityayandip@gmail.com*

Organic farming emphasizes the use of natural inputs and ecological processes to maintain soil fertility and manage pests, aiming for sustainability and environmental harmony. However, challenges such as declining soil health, increasing pest pressure, and inconsistent yields often limit its scalability. In recent years, the integration of biotechnology and artificial intelligence (AI) has emerged as a transformative solution to these limitations, offering new tools for sustainable intensification of organic agriculture.

Biotechnological innovations, including the use of biofertilizers, biopesticides, and microbial consortia, play a critical role in improving nutrient cycling, enhancing soil microbial diversity, and suppressing soil-borne pathogens—without the use of synthetic chemicals. Meanwhile, AI-powered tools like machine learning algorithms, remote sensing, and image recognition aid in early pest and disease detection, real-time soil health monitoring, and predictive decision-making, leading to more precise and efficient farm management.

This paper reviews recent breakthroughs in biotechnology and AI applications tailored for organic farming, highlighting case studies, technological frameworks, and future prospects. It emphasizes how these technologies can bridge traditional practices with cutting-edge science, enhancing sustainability while adhering to organic principles. The synergistic application of biotech and AI not only optimizes productivity but also ensures long-term ecological balance—paving the way for a resilient, smart, and truly sustainable organic farming system.

Keywords: Organic Farming, Biotechnology, Artificial Intelligence (AI), Soil Health, Pest Management

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Effect of Foliar Application of Different Sources of Nutrients on Growth of Jambheri Seedlings

R. R. Todkar¹, R. M. Bhusari², H. B. Goramnagar³, Y. V. Kherde⁴,
Hiteshwari A. Katankar⁵ and S. V. Dahake⁶

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The present investigation, titled “Effect of Foliar Application of Different Sources of Nutrients on Growth of Jambheri Seedlings,” was carried out at the Centre of Excellence for Citrus, College of Agriculture, Nagpur, during the academic year 2022–23. The study aimed to (i) evaluate the impact of foliar application of different nutrient sources on the growth of *jambheri* (*Citrus jambhiri* Lush.) seedlings and (ii) identify the most effective nutrient source for foliar application. The experiment was conducted using a Randomized Block Design (RBD) in the primary nursery and a Completely Randomized Design (CRD) in the secondary nursery, with nine treatments replicated three times. The treatments consisted of foliar applications of Nano urea at 100, 150, and 200 ppm (T1, T2, T3), Nano DAP at 100, 150, and 200 ppm (T4, T5, T6), 19:19:19 (1%) (T7), Urea (1%) (T8), and a control (water spray) (T9).

The results demonstrated that Nano DAP (200 ppm) (T6) significantly improved shoot length, shoot diameter, and leaf area in both the primary and secondary nurseries. Additionally, T6 recorded the highest values for number of leaves per seedling, root diameter, root length, root volume, fresh seedling weight, dry seedling weight, and root dry weight in the primary nursery. The root-to-shoot ratio was observed to be significantly higher in Nano DAP (150 ppm) (T5). In the secondary nursery, T6 (Nano DAP 200 ppm) produced the maximum number of buddable seedlings, whereas T3 (Nano urea 150 ppm) recorded the highest number of leaves per seedling and number of shoots per seedling. However, budding success and time required for sprouting were found to be non-significant across all treatments in the secondary nursery.

Overall, the study highlighted Nano DAP (200 ppm) as the most effective foliar nutrient source for enhancing the growth and development of *jambheri* seedlings. The findings suggest that the application of Nano DAP at 200 ppm can be a promising strategy to improve early seedling growth and nursery performance of *jambheri*, which can ultimately contribute to the successful establishment of citrus rootstocks.

Keywords: *Jambheri* seedlings, foliar application, Nano urea, Nano DAP, nutrient sources.

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Impact of Inorganic Nutrients and Biofertilizers on the Economic Performance of Spinach Beet Cultivation

S. Hima Bindu^{1*} and T. Baby Rani²

¹Research Scholar, ²Assistant Professor, SKLTGHU

Email ID: hbindu.saisu@gmail.com

The increasing demand for sustainable agricultural practices has led to growing interest in integrating organic and inorganic nutrient sources to enhance crop productivity and economic returns. This study investigates the impact of inorganic nutrients and biofertilizers on the economic performance of spinach beet (*Beta vulgaris* var. *bengalensis*) cultivation. A field experiment was conducted to evaluate the effects of different fertilization regimes, including the application of inorganic fertilizers, biofertilizers, and their combined use, on crop yield, input costs, and net returns. Treatments comprised recommended doses of nitrogen, phosphorus, and potassium (NPK), biofertilizers such as Azotobacter, Phosphate-solubilizing bacteria (PSB), Potassium Solubilizing Bacteria and Arka Microbial Consortium (AMC) as integrated nutrient management strategies. Results indicated that the combined application of 50% inorganic nutrients and 50% biofertilizers significantly improved both yield and economic returns compared to other applications. This integrated treatment enhances the nutrient availability resulting in vigorous plant growth and dry matter production which in turn resulted in giving higher yields and economics over other treatments. From an economic standpoint, the integrated approach recorded the highest net returns and benefit-cost ratio, primarily due to improved productivity and reduced reliance on costly chemical fertilizers. This study highlights the potential of integrated nutrient management (INM) as a sustainable and economically viable option for spinach beet growers. It offers a balanced solution that enhances soil health, reduces input costs over time, and sustains productivity. Adoption of such practices could play a significant role in ensuring food security while maintaining environmental integrity. Future research may focus on optimizing dosage, combinations, and application timing to maximize the benefits of INM under different agro-climatic conditions. Overall, the findings support the promotion of biofertilizer use alongside inorganic inputs for improved economic performance in leafy vegetable cultivation systems.

Key words: Spinach Beet, Inorganic Nutrients, Biofertilizers, Economics and Sustainable

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Artificial Intelligence in Cold Chain Management: Challenges for Small and Marginal Farmers

Dr. Pradipta Chandra

Chandigarh Group of Colleges (CGC), Jhanjeri, Mohali, Punjab – 140307.

Department of Management, Chandigarh School of Business

ORCID ID:0000-0003-4186-8706

Scopus Author ID: 57202374305

E-mail: pradipta.j3657@cgc.ac.in; drchandraiitkgp@gmail.com

A cold chain or cool chain is a temperature-controlled supply chain that involves the storage, transportation and distribution of perishable goods such as vaccine, chemical, sea-food, meats and dairy products. Multiple challenges are there in the business activities where products are agriculture, food and pharmaceutical based. This review paper highlights on the possible challenges associated with the intervention of artificial intelligence in various applications for cold chain in agriculture, horticulture and food processing. Maintaining a stable temperature throughout the supply chain is crucial to handle such products, specially by small and marginal farmers, as there are certain guidelines associated with nutrition quality, safety and freshness of the fruits and vegetables. To achieve these, alongwith temperature, other parameters like time, duration, humidity, handling, storage, transportation and logistics, monitoring, packaging, training are equally important. By monitoring and controlling the variables for a suitable parameter, the goal of cold chain can be achieved where artificial intelligence can play an instrumental role.

Keywords: Cold Chain, AI, Small and Marginal Farmers, Supply Chain and Logistics, India

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Chemopreventive Activity of *Swertia chirata*, Beetroot, and Triphala: A Comprehensive Review

Pallabi Sarkar¹ and Dr. Biswa Prasun Chatterji²

*1 Assistant Professor, The Assam Royal Global University, Guwahati, Assam
sarkarpallabi010@gmail.com*

*2 Professor, Assam Downtown University, Panikhaiti, Guwahati, Assam
biswaprasun@gmail.com*

The chemopreventive activities of *Swertia chirata*, Beetroot, and Triphala have gained significant attention due to their rich bioactive compounds that exhibit antioxidant, anti-inflammatory, and anticancer properties. This comprehensive review explores the biochemical mechanisms, clinical studies, and traditional uses of these three natural agents. *Swertia chirata*, containing xanthones, swertiamarin, and amarogentin, has demonstrated potent chemopreventive effects by inducing apoptosis in cancer cells and inhibiting the PI3K/Akt pathway. Beetroot, rich in betalains and dietary nitrates, exhibits chemopreventive effects through its antioxidant properties and modulation of inflammatory pathways, while also showing potential in reducing tumour growth and metastasis. Triphala, an Ayurvedic formulation, is noted for its polyphenols and flavonoids, which inhibit key signaling pathways and induce apoptosis in various cancer models. Comparative analysis reveals that while all three agents share common chemopreventive mechanisms, their specific pathways and clinical studies vary, with Triphala being more extensively researched. The review concludes that the combination of these extracts may yield synergistic effects, enhancing their chemopreventive potential against specific cancers, including prostate, breast, and colorectal cancers. Further clinical studies are warranted to validate their efficacy and explore therapeutic applications.

Keywords: chemopreventive, bioactive compounds, *Swertia chirata*, beetroot, triphala

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Development of an Integrated Pest Management Strategy for White Grubs in Potato-Growing Regions of Jammu

Shailla Hussain¹, Dr. Magdeshwar Sharma²

*Sher-e-Kashmir University of Agricultural Sciences and technology of Jammu, Jammu & Kashmir,
India-180009*

Email id: shaillahussain16@gmail.com

White grubs (Coleoptera: Scarabaeidae) are major underground pests in potato-growing regions of Jammu, causing tuber damage and significant yield loss. Surveys conducted during 2022–2024 across 3 different locations in Jammu region—revealed an average grub infestation of 18.6%, with peak incidence of 35.2%. The predominant species identified were *Brahmina coriacea*, *Melolontha fuscicauda*, and *Anomala rufiventris*. A field-based IPM module was developed and evaluated over two crop seasons. The module included: (i) deep summer ploughing in May–June, (ii) application of *Metarhiziumanisopliae* @ 2×10^8 conidia/g mixed with FYM at planting, (iii) use of pheromone and light traps for beetle management during pre-monsoon emergence, and (iv) need-based application of chlorpyrifos 20 EC @ 2.5 L/ha. Results showed a significant reduction in grub population (65.4%) and a 41.7% increase in marketable yield compared to untreated controls. Moreover, the IPM-treated plots recorded only 6.8% tuber damage, as against 21.3% in non-IPM fields. These findings demonstrate the efficacy of integrated strategies in white grub management and suggest a scalable, eco-friendly alternative to sole reliance on chemical control. The study underscores the importance of species-specific monitoring and location-tailored IPM interventions for sustainable potato production in hilly agro-ecosystems.

Keywords : white grub ,IPM, module

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Development of Value Added Vegan Burger Patty Incorporated with Millets

Prapty Mallick¹, Dr. Bhawna Thukral²

¹PG Scholar, Department of Nutrition & Dietetics, Chandigarh University

²Faculty, Department of Nutrition & Dietetics, Chandigarh University.

Email- praptymallick12@gmail.com; Bhawana.E8633@cumail.in

The objective of this study was to formulate a healthy vegan burger patty from foxtail millet, proso millet, and sweet potato. Four formulations (S1–S4) were made with different ratios and compared with a conventional potato control. Sensory analysis on a 9-point hedonic scale revealed that the highest acceptability (7.85 ± 0.25) was exhibited by sample S3 (15% foxtail millet, 15% proso millet, 70% sweet potato), which closely resembled the control. Nutritional evaluation indicated S3 had much higher content of protein (13.40 ± 0.20 g), fiber (10.70 ± 0.20 g), and mineral composition—iron (2.50 ± 0.05 mg), calcium (74.50 ± 1.25 mg), zinc (9.16 ± 0.15 mg), and potassium (70.90 ± 0.75 mg)—with $p < 0.001$. Vitamin A was much higher as well (43.00 ± 1.00 IU) from the control value (12.00 ± 1.00 IU). The findings emphasize the ability of millet and sweet potato to improve the sensory and nutritional attributes of plant-based patties.

Keywords: Burger-patty, Foxtail millet, Proso millet, Sweet potato, Vegan

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Vegetable Seed Priming: Techniques and Benefits

Dev raj Gurjar¹, Mahendra Meena¹, Bhavna¹, Akash Saini¹

*¹Department of Horticulture, Sri Karan Narendra Agriculture University,
Jobner-303329, Rajasthan, India
Email Id: -ddevnekadi@gmail.com*

Seed priming is a pre-sowing technique that enhances the physiological and biochemical processes within seeds, leading to improved germination, seedling vigor, and overall crop performance. This method is particularly beneficial for vegetable crops, as it ensures uniform seedling emergence, which is crucial for successful field establishment. The process involves controlled hydration of seeds, allowing pre-germinative metabolic activities to occur without radical protrusion. Once the seeds are dried and stored, they germinate more rapidly when sown under field conditions. Vegetable crops often face challenges such as poor germination under suboptimal environmental conditions, including drought, salinity, and extreme temperatures. Seed priming can help mitigate these challenges by enhancing the seed's tolerance to abiotic stresses. This technique is widely used for various vegetables such as tomato, pepper, onion, carrot, and lettuce. The choice of seed priming method depends on factors such as seed type, environmental conditions, and economic feasibility. In this article, we explore different types of seed priming, their mechanisms, benefits, and limitations.

Keywords: Vegetable crops, Seed priming, Seed germination enhancement, Priming methods

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Study of Pre-Harvest Spray of NAA, GA₃ and KNO₃ on Growth Characteristics of Ber (*Zizyphus mauritiana* L.)

Dhanraj Choudhary^{1*}, Kan Singh², Karanvir Singh³ and Nilesh Ninama⁴

¹Department of Horticulture, College of Agriculture, RVSKVV, Gwalior, M.P.

²Department of Horticulture (Floriculture, Land scape and Architecture), College of Agriculture Horticulture, Mandsaur, M.P.

³RVSKVV-KVK Bhind, Gwalior, M.P.

⁴Department of Vegetable Science, RVSKVV, Gwalior, M.P.

Presenting Author: dhanraj02017@gmail.com

The field experiment was performed on “Study of pre-harvest spray of NAA, GA₃ and KNO₃ on growth, yield and quality of ber (*Zizyphus mauritiana* L.) cv. Apple Ber” Research Farm, Sirsod, Gwalior (M.P.). The experimental area is situated at Research Farm, Sirsod, Gwalior (M.P.). The experimental observation comprised of ten different treatments Control (No use of PGR and chemicals), NAA (20 ppm), NAA (35 ppm), NAA (45 ppm), GA₃ (30 ppm), GA₃ (40 ppm), GA₃ (50 ppm), KNO₃ (1 %), KNO₃ (1.5 %) and KNO₃ (2 %). And the growth parameters are recorded in which results shows that the suitable concentration of NAA 45 ppm was recorded maximum plant height (4.70 m) in ber and it was at par to treatment (NAA 35 ppm), (GA₃ 40 ppm), (GA₃ 50 ppm) and (KNO₃ 2 %) however, the use of no PGR and chemicals (Control) was observed minimum plant height (3.50 m) in ber, the maximum plant spread N- S (5.50 m). It was at par to treatment (GA₃ 50 ppm) and (KNO₃ 2 %). However, the minimum plant spread N - S (4.30 m) was recorded in treatment (Control-No use of PGR and chemicals). the maximum plant spread E - W (5.70 m) was recorded suitable concentration in treatment (NAA 45 ppm) and it was found the best suitable spray of NAA, GA₃ and KNO₃ treatment for enhancing the plant spread in ber. It was at par to treatment T₃ (NAA 35 ppm), (GA₃ 50 ppm) and (KNO₃ 2 %). However, the minimum plant spread E - W (4.50 m) was observed in treatment (Control-No use of PGR and chemicals).

Keywords: ber, KNO₃, growth and yield.

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Efficacy of Pre-and Early post Emergent Herbicides on Weed Management in Sesamum (*Sesamum indicum* L.)

Dhanush, G* and Geetha, K. N.

Department of Agronomy, UAS, GKVK, Bengaluru
*dhanushgangadhar28@gmail.com

Effective weed management is crucial for optimizing the growth and yield of sesamum (*Sesamum indicum* L.), as weeds compete for resources and significantly impact crop productivity. A field experiments were conducted at AICRP on weed management field unit, UAS, GKVK, Bengaluru during *Kharif* (rainy season) of 2022 and 2023 to evaluate the efficacy of various weed management practices, including pre-emergent and early post-emergent herbicides, with thirteen treatments and three replications. The results revealed that hand weeding twice at 20 and 40 days after sowing (DAS) (weed free check) recorded the lowest weed population 62.00 /m², dry weight 26.26 g/m² and the highest weed control efficiency (WCE) 85.90% at harvest and among herbicides pendimethalin 30% EC at 0.75 kg a.i. ha⁻¹ was the most effective treatment, significantly reducing weed density and dry weight by 44.01% and 60.39%, respectively at harvest and recorded higher weed control efficiency of 73.5% at 30 days after sowing (DAS). This treatment also resulted in the highest sesamum seed yield of 489.7 kg ha⁻¹, bridging a yield gap between weedy check (117.5 kg ha⁻¹) and weed-free treatment (616.8 kg ha⁻¹) by 74.6 % and led to enhanced nutrient uptake, with nitrogen, phosphorus and potassium uptake. All the early post-emergent herbicides applied in the study exhibited varying degrees of phytotoxic effects on the sesamum crop and negatively impacted nutrient uptake. Whereas, treatments metribuzin 70% WP@ 0.30 kg a.i. ha⁻¹ and diuron 80% WP @ 1.0 kg a.i. ha⁻¹, effective in weed control but demonstrated severe phytotoxicity, resulting in complete destruction and death of the crop plants Economic analysis confirmed that pendimethalin 30% EC was the most cost-effective herbicidal treatment, yielding a net return of ₹54068 ha⁻¹. Overall, pendimethalin 30% EC at 0.75 kg a.i. ha⁻¹ provided the best balance of weed control efficiency, crop safety, and economic viability, making it the optimal choice for sesamum cultivation.

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Integrating Streptococcus Pathogen Management into Organic Farming Systems: Challenges, Policies, and Innovations

Harsha Sharma¹, Diksha¹

*Assistant Professor, Research Scholar, Department of Microbiology, Faculty of Science
Motherhood University, Roorkee, Uttarakhand*

Organic farming, while promoting sustainability, biodiversity, and eco-friendly practices, faces significant challenges in managing animal health without the use of synthetic chemicals. One such challenge is Streptococcus pathogens, which can severely impact livestock health, particularly in dairy and swine systems. This article explores the intersection of Streptococcus pathogen management within the framework of organic farming, addressing its implications across agroecological conservation, climate adaptation, technological capacity building, policy development, and international certification standards. Emphasis is placed on alternative treatments, early detection technologies, and the role of extension services in disease prevention. The need for integrated policies, stakeholder collaboration, and alignment of export regulations is highlighted, underscoring the importance of holistic and innovative approaches to ensure biosecurity while maintaining organic integrity.

Keywords: Climate adaptation, livestock biosecurity, organic farming, streptococcus pathogens, disease management.

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***In vitro* Seed Dormancy Breaks Down and Plant Regeneration of
Rhynchosia beddomei Baker Threatened Forestry Plant of Eastern Ghats
of India for *ex-situ* Conservation**

S. Soneya, Rajakumari, K.V. Saritha*

Department of Biotechnology, Sri Venkateswara University, Tirupati, A.P. India

**Corresponding author: kvsarithasvu@gmail.com*

In this research study, an effective approach for the *in vitro* seed germination and plant regeneration established for *ex-situ* conservation of threatened forestry plant of *R. beddomei* (Fabaceae). Low/zero percentage of seed germination observed due to hard and an impermeable seedcoat of mature dry seed of *R. beddomei*. Physical and physiological dormancy breakdown of mature seeds achieved by acid scarification (pre-soaked) in 10% H₂SO₄ (v/v) for 48 hr and again pre-soaked in sterile distilled water with GA₃ (1.0 mg/L) for 72 hr. *In vitro* seed germination (100%) and plant regeneration observed on MS with GA₃ 3.0 mg/L. Shoot proliferation observed on MS with BAP 6.0, Kn 6.0, GA₃ 0.5, IAA 1.0 mg/L. *In vitro* grown plantlets acclimatized under greenhouse conditions and transferred to the field with a survival rate of 70%. This protocol will be useful for overcoming seed germination inconveniences and for rapid multiplication and conservation of *R. beddomei* using mature seed culture method.

Keywords: threatened plant, *Rhynchosia beddomei* Baker (Fabaceae), seed dormancy, acid scarification, *in vitro* propagation.

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Impact of Zinc and Silica Solubilizing Bacteria and their Consortia on Soil Physicochemical, Microbial, Chlorophyll Content and Dry Matter Production on Paddy in Field Conditions

S. Vinod Babu^{1*}, A. Vijaya Gopal¹, N. Trimurtulu¹, G. Kishore Babu²
and S. L. Bhattiprolu³

¹Department of Agricultural Microbiology, Advanced Post Graduate centre, ²Department of Soil Science, ³Department of Plant Pathology, RARS, ANGRAU, Lam, Guntur, India

*Corresponding author

The study of influence of zinc and silica solubilizing bacteria and their consortia on soil physico chemical, biological properties, chlorophyll content and dry matter production on paddy was conducted with three replications and 13 treatments at Agricultural Research Station, Jangamaheswarapuram, ANGRAU, Guntur, Andhra Pradesh. pH, EC, organic carbon, bacterial, fungal, actinomycetes population, zinc, silica solubilizing bacterial population, chlorophyll 'a', chlorophyll 'b', total chlorophyll content and dry matter production in different crop growth stages *i.e.*, 45, 90 and 120 DAS were investigated under field conditions. Highest pH (8.2) and highest organic carbon content (0.46) was recorded in T₁₃ (RDF + ZnKJJ-4 & ZnPGG-1 + SiKPP-1 & SiPYY-3) at 45 DAS and 120 DAS, respectively. At 90 DAS highest EC (0.46 dS m⁻¹) was observed in T₁₃ compared to other treatments. Highest total bacterial, fungal, actinomycetes population (9.96, 5.48 and 6.89 Log CFU g⁻¹ of soil); total zinc solubilizing bacteria (ZnSB) and silica solubilizing bacteria (SiSB) population (6.98 and 6.94 Log CFU g⁻¹ of soil) and highest chlorophyll 'a', chlorophyll 'b' and total chlorophyll content in leaves (1.26, 0.78 and 2.04, respectively) were observed in T₁₃ at 90 DAS as against other treatments and control. Total dry matter production was observed highest in T₁₃ (13936 kg ha⁻¹) at 120 DAS. In conclusion zinc and silica solubilizing bacteria and their consortia influenced the soil pH, EC, Organic carbon, bacterial, fungal, actinomycetes population, zinc, silica solubilizing microbial population, chlorophyll 'a', chlorophyll 'b', total chlorophyll content and dry matter production in different crop growth stages in comparison to the individual microorganisms. It was directly effect on the crop growth and yield.

Keywords: Zinc and silica solubilizing microorganisms, pH, EC, Organic carbon, microbial population, chlorophyll content and dry matter production.

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Salt and Temperature-Tolerant *Pusillimonas* sp.: STT-K15 with Biocontrol Potential has been Isolated, Identified, and Described from Tomato Rhizosphere Soil

¹Satyam*, ²A. M. Navale, ³V.K. Bagul, ⁴Anuradha Ojha and ⁵Himani Priya

*Satyam** Corresponding Author email: satyam868@gmail.com

¹Ph.D., Department of Agricultural Microbiology, Post Graduate institute, MPKV, Rahuri, Maharashtra, India-413722.

²Head, Department of Plant Pathology and Agricultural Microbiology, Post Graduate institute, MPKV, Rahuri, India.

³Ph.D., Department of Plant Pathology, PGI, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India

⁴Ph.D. Scholar, Punjab Agricultural University, Ludhiana 141004.

⁵ICAR-Indian Agricultural Research Institute, Gauria Karma, Barhi, Hazaribagh, Jharkhand 825405.

The current investigation concentrated on the separation, identification, and characterisation of temperature- and salt-tolerant rhizobacteria from tomato rhizosphere soil. Between 2020 and 2023, 138 isolates were extracted from the rhizosphere of tomato plants cultivated at the Department of Agricultural Microbiology's lab at MPKV, Rahuri, Maharashtra, using Ashby's Mannitol agar, King's B, and Nutrient Agar medium. Under a transmission electron microscope, the STT-K15 was discovered to be rod-shaped and 3-3.5 µm in size. Motile, gram-negative, and endospore-forming. To assess their resistance to salt and temperature stress in King's B media, STT-K15 was exposed to various concentrations of NaCl, MgCl₂, and pH levels. Up to a 25% NaCl concentration, STT-K15 isolates showed encouraging salt tolerance. Additionally, STT-K15 grew at 4.0% MgCl₂. In terms of tolerance to pH, STT-K15 flourished at pH 9.0. STT-K15 was the one that could withstand temperatures as high as 65°C. For sequencing, the bacterial cultures were delivered to the National Centre for Microbial Research in Pune, India. Sequences in FASTA format were then submitted to nucleotide BLAST after received forward and reverse sequences were combined. Once STT-K15 was identified, *Pusillimonas* sp. Additionally, the sequence was sent to the NCBI, where it was assigned the accession number OR432559. The maximum percentage inhibition of *Pusillimonas* sp. STT-K15 against *Fusarium oxysporum* was 72.5%, while the maximum percentage inhibition against *Pestalotiopsis psidii* was 46.66%. These results suggest that *Pusillimonas* species can regulate *Fusarium oxysporum*, making them suitable for application as a biocontrol agent in conditions of severe salinity and temperature stress.

Keywords: Rhizobacteria, *Fusarium oxysporum*, *Pestalotiopsis psidii*, temperatures and salt, Tollerant and *Pusillimonas* sp.

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Transforming Indian Agriculture: Pathways to Sustainability and Resilience

Ankita Khakhal^{1*}

¹Ph.D. Research Scholar, Department of Agricultural Extension and Communication, SKRAU-Bikaner

**Corresponding author Email: khakhalankita18@gmail.com
Mobile no. 9610536276*

Indian agriculture is at a critical crossroads, balancing the dual imperatives of ensuring food security for a growing population and achieving sustainable development. The sector, which supports nearly 58% of the nation's workforce, has undergone significant changes through initiatives such as the Green Revolution, National Food Security Mission (NFSM), and digital agriculture interventions. Despite notable progress in production, Indian agriculture continues to face systemic challenges including small and fragmented landholdings, climate vulnerability, water stress, and limited access to credit and markets. Recent government schemes like the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), e-NAM (National Agriculture Market), and the push for natural and organic farming represent transformative efforts to modernize the sector. Integration of Information and Communication Technologies (ICT), precision farming, and climate-smart practices offers promising avenues for increasing productivity while preserving natural resources. A strategic shift towards holistic, inclusive, and technology-driven approaches is essential to make Indian agriculture more resilient, sustainable, and farmer-centric.

Keyword: Agriculture, ICT, Technology, Farming, sustainable, Climate

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Effect of Fermentation and Sprouting on Nutritional, Antioxidant, and Anti-Nutritional Factors of Soybean (*Glycine max* L.)

Sheetal and Urvashi Nandal

Department of Food and Nutrition

CCS Haryana Agricultural University, Hisar, (Haryana), India – 125004.

**Email: sheetalsaini036@gmail.com*

Soybean (*Glycine max* L.) is a nutrient-rich legume known for its high protein content and nutritional potential. Soybean seed contains numerous bioactive compounds having radical scavenging and anti-carcinogenic activities. However, anti-nutritional factors such as phytic acid, tannins, and trypsin inhibitors hinder its full utilization in human diets. This study aimed to investigate the effect of two traditional bioprocessing methods—fermentation and sprouting on the nutritional composition, antioxidant activity, and anti-nutritional factor of soybean seeds. The effect of fermentation was studied at 24 hrs, while that of sprouting was studied at 48 hours. The results revealed that both fermentation and sprouting significantly enhanced the protein content and antioxidant potential of the soybeans. Notably, fermentation showed a significant ($p \leq 0.05$) increase in total phenolic content and free radical scavenging activity, while sprouting significantly ($p \leq 0.05$) improved mineral bioavailability. Both sprouting and fermentation significantly ($p \leq 0.05$) decreased anti-nutrient contents, with fermentation having a more substantial impact on reducing phytic acid and trypsin inhibitors. The findings highlight the potential of fermentation and sprouting as effective, low-cost methods to improve soybeans' nutritional quality and functional properties.

Keywords: Soybean, Fermentation, Sprouting, Antioxidants, Anti-nutritional factors, Nutritional enhancement

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Salinity Stress Effect on Ion Homeostasis, Physio-biochemical and Growth Traits and Activation of Antioxidant Defense Responses in *Avena* spp.

Shahid Ahmed, Parichita Priyadarshini, Indu Ia, Maneet Ranaa, Gajendra Yadav, A.K. Rai, Subhash Chand, Monika Yadava, Mahendra Singh, Chitrangna Singh Chhipa*, Rajesh Kumar Singhal

ICAR-Indian Grassland and Fodder research Institute, Jhansi, India, 284003

ICAR- Central Soil Salinity Research Institute, Karnal, India, 132001

Corresponding mail: chitrangnasingh20@gmail.com

Stress due to salinity hinder the physiology, metabolism, growth and yield in crops. To quantify the critical tolerance limits of oat to different field salinity levels (2.9-3.2; S₀; control, 4.4-5.7 moderate; S₁ and 6.9-7.3; high salinity; S₂ dS/m), is the main purpose of this study. Reduction of growth attributes such as reduced 46.52% and 40.32% in fresh(FWM) and dry biomass(DWM) respectively, has been observed after S₂ treatment. Oat genotypes showed similar results when they were tested under imposed salinity levels (50 mM; S₁' and 100 mM; S₂') of NaCl+ Na₂SO₄ (1:1) with control (S₀'). The reduction was found in Relative Water Content (RWC%) and Membrane Stability Index (MSI%). The malonaldehyde content and SPAD values were found to be increased. Salinity condition elicited the plant defense by elevating the superoxide dismutase (SOD), catalase (CAT), and ascorbate peroxidase (APX) and proline content. Also, a significant positive correlation was found between RWC and MSI; proline and APX; SPAD and CAT and CAT and PRO at 75 days after sowing under S₂', whereas FWM showed a significant positive correlation with DWM and PL under field S₂ levels. The PCA analysis was conducted for growth and biochemical attributes under higher salinity levels which showed 83.85 and 89.1 % of the total genetic variation. Gene expression study was also done for few known salt stress specific genes like sodium/hydrogen exchanger, potassium transporter and glutathione S- transferase which revealed their significant differential expression under salt stress. And therefore, this study gives us a new idea to understand basic tolerance mechanism to adapt salinity stress and developing salinity tolerant oats.

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Effect of Salinity Stress on Growth, Physio-biochemical and Ion Homeostasis and Activation of Antioxidant Defense Responses in *Avena* spp.

Shahid Ahmed, Parichita Priyadarshini, Indu Ia, Maneet Ranaa, Gajendra Yadav, A.K. Rai, Subhash Chand, Monika Yadava, Mahendra Singh, Chitrangna Singh Chhipa, Rajesh Kumar Singhal

ICAR-Indian Grassland and Fodder research Institute, Jhansi, India, 284003

ICAR- Central Soil Salinity Research Institute, Karnal, India, 132001

Corresponding mail: rajasinghal151@gmail.com ; rajesh.singhal@icar.gov.in

ORCID ID: 0000-0003-2685-6299

Salinity stress impedes the growth, physiology, metabolism and yield in crops. The present study was carried out to quantify the critical tolerance limits of oat to different field salinity levels (2.9-3.2; S₀; control, 4.4-5.7 moderate; S₁ and 6.9-7.3; high salinity; S₂ dS/m). The S₂ treatment reduced growth attributes, which contributed to reduction in fresh (FWM) and dry biomass (DWM) by 46.52 and 40.32%. Similarly, the oat genotypes were tested under imposed salinity levels (50 mM; S₁' and 100 mM; S₂') of NaCl+ Na₂SO₄ (1:1) with control (S₀') and found the reduction in relative water content (RWC %) and membrane stability index (MSI %), while malonaldehyde content and SPAD values were increased. Salinity also elicited the plant defense by elevating the superoxide dismutase (SOD), catalase (CAT), and ascorbate peroxidase (APX) and proline content. Further, a significant positive correlation was found among RWC and MSI; proline and APX; SPAD and CAT and CAT and PRO at 75 days after sowing under S₂'. Whereas, FWM showed a significant positive correlation with DWM and PL under field S₂ levels. The PCA analysis for growth and biochemical attributes under higher salinity levels showed the 83.85 and 89.1 % of the total genetic variation. Gene expression study of few known salt stress specific candidate genes like sodium/hydrogen exchanger, potassium transporter and glutathione S- transferase revealed their significant differential expression under salt stress. Therefore, this study gives a new insight into the understanding basic tolerance mechanism to adapt salinity stress and developing salinity tolerant oats.

Keywords : Salinity stress. *Avena* spp.. antioxidants, fodder traits. ion homeostasis. salt tolerance

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Factors Influencing the Honey Production and Consumption Trend of Honey in India

Geeta Rani* Vanita Ahlawat,**

**Research Scholar, Haryana School of Business, Guru Jambheshwar University of Science & Technology, Hisar geetikabishnoihsr29@gmail.com*

***Assistant Professor, Haryana School of Business, Guru Jambheshwar University Of Science & Technology, Hisar vanita.ahlawat@gmail.com*

The intensely competitive business environment compels beekeepers to generate value that is more difficult to reproduce than that of their rivals. To thrive in a highly competitive business, beekeepers must concentrate on innovative solutions. These initiatives may encompass measures to ensure honey quality, drive further product innovation, and develop value-added honey products that enhance corporate success. This study examines the current state of honey production and consumption trends in India, with the goal of understanding demographic characteristics, consumer preferences, and the challenges faced by honey producers. Data were gathered using standardized questionnaires distributed to a varied sample of consumers and producers. The investigation utilized descriptive and multiple regression methods to determine the primary factors affecting honey consumption and production. Findings indicate that customers predominantly appreciate honey for its health advantages and quality guarantees, favoring organic varieties. Producers have considerable obstacles, such as elevated production expenses and insufficient contemporary equipment. The results indicate that although honey consumption is motivated by health factors, advancements in production infrastructure and market accessibility are crucial for improving the industry's efficiency and sustainability.

Keywords: Honey production, Honey consumption, Consumer preferences, Production challenges, Organic honey, Multiple linear regression, India

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Flemingia Integration in Agroforestry: Impacts on Crop Growth and Biomass Production

L.Chanu Langlentombi¹, S. Goshal² and N.K.Sinha²

¹ICAR Research Complex for NEH region, Manipur Centre, Lamphelpat

²ICAR National Institute of Secondary Agriculture, Namkum, Ranchi

Agroforestry systems have gained recognition for their potential to enhance crop productivity and ecosystem sustainability. This study evaluates crop growth and biomass production under a *Flemingia semialata*-based agroforestry system in comparison to conventional monocropping. The integration of *Flemingia*, a nitrogen-fixing shrub, created a microenvironment that positively influenced soil fertility, moisture retention, and reduced weed pressure. Crops grown under the agroforestry system exhibited improved growth parameters such as plant height, number of leaves, particularly during the mid to late growth stages. Biomass accumulation, both above and below ground, was significantly higher under the *Flemingia*-based system than in monocropped plots. The presence of *Flemingia* contributed to higher organic matter inputs and moderated microclimatic conditions, leading to a more resilient cropping environment. Overall, the *Flemingia*-based agroforestry system demonstrated a viable alternative to monocropping by enhancing crop growth and biomass yield.

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Formononetin-A Vital Phytochemical of *Butea monosperma* var. *Lutea* (Witt) Maheshwari: Isolation and Characterization via Analytical Techniques

Divyank M. Umale and Dr. Esha Rami*

Department of Life Sciences, Parul Institute of Applied Sciences, Parul University, Vadodara,
Gujarat, India

divyankumale@gmail.com; (Assistant professor)-esha.rami82036@paruluniversity.ac.in

Butea monosperma var. *lutea* (Witt.) Maheshwari, a member of the Fabaceae family, is a highly valuable deciduous tree found in the tropical and subtropical regions of the Indian Subcontinent, Burma, and Ceylon. *B. monosperma* var. *lutea* has been scientifically demonstrated to possess a significant abundance of pharmacologically significant chemicals that hold commercial potential. It has been demonstrated scientifically that *B. monosperma* has a large number of pharmacologically important compounds with potential for commercial use. The plant is an endangered species with a high concentration of phytochemicals, its antioxidant capabilities and therapeutic potential need considerable cultivation and the isolation of phytoconstituents classes for medicinal purposes. Flavonoids are used as antioxidants, pigments, and preservatives in the food industry. Pharmaceuticals and cosmetics are among the other industries that use them. Formononetin (isoflavonoid) is a prevalent secondary metabolite found in legumes and fabaceae plants in Asian countries. Formononetin (FMN) shown several features in the field of modern medicine, such as antibacterial, antioxidant, anti-hyperlipidemic, anti-diabetic, anti-tumor, neuroprotective, and cardioprotective activities. FMN can be derived from botanical sources by drug extraction and purification techniques, including extraction, ultrasound, microwave, supercritical water treatment, and pressurisation. **Result:** The RF value is 0.303 according to the HPTLC method. 7 mg of formononetin was isolated using the supercritical fluid extraction method. With a retention period of 16.33 minutes, the extracted formononetin was examined by LC-MS/MS analysis with m/z ratio. The plant's isolated formononetin was analysed to determine its ¹H and ¹³C NMR spectra.

Keywords: *Butea monosperma* var. *lutea* (Witt.) Maheshwari, formononetin, FTIR, HPTLC, HPLC, Supercritical fluid extraction, LC-MS/MS, ¹H and ¹³C NMR analysis.

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The Role of AI, Biotechnology, and Alternative Proteins in Future Diets

Nitin Sonkar^{1*}, ChitraSonkar²

^{1*} Assistant Professor, Department of Food Processing and Technology, Gautam Buddha University),
Greater Noida, India, 201312

² Assistant Professor, Department of Processing and Food Engineering, SHUATS Prayagraj, India,
211007

**Corresponding author*

The integration of sustainability, technological advancement, and nutritional research is transforming the global food sector. Next-generation foods, such as plant-based meats, lab-grown meat, insect-derived proteins, and 3D-printed meals, are emerging as effective solutions to tackle the issues of food security, environmental degradation, and malnutrition. This study examines the influence of sophisticated technologies, including artificial intelligence, nanotechnology, and precision fermentation, on the future of food production, processing, and customization. Artificial intelligence and extensive data provide predictive modeling and individualized nutrition, whereas nanotechnology improves food safety and nutritional dissemination. Moreover, intelligent sensors and IoT technologies are enhancing real-time monitoring of food quality. Cellular agriculture and microbial fermentation are producing sustainable alternatives to conventional animal-derived goods, providing ethical and environmentally favourable options for protein consumption. Notwithstanding significant progress, obstacles remain in scalability, cost-effectiveness, and consumer adoption. The study highlights the revolutionary potential of interdisciplinary innovation in food science and nutrition, advocating for ongoing research and policy support to establish a sustainable, health-focused, and technologically connected global food system.

Keywords: Next-generation foods, Sustainable nutrition, Food technology, Artificial intelligence, Alternative proteins

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Green Nanotechnology for DBM Control: Efficacy of Essential Oil Nanoemulsions in Organic Crop Protection

^{1*}Kasturi Sarmah, ²Thirumurugan Anbalagan

¹*Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, India*

²*ICAR- Krish Vigyan Kendra, Virinjipuram, Vellore, India*

Corresponding authors E-mail: kasturisarmah5005@gmail.com

The diamondback moth (*Plutella xylostella*) is one of the most damaging pests of cruciferous vegetables worldwide, leading to significant economic losses and increasing resistance to conventional insecticides. In response to the need for sustainable and eco-friendly pest control solutions, this study investigates the potential of essential oil-based nanoemulsions developed through green nanotechnology for the organic management of *P. xylostella*. Initially, twelve plant-derived essential oils were screened for their insecticidal efficacy. Among them, thyme (*Thymus vulgaris*) essential oil showed the highest toxicity and was selected for nanoemulsion formulation. Gas Chromatography–Mass Spectrometry (GC-MS) analysis of thyme oil revealed **thymol (33.54%)** as the major active constituent, along with other minor components contributing to its bioactivity. A high-energy ultrasonication method was used to prepare the thyme oil nanoemulsion, employing a surfactant and deionized water as the continuous phase. The resulting nanoemulsion had a mean droplet size of **158 nm**, indicating good stability and dispersion. Pot culture experiments were conducted to evaluate the insecticidal performance of the thyme oil nanoemulsion under controlled conditions. The formulation demonstrated significant efficacy, achieving **up to 90% mortality** of *P. xylostella* larvae within 24 hours of application. No phytotoxic effects were observed on treated plants, indicating the safety of the formulation for crop use. This study highlights the effectiveness of essential oil nanoemulsions, particularly those based on thyme oil as a promising organic biopesticide. The use of green nanotechnology not only enhances the delivery and stability of the active compounds but also aligns with sustainable agricultural practices. The findings support the development of essential oil nanoemulsions as a viable alternative to chemical insecticides in integrated pest management (IPM) programs targeting *P. xylostella*.

Keywords: diamond backmoth, essential oils, nanoemulsion, pest management, thyme oil

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Harnessing Microfluidic Systems for Sustainable Food Industry

Vishwaradhya M Biradar^{1*}, Sharanagouda Hiregoudar², Udaykumar Nidoni³,
Ramappa, K.T⁴., Swapna⁵, Santosh Pawar⁶, Lakshmikanth M⁷

^{1*}Ph.D. Scholar, Department of Processing and Food Engineering, CAE, UAS, Raichur-584101

²Professor and Head, Department of Processing and Food Engineering, CAE, UAS, Raichur-584101

³Professor and University Head, Department of Processing and Food Engineering, CAE, UAS,
Raichur-584101

⁴Assistant Professor, Department of Processing and Food Engineering, CAE, UAS, Raichur-584101

⁵Assistant Professor of Agricultural Microbiology, AICRP on PHT, CAE, UAS, Raichur-584101

⁶Assistant Professor of Computer Science, CAE, Raichur-584101

⁷Assistant Professor (Bio-chem), Department of Soil Science, UAS, Raichur-584101

Microfluidic technologies are rapidly emerging as transformative tools for the food, agriculture and biosystems industries. These systems process small volumes of fluids through micro-scale channels, offering significant advantages in efficiency, cost and precision. Key applications include pathogen detection in food and water, nano-particle encapsulation for nutrient delivery, antibiotic residue monitoring in dairy and improving food safety standards. In agriculture, microfluidics enables nutrient monitoring, plant cell sorting, biopesticide delivery and efficient *in-vitro* fertilization in animal breeding. The technology also holds promise for biofuel production, enhancing enzymatic reactions and improving biodiesel yield. Microfluidic devices, with their high throughput, minimal reagent consumption and real-time analysis capabilities, offer sustainable solutions for improving food quality, crop yield and bioenergy research. Despite their benefits, challenges such as scalability, portability and integration into large-scale systems remain. However, ongoing advancements in manufacturing, multiplexing and device design are expected to overcome these limitations. The potential for commercial applications is vast, as microfluidics promises to revolutionize traditional processes in food production, agriculture and biosystems engineering. Further research and development will help address current technical challenges and enable broader adoption across food and allied industries.

Keywords: Agriculture, biofuel production, food safety, pathogen detection

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Advancing Natural Farming In India: Extension Strategies and Policy Support

Hiwarale A.S.¹, Ahire R.D.² and Samrit V.B³

¹Ph.D. Scholar, Department of Agricultural Extension Education, V.N.M.K.V., Parbhani (Email: ¹abhishekshiwarale2050@gmail.com)

²Director of Extension Education, V.N.M.K.V., Parbhani (Email: ²rdahire13@gmail.com)

³Ph.D. Scholar, Department of Agricultural Extension Education, V.N.M.K.V., Parbhani (Email: ³vipinsamrit1997@gmail.com)

Natural farming, rooted in indigenous knowledge and ecological principles, is gaining momentum in India as a sustainable alternative to chemical-intensive agriculture. In 2025, the promotion of natural farming has been prioritized by the Government of India through a multifaceted approach involving comprehensive extension strategies and supportive policy frameworks. This paradigm shift aims to restore soil health, reduce input costs, enhance farmers' income, and ensure long-term environmental sustainability.

The Indian government, through flagship programs like the BharatiyaPrakritik Krishi Paddhati (BPKP) under Paramparagat Krishi Vikas Yojana (PKVY), has provided significant impetus to natural farming. Financial incentives, capacity-building initiatives, and cluster-based development models have been introduced to encourage adoption. Integration of natural farming into state-specific agricultural policies and the formation of farmer producer organizations (FPOs) have further strengthened grassroots implementation.

Extension strategies in 2025 have evolved to include digital tools, community resource persons (CRPs), and experiential learning platforms such as model farms and field schools. Emphasis is placed on participatory approaches, peer-to-peer learning, and knowledge-sharing through mobile apps, WhatsApp groups, and Krishi Vigyan Kendras (KVKs). Public-private partnerships and NGOs also play a critical role in training and awareness generation.

Despite significant progress, challenges such as yield-related concerns, limited market access for naturally grown produce, and resistance to change among conventional farmers persist. Therefore, coordinated policy support including assured procurement, certification facilitation, and market linkage through e-NAM and specialized branding is crucial.

In conclusion, India's strategy in 2025 reflects a holistic and inclusive model for promoting natural farming, focusing not only on environmental sustainability but also on socio-economic empowerment. Strengthening the synergy between research, extension, and policy will be key to mainstreaming natural farming and achieving national goals of sustainable agriculture and climate resilience.

Keywords: Natural farming, extension strategies, government policies, sustainable agriculture, BPKP, India 2025

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Community Approaches in Agriculture

Hiwarale A.S.¹, Ahire R.D.² and Gaikwad S.R.³

¹Ph.D. Scholar, Department of Agricultural Extension Education, V.N.M.K.V., Parbhani (Email: ¹abhishekshiwarale2050@gmail.com)

²Director of Extension Education, V.N.M.K.V., Parbhani (Email: ²rdahire13@gmail.com)

³Ph.D. Scholar, Department of Agricultural Extension Education, V.N.M.K.V., Parbhani
(Email: ³shrutikargaikwad21@gmail.com)

Agriculture in India, traditionally a community-oriented occupation, is witnessing a resurgence of collective action through innovative community-based approaches. In the face of challenges such as small landholdings, climate variability, resource constraints, and market fluctuations, these approaches have emerged as powerful tools to enhance productivity, sustainability, and resilience among farming communities.

Community approaches in Indian agriculture include Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), Water User Associations (WUAs), and Joint Liability Groups (JLGs), among others. These platforms enable small and marginal farmers to pool resources, share knowledge, access inputs and credit, adopt new technologies, and strengthen their bargaining power in input and output markets. Government schemes such as the formation and promotion of 10,000 FPOs under the Ministry of Agriculture and Farmers Welfare have significantly encouraged collective action across the country.

Participatory planning, community-based natural resource management, and inclusive extension systems are central to the success of these approaches. Programs like the National Rural Livelihoods Mission (NRLM), Integrated Watershed Management Programme (IWMP), and climate-smart village models emphasize community participation in planning, implementation, and monitoring of agricultural development activities. Women-led SHGs and youth groups have also demonstrated substantial impact in driving agricultural innovation and diversification at the grassroots level.

Digital platforms and ICT tools are being increasingly integrated to support community initiatives, offering access to market intelligence, weather forecasts, advisory services, and e-commerce. However, challenges such as capacity building, leadership development, financial literacy, and sustained handholding support remain critical for the long-term viability of community-based models.

In conclusion, community approaches in Indian agriculture offer a participatory, inclusive, and sustainable pathway to address the socio-economic and environmental challenges faced by rural India. Strengthening institutional frameworks, enhancing convergence between stakeholders, and ensuring policy support are essential for scaling up these models and transforming Indian agriculture into a more resilient and equitable sector.

Keywords: Community-based agriculture, Farmer Producer Organizations, participatory extension, sustainable farming, India

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Harnessing Native Thar Desert Fruits as Natural Antioxidant Nutritional Supplements for Frying Applications

Crops from intensive chemical farming frequently suffer from diminished nutritional quality due to agrochemical overuse and soil degradation. Additionally, traditional Indian cooking practices, especially deep or shallow frying, accelerate nutritional losses and oxidative degradation in oils. Although synthetic antioxidants like BHT and BHA are used to preserve food quality, their long-term health risks are a growing concern.

This presentation explores the untapped potential of native Thar Desert fruits— Jhar Ber (*Ziziphus nummularia*), Kair (*Capparis decidua*), Sangri (*Prosopis cineraria*), Mateera seeds (*Citrullus lanatus*), Kachra (*Cucumis colocynthis*), Guar Phali (*Cymopsis tetragonoloba*).

These fruits are naturally rich in thermostable polyphenols, tannins, and antioxidant phytochemicals. When used in blended extract form, they show promise as functional additives to improve the nutritional value and oxidative stability of fried foods and cooking oils.

The results indicate a dual benefit extending product shelf life and fortifying food with naturally derived nutrients and antioxidants—making them highly suitable for functional food systems, clean-label processing, and sustainable value addition.

Preliminary results of the GC-MS analysis showed high quantity of α linoleic acid and its esters, hexa-dicanoic acid, β sitosterol, γ techoferol(vitamin E). Phytochemical analysis showed 3.51% polyphenol content. Bikaneri bhujia, biscuits prepared with 10% extract increased polyphenol content from 1.2 mg/gm to 1.30 mg/gm for Bikaneri bhujia and 1.00 mg/gm to 1.80 mg/gm for Biscuits. Antioxidant activity by DPPH (ORAC Value) for Bikaneri bhujia is increased from 11.97 uM of TE/g to 14.35 uM of TE/g. These Preliminary results clearly establish potential of these extract as natural antioxidant nutritional supplements for frying applications.

Keywords: Thar Desert fruits, natural antioxidant, nutritional supplement, edible oils, food shelf life, traditional Indian cooking, polyphenols, climate-resilient plants.

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Integrating Nutrient Management Strategies for Enhanced Growth and Yield of Turmeric

¹Tayshi Tolma, ²Kulveer Kaur ³Harpreet Kaur

¹²³Department of Agronomy, Punjab Agricultural University Ludhiana, Punjab, 141004, India
Email- tayshiagri62@gmail.com

Turmeric (*Curcuma longa* L.), a vital ancient spice and medicinal herb, originates from Southeast Asia and thrives in tropical and subtropical regions. Traditionally used in medicine and cooking for centuries, turmeric is celebrated for its vibrant yellow color and distinctive flavor. As a long-duration crop (8–9 months) and a heavy feeder, turmeric demands substantial nutrition for high yield and quality. Organic manures and biofertilizers have emerged as eco-friendly alternatives, increasingly adopted in spice crop cultivation, including turmeric. Integrated Nutrient Management (INM), which combines organic and inorganic inputs, enhances crop yield while improving soil's physical, chemical, and biological properties. It helps increase water-holding capacity, fertility, and overall productivity. Moreover, organic amendments boost soil microbial biomass and activity, enhancing nutrient transformation and availability. Biofertilizers, known for biological nitrogen fixation and growth-promoting properties, further improve plant growth and yield. The use of different organic sources like FYM, neem cake, and vermicompost has shown positive effects on turmeric growth and yield. Efficient integration of chemical, organic and biological nutrient sources will not only meet the crop's nutritional requirements but also ensures long-term soil health and sustainability. Hence, INM is essential for maintaining turmeric productivity, preserving biodiversity, and promoting environmentally responsible agriculture.

Keywords: Biofertilizers, Integrated Nutrient Management, Water-holding capacity

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Significance of Public Communication in Scientific Research

Pushpalata Kyatham^{1*} and Prathyusha Kantheti²

*^{1*}Department of Apparel and Textile Science, College of Community Science, Professor Jayashankar
Telangana State Agricultural University, Hyderabad, India*

*²Department of Apparel and Textiles, College of Community Science, Odisha University of
Agriculture and Technology, Bhubaneswar, Odisha, India*

Mail Id of Corresponding drpushpalathakyatham@gmail.com

In today's era the technology is rapidly growing where scientific advancements are rapidly influencing and redesigning societal development, and it is becoming important to share research findings beyond traditional academic settings has become increasingly evident. Peer-reviewed publications and scholarly conferences are one of the major and traditional sources for maintaining the integrity and development of scientific inquiry, they often do not reach audiences outside the academic community

This paper deliberates why community communication is important and how it can benefit both researchers and society. It also focuses on various platforms available for mass communication including print media, electronic media, web publishing, social media, blogs, podcasts, public speaking, and personal publishing that scientists can use to publicize their work outside of academic contexts. These resources help in understanding the complex things in simple way for application in day to day life. The study also comprises of how research communication has evolved over time, shifting from printed publications to online and digital formats that facilitate quicker and more extensive information sharing. It also offers helpful guidance for researchers who wish to reach a greater audience and increase their communication capabilities. By adapting and utilising the various publication resources, scientists may enhance their work's impact and visibility, foster scientific confidence, and also can take part in helping the society to make better decisions by interacting with the community. This promotes more informed and evidence-based social decisions in addition to boosting public confidence in science.

Keywords: Science communication, Public engagement, Research dissemination, Digital media, Social media.

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Comparative Evaluation of Nutrient Recovery and Vermicomposting Efficiency in Indigenous and Crossbred Cattle Dung

Bhupender*, Hari Om Pandey, Ambili KS, Shubham Yadav, Mahendra Sinver and Neha, Sujit Mote

*Livestock Production and Management Section, ICAR-Indian Veterinary research Institute (IVRI),
Izatnagar, Bareilly, Uttar Pradesh, 243122, India*

**Correspondence : bhupender98703@gmail.com*

Vermicomposting represents an sustainable and economical method that farmers can readily implement to enhance soil fertility while minimizing reliance on chemical fertilizers. The dung produced by indigenous breeds like *Tharparkar* differs significantly in its physical and chemical properties when compared to that of crossbred cattle such as *Vrindavani*. These compositional differences have a notable impact on both the efficiency of the vermicomposting process and the nutrient content of the resulting compost. This research aimed to evaluate the effectiveness of vermicomposting and nutrient recovery from the dung of Tharparkar and Vrindavani cattle. A total of 400 kg dung from each breed was used, with three replications for each. Windrow beds of 10 × 4 × 1 feet were constructed for composting. Samples were taken from five randomly selected points within each bed on Days 0, 15, 30, 45, 60, and 90. These samples were air-dried and examined for key indicators such as organic carbon, nitrogen (N), phosphorus (P), and potassium (K).

The study revealed that Tharparkar dung yielded a higher vermicompost recovery rate of 40.1%, in comparison to 37.05% from Vrindavani dung. Nitrogen levels in Tharparkar compost increased from 1.40 ± 0.017% on Day 0 to 1.93 ± 0.008% by Day 90, while Vrindavani compost showed a rise from 1.30 ± 0.020% to 1.87 ± 0.005%. Phosphorus content also improved, reaching 0.65 ± 0.036% from an initial 0.446 ± 0.063% in Tharparkar, and 0.62 ± 0.02% from 0.48 ± 0.034% in Vrindavani, indicating a similar enrichment trend.

In terms of potassium mobilization, Tharparkar compost again outperformed Vrindavani, increasing from 0.43 ± 0.01% to 0.92 ± 0.011%, whereas Vrindavani compost increased from 0.38 ± 0.011% to 0.87 ± 0.008%. Both compost types demonstrated effective organic matter decomposition. Organic carbon content in Tharparkar compost dropped from 45.70 ± 1.60% to 19.36 ± 1.24%, while Vrindavani showed a decrease from 45.46 ± 1.76% to 21.46 ± 1.17%.

Overall, the findings establish that dung from Tharparkar cattle offers better nutrient recovery, especially in terms of nitrogen and potassium, making it a more efficient input for high-quality vermicompost production. The results emphasize the critical role of selecting suitable dung sources to optimize vermicomposting outcomes, thereby promoting a sustainable approach to improving soil health and managing organic waste effectively.

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Eco-Friendly Adhesive Innovation for Reduced Formaldehyde Emissions in Agro-Based wood Composites

*Ranjana Yadav**

**Forest Product Division, ICFRE-Forest Research Institute, Dehradun-248006*

Corresponding Author: ranjanay7@gmail.com

Formaldehyde emissions from agro-based and wood-derived composite panels—such as plywood, particleboard, medium-density fiberboard (MDF), oriented strand board (OSB), and laminated veneer lumber (LVL)—are a growing concern due to their adverse effects on human health. Elevated formaldehyde levels are known to cause eye irritation, respiratory discomfort, and, in severe cases, nasal cancer in humans and animals. With increasing awareness about indoor air quality and public health, there is a critical need to develop eco-friendly adhesives that minimize formaldehyde emissions while supporting the use of renewable and agro-residue resources in composite manufacturing.

This study focuses on the formulation of an environmentally friendly adhesive system by incorporating acrylamide (1.5–3.5%) as a formaldehyde scavenger in urea-formaldehyde (UF) resin. The modified resin was evaluated for its emission characteristics using the perforator method (IS 13745:1993), which limits formaldehyde release to 10 mg per 100 g of dry board. The results demonstrate that acrylamide-modified UF adhesive significantly reduces formaldehyde emission, making it a promising option for manufacturing low-emission agro-based composite panels.

This innovation aligns with sustainable forest and agroforestry practices by promoting safer, low-toxicity products and efficient utilization of biomass and agricultural residues. It also offers a viable path forward for the development of green building materials with reduced environmental and health impacts.

Keywords: agro-based composites, formaldehyde emission, eco-friendly adhesive, acrylamide, sustainable materials

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Effect of Integrated Nutrient Management on Yield of Maize

Dipak Gite, Sushant Patil

School of Agriculture, Lovely Professional University, Phagwara, Punjab (144411)

Corresponding author: dipakgite01@gmail.com

A field study was conducted during the kharif season of 2023–2024 at the Experimental Farm of Lovely Professional University, Phagwara, Punjab, to assess the influence of integrated nutrient management on maize productivity. The experiment consisted of four main plot treatments and three sub-plot treatments, arranged in a split plot design with three replications. Results demonstrated that the application of 100% recommended dose of fertilizers (RDF) produced the highest yield attributing characters, grain yield, stover yield and biological yield, significantly outperforming the reduced RDF levels. Similarly, the application of 10 t FYM ha⁻¹ led to a notable increase in yield attributing characters, grain yield, stover yield and biological yield, compared to lower FYM treatments. The N₃F₂ treatment combination (100% RDF + 10 t FYM ha⁻¹) recorded the highest yield, showing significant superiority over all other treatment combinations.

Keywords: Maize, INM, Yield.

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Incorporating Traditional Fermented Foods into Modern Diets to Combat Lifestyle Disorders

Raveena Rani¹ and Veenu Sangwan²

Research Scholar and Associate Professor

I.C. College of Community Science, CCS Haryana Agricultural University, Hisar-125004, India

E-mail: raveenajyani123@123gmail.com

The escalating prevalence of lifestyle disorders such as obesity, type 2 diabetes, cardiovascular diseases and metabolic syndrome poses a significant public health challenge globally. These conditions are often driven by urbanized diets, reduced physical activity and disrupted gut microbiota. Traditional fermented foods, rooted in cultural dietary practices, present a promising, natural and sustainable solution to counteract these health issues. Rich in probiotics, bioactive peptides, vitamins and enzymes, fermented foods like yogurt, kefir, kimchi, tempeh, sauerkraut, miso and indigenous preparations such as idli, dosa, kanji and gundruk have been associated with improved gut health, enhanced immune response and better metabolic function. The role of gut microbiota in regulating systemic inflammation, glucose metabolism, lipid profiles and even mental health. Fermented foods help restore microbial diversity, modulate immune responses and improve nutrient bioavailability, making them valuable in both the prevention and management of lifestyle-related disorders. Furthermore, fermentation enhances the functional properties of foods by breaking down anti-nutritional factors and enriching them with health-promoting compounds. Despite their potential, traditional fermented foods are often underutilized in modern diets due to shifts in dietary patterns, food safety concerns and lack of awareness. Integrating these foods into contemporary nutritional guidelines requires a concerted effort involving nutrition education, food technology innovations and culturally sensitive public health strategies. The scientific evidence supporting the incorporation of traditional fermented foods into modern diets and explore pathways for their mainstream adoption. By bridging traditional knowledge with modern science, we can revitalize these age-old dietary practices as functional foods and leverage them as a cost-effective strategy to mitigate the burden of lifestyle disorders. Promoting the regular consumption of fermented foods could represent a critical step toward achieving sustainable health and nutrition outcomes worldwide.

Key words: fermented foods, lifestyle disorders, probiotics, idali, metabolic function, health promoting, food safety.

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Integrated Applications of Biochar to Induce Resistance in Tomato (*Solanum lycopersicum*) for the Management of *Alternaria solani*

Pinki Kumari and Aspak

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Tomato is a model plant for classical genetic and genomic research. In 2024 the global production of tomatoes was total 207.17 billion tons. In a global study of soilborne fungi, *Alternaria* was the most abundant plant pathogen. *A. solani* sexual stage is unknown, reproduction occurs asexually. The effect of biochar as soil amendment on *A. solani* causing EB of tomato, a pathosystem of huge economic impact, is yet to be determined. Among the two bio-control agents, *Trichoderma harzianum* showed the percentage inhibition by 70.73%, whereas test pathogen has the least mycelial growth of pathogen 23.703mm. *Pseudomonas fluorescence* showed the percentage inhibition by 78.18%, whereas test pathogen has least 17.670mm. *Pseudomonas fluorescence* has the highest percentage of inhibition against *Alternaria solani*. Peroxidase detection, Biochar 3%(T₅) show maximum increase (87.10%) as compared to other treatments. Biochar + *pseudomonas fluorescence* (T₉) significantly increases total by 85.10 % biochar 2.5%(T₄) are statistically at par from each other, and they increase production of total Peroxidase detection by 83.72%. of Reducing sugar, Biochar(T₆) show maximum increase (91.93%) as compared to other treatments. Biochar (T₅) are statistically at par from each other, and they increase production of total reducing sugar by 89.66%. disease severity 3% biochar (T₆) and 2.5% biochar (T₅) are second best treatments and statistically at par from each other and observed to have disease severity of 0.23 and 0.38% respectively. Disease severity 3% biochar (T₆) and 2.5% biochar (T₅) are second best treatments and statistically at par from each other and observed to have disease severity of 0.23 and 0.38%.

Key words: *Alternaria* , biochar, reducing sugar , yield, physicochemical properties

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Integration of Recirculating Aquaculture Systems (RAS) for Sustainable Fish Farming Practices

Raja Gopal, V^{1*}, Raja Ganapathy, V²

^{1*}Ph.D Scholar, Tamil Nadu Agricultural University, Coimbatore –641 003

Bachelor of science (Hons) in Agriculture, Kumaraguru Institute of Agriculture, TamilNadu

Agricultural University, Sakthinagar-638315

Correspondence: rajagopal2304@gmail.com

Recirculating Aquaculture Systems (RAS) have emerged as a sustainable and efficient solution to address the growing water scarcity concerns in aquaculture. By utilizing a closed-loop system, RAS minimizes water consumption by up to 99% through continuous filtration and recirculation processes. This technology integrates advanced mechanical, biological, and chemical filtration methods to maintain optimal water quality, enabling high-density fish production with minimal environmental impact. RAS also decreases the discharge of waste and the need for antibiotics, contributing to a healthier ecosystem. Key components such as biofilters, UV sterilization, and oxygenation systems contribute to improved fish health, reduced disease risks, and enhanced growth performance. Additionally, RAS offers greater control over environmental parameters, allowing for year-round production in controlled settings. The integration of RAS not only conserves freshwater resources but also supports sustainable intensification by reducing effluent discharge and nutrient pollution. Recent advancements in automation, sensor-based monitoring, and energy-efficient designs have further enhanced the viability of RAS for commercial aquaculture operations. This review highlights the principles, technological advancements, and environmental benefits of RAS while addressing challenges such as high initial costs, energy demands, and system management complexities. Emphasizing its role in promoting water conservation and environmental sustainability, RAS is positioned as a key innovation for the future of aquaculture.

Key words: Aquaculture, closed loop system, fresh water and fish production

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Isolated in a Connected World: The Silent Struggle of Young Adults

KM. Pratima*¹, Anushka Tiwari**²

¹Research Scholar, Department of Human Development and Family Studies, CCAS, MPUAT, Udaipur, Rajasthan, India 1; pandeypratima344@gmail.com

²Research Scholar, Resource Management and Consumer Science, M.P.U.A.T., Udaipur, 313001 (Rajasthan), India

Corresponding author: KM. Pratima, Research Scholar, Department of Human Development and Family Studies, CCAS, MPUAT, Udaipur, Rajasthan, India 1; pandeypratima344@gmail.com

In today's digitally connected era, young adults face an ironic yet growing challenge—loneliness. This study explores the extent and underlying factors of loneliness among young adults aged 18 to 30. A total of 360 participants were surveyed using standardized tools, including the UCLA Loneliness Scale and a mental well-being questionnaire. The sample included individuals from diverse educational and socio-economic backgrounds, primarily from urban and semi-urban settings. Findings reveal that a significant proportion (over 60%) reported persistent feelings of loneliness, often linked to social media overuse, lack of emotional support, and high academic or career-related stress. Despite frequent digital interactions, many participants lacked meaningful offline connections. The study highlights the urgent need for targeted mental health interventions, awareness programs, and the promotion of real-life social engagement among youth. These findings aim to inform future research, policymaking, and institutional practices in addressing this silent epidemic among young adults.

Keywords: Loneliness, Young Adults, Social Media, Mental Health, Emotional Well-being, Digital Connectivity, Social Isolation, Youth Psychology, Urban Youth, Mental Health Intervention.

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Indebtedness and Financial Vulnerability among Tenant Farmers:

A Comparative Study of Tenants in Haryana and Rajasthan

¹Priyanka Jakhar, ²Dr. Subhash Chandar

¹PhD Scholar, ²Assistant Scientist, Department of Sociology, COBS&H, CCS HAU Hisar, Haryana

¹Corresponding Email- priyanka.jakhar2@gmail.com

Tenant farmers represent one of the most economically vulnerable segments of Indian agriculture. Although they comprise only 10.4% of the farming population, they account for nearly 80% of farmer suicides, highlighting their severe exposure to financial distress and economic instability. This study examines the nature, extent, sources, and socio-economic repercussions of indebtedness among 320 contractual tenant farmers in Haryana and Rajasthan. A particular focus is placed on the challenges faced before and after acquiring credit, offering a comparative analysis between the two states. The study found that prior to taking loans, the most commonly reported issues were limited access to land (78.12% in Rajasthan) and dependence on daily wages (71.87% in Haryana). After availing credit, the perpetuation of the debt cycle emerged as the most severe problem, affecting 76.88% of respondents—highest in Rajasthan (88.75%) and lowest in Haryana (65.00%). Reduction in landholding size was the least reported post-loan issue (16.25%). The study further revealed significant socio-economic repercussions of indebtedness on tenant's families where chronic debt cycles persisted for the majority of tenants (76.88%), while family conflicts (65.62% in Haryana), healthcare neglect (60.00% in Haryana), and increased dependency on informal lenders were also widespread. These findings highlight the urgent need for policy interventions aimed at improving access to institutional credit, simplifying loan acquisition procedures, and strengthening financial literacy among tenant farmers. Furthermore, the development of tailored credit instruments, crop insurance schemes, and comprehensive social support systems is essential for promoting sustainable debt management and enhancing the financial resilience of tenant farming households.

Keywords: debt cycle, socio-economic repercussions, landholding, daily wages, informal lenders, family conflicts, healthcare neglect, financial literacy.

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Studies on Genetic Divergence for Yield and Yield Attributing Traits in Durum Wheat [*Triticum turgidum* L. subsp. *durum* (Desf.) Husn.]

J. S. Usadad¹, S. B. Chaudhari²

Department of Genetics and Plant Breeding, Junagadh Agricultural University, Junagadh

¹Corresponding Author, M.Sc. (Agri.) Student, Department of Genetics and Plant Breeding
JAU, Junagadh. E-mail: jenishusadad@gmail.com

²Assistant Research Scientist, Department of Genetics and Plant Breeding,
College of Agriculture, JAU, Junagadh, E-mail: sidhharth@jau.in

The present investigation was carried out to assess genetic divergence in 40 diverse genotypes of durum wheat grown in a Randomized Block Design with three replications at the Junagadh Agricultural University, Junagadh during *rabi*-2020. The statistical analysis for genetic divergence was done using Mahalanobis-D² statistics and clustering of genotypes was done using Tocher method. The genetic diversity analysis revealed the formation of six clusters suggested that the presence of considerable genetic diversity among the 40 genotypes studied. The analysis revealed that maximum contribution to divergence due to leaf area (90 DAS) followed by leaf area (53 DAS), chlorophyll content at 21 days after anthesis, specific leaf area (53 DAS) and harvest index contributed towards the total genetic divergence. They accounted for 75.64% of total divergence in the material studied. Clustering of genotypes revealed that cluster-I has maximum number of genotypes (20) and cluster IV, V and VI each has single genotype only. The highest intra-cluster distance was exhibited by cluster-III (13.20) revealing maximum genetic divergence among its constituents. The maximum inter-cluster distance was observed between cluster III and V was ($D=23.28$) and minimum inter-cluster distance was found between cluster II and IV ($D=12.78$). Based on the maximum genetic distance, it is advisable to attempt crossing of the genotypes from cluster III with the genotypes of cluster V, which may lead to the generation of broad spectrum of favourable genetic variability for yield improvement in durum wheat.

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Entrepreneurial Attributes of Ajwain Growers of Rajasthan

Kavita lakhara¹, Surbhi Jangir^{2*} and Rekha Badhala³

²Research Scholar, Department of Extension Education, MPUAT, Udaipur, Rajasthan,

^{1&3}Assistant Professor & ³Research Scholar, Department of Extension Education, Sri Karan Narendra Agriculture University, Jobner, Jaipur, Rajasthan

Email- jangirsurbhi95@gmail.com , contact-8696780062

Ajwain is mainly cultivated for its seed and volatile oil (*Thymol*). The greyish brown seeds of Ajwain are usually considered for medical and nutritional purposes. Rajasthan is a leading state in cultivation of spices. There is wide scope for tribal farmers to become successful entrepreneurs in Ajwain production, marketing etc. With this background, present study was conducted to know the profile of Ajwain growers, study entrepreneurial attributes, their relationship and constraints faced by them. Based on highest production of Ajwain, Choti Sdari tehsil of Pratapgarh district of Rajasthan was selected. Total 65 tribal respondents were selected purposively for the study. Data were collected with well-structured interview schedule and analyzed by using statistical tools. The study revealed that 70.77 per cent of the Ajwain growers belonged to middle age category with secondary to graduate level education (30.77 per cent). Most of them (38.46 per cent) had marginal land holding less than 1 ha with annual income of Rs. 11,743 to 133,036. Also majority of them had medium experience and used medium sources of information. As concerned to entrepreneurial attributes, study revealed that majority of them (64.21 per cent) possessed medium level of overall entrepreneurial attributes. Among which leadership ability (71.27 per cent), economic motivation (74.57 per cent), and management ability (69.34 per cent) were possessed by most of the respondents and more scope to develop innovativeness, risk taking, decision making abilities etc. Socio-economic characteristics like education, experience, annual income and sources of information had shown significant relationship with entrepreneurial attributes of Ajwain growers. The major constraints faced by the respondents were unavailability of quality seeds, high cost of inputs and labors, lack of storage and transportation facility, lack of knowledge about export oriented practices etc.

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Knowledge Assessment of Farmers on Pratapdhan Breed in Backyard Poultry Farming under AICRP in Udaipur District, Rajasthan

Meenu, Ananda K R

** Ph.D. Scholar, Department of Agricultural Extension, ICAR-IARI, New Delhi*

This study evaluates the knowledge levels of backyard poultry farmers in Udaipur district, Rajasthan, regarding the Pratapdhan breed under the All India Coordinated Research Project (AICRP). Conducted in 2022-23 across four villages in Girwa and Gogunda tehsils, the study surveyed 120 farmers. Findings revealed that 69.17% of respondents had a moderate level of knowledge, while 16.67% and 14.17% exhibited low and high knowledge levels, respectively. In Girwa tehsil, 75% of farmers had moderate knowledge, compared to 59.09% in Gogunda. Statistical analysis indicated a significant difference in knowledge levels between the two tehsils ($Z = 3.233$, $p < 0.01$). The results highlight the need for targeted training programs and enhanced exposure to improve poultry management knowledge, thereby fostering sustainable backyard poultry farming in rural areas.

Keywords: Backyard poultry, Pratapdhan breed, poultry farming, knowledge assessment, rural development

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Biopolymer Hydrogel-Based Encapsulation Systems: A Novel Strategy for Enhancing Probiotic Viability in Functional Foods

Kundan^{1†}, Vishnu B. Gore¹, Anil Dahuja¹, Monika Rai¹, Sweta Kumari¹, Krishna Priya¹

¹*Division of Biochemistry, ICAR-Indian Agricultural Research Institute, New Delhi-110012*

[†]*Presenter* [†]*Correspondence: sumansourav.get@gmail.com*

Chronic diseases linked to modern lifestyles have intensified interest in functional foods enriched with probiotics. However, ensuring the viability of these beneficial microorganisms through food processing and the gastrointestinal tract remains a formidable challenge. This study explores the innovative use of biopolymer-based hydrogels as advanced encapsulation systems to protect and effectively deliver probiotics to the colon. Biopolymer hydrogels—comprising natural polymers such as alginate, cellulose, starch, carrageenan, and their composites—demonstrate exceptional promise in creating protective matrices around probiotic cells. These materials enable controlled release, improved survivability under gastrointestinal stress, and functional compatibility with diverse food matrices. Techniques like extrusion, emulsification, and 3D printing have further refined microgel design for targeted delivery. The study also highlights the synergistic effects of mixed polysaccharide systems, crosslinkers, chelating agents, and prebiotic co-encapsulation in enhancing probiotic efficacy. This work underscores the potential of hydrogel encapsulation to revolutionize nutrient delivery, offering a sustainable and scalable solution for improving gut health through functional foods. These findings pave the way for the development of next-generation dietary interventions tailored to immune support, gastrointestinal well-being, and disease management.

Keywords: Probiotics, Functional Foods, Hydrogels, Biopolymer Encapsulation, Nutrient Delivery, Gut Health

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Lab Grown Meat: An Overview

Ganesh Ram Jat¹ and Vinod Bhateshwar²

¹Kerala Agricultural University, Thrissur- 680656

²SKN Agriculture University, Jobner (Jaipur)-303329

Corresponding author- ganeshsknau@gmail.com

Meat is an essential component of human diet and the primary and significant source of protein, vitamins, and minerals. Driven by global population growth and prosperity, it is anticipated that the world's meat consumption will increase by 1.2% year per capita, reaching a total increase of 14% by 2030. On the other hand, this increase in meat production leads to problems like the careless killing of animals, the increase in methane gas emissions and consequent worsening of the global warming phenomenon, the increased risk of human-animal disease, the development of antibiotic-resistant pathogens, and excessive water consumption. In line with the global sustainability trends, lab-grown meat has been introduced in the last decade as a meat alternative. Stem or satellite cells are taken from the animal's muscle tissue during the meat-cultivation process without endangering the animal. Following that, these cells are put in a culture medium that contains fetal bovine serum. It is created in-vitro by combining animal cells using the cell culture process and biomaterials in a bioreactor under ideal growing conditions until they develop into mature tissues, which results in lab-grown meat. The production of lab- grown meat required high-throughput technology at a wide scale to develop high-quality meat in the laboratory customized for the livestock agriculture industry, environment, animal welfare and human health. However, given the significant market demand for meat substitutes, this area of study is anticipated to add to the company's portfolio; therefore, additional investment and research are needed to guarantee its safety and meet societal standards.

Keywords: Lab-grown meat, Meat alternatives and Global warming- population

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Effect of Paclobutrazol and Potassium Nitrate on Vegetative Growth, Leaf Nutrient Content, Flowering and Yield of Mango (*Mangifera indica* L.) cv. Amrapali Planted under Different Spacing

Laxmipriya Swain¹, Subash Ch. Swain², Deepa Samant³ and Mahesh R Patil⁴

¹Asstt Agriculture Officer, Department of Agriculture and farmer's empowerment, Govt. of Odisha

²Associate professor and Head, Department of Fruit Science and Horticulture Technology, Odisha University of Agriculture and Technology, Bhubaneswar -751003, Odisha, India

³Senior scientist Central Horticulture Experiment Station (ICAR-IIHR), Bhubaneswar - 751019, Odisha, India

⁴Associate professor, Department of Agricultural Statistics, Mahatma Phule Krishi Vidyapeeth, Rahuri -413722, Ahmednagar, Maharashtra

Contact number- 7008445610, email id – laxmipriyaswain729@gmail.com

Mango (*Mangifera indica* L.) is one of the most important tropical fruits of India. In mango, continuous vegetative growth has been observed under tropical condition and thus affects the reproductive phase particularly in high density planting systems. Thus, controlling tree vigour and canopy size of the fruit crop under high density plantation are important for enhancing the orchard efficiency and productivity without causing injury to plants. To study the effect of chemicals like paclobutrazol and potassium nitrate on mango cv. Amrapali planted under higher densities an experiment was carried out at Horticultural Research Station, OUAT, Bhubaneswar during 2018-19 and 2019-20. The experiment was laid out in a Factorial Randomized Block Design with 12 treatment combinations and 3 replications. The treatment combinations consist of two levels of spacings (8.0 x 2.0 m and 4.0 x 4.0 m) and 6 levels of chemical treatments (Paclobutrazol @0.25, 0.50 and 0.75 g a.i. per meter of canopy spread and KNO₃@ 2% and 4%) and a control with water application. The results of the study revealed that the plants spaced at 8.0 x 2.0 m recorded minimum vegetative growth except plant height and lower leaf nutrient content in comparison to the plant spacing of 4.0 x 4.0 m. Among chemical treatments paclobutrazol irrespective of its concentration significantly reduced vegetative growth, increase flowering intensity and yield. Higher concentration of Paclobutrazol (0.75 g a.i.) reduced the yield. Whereas KNO₃ increase the vegetative growth, flowering intensity and yield. But the increase in yield of mango plant due to Paclobutrazol treatment @ 0.50 g a.i. and 0.25 g a.i. was significantly higher than KNO₃ at both the applied concentration. Hence, soil drenching of paclobutrazol at 0.50 g a.i. per meter of canopy spread irrespective of plant spacing during September seems recommendable for regulating tree size and enhancing yield in mango cv. Amrapali planted under higher densities.

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An Economic Analysis of Production of Maize in Balrampur District of Chhattisgarh

Dr. Shweta Singh^{1*}

^{1*} Guest teacher, Department of Agricultural Economics, Late Dr. Ramchandra Singhdev College of Agriculture & Research Station, Korea (Chhattisgarh)
Email address: Shwetasingh9967@gmail.com

The study conducted “An economic analysis of production of maize in Balrampur district of Chhattisgarh”. Maize (*Zea mays* L.) is a crucial crop in Indian agriculture, ranking third in significance after rice and wheat. This study was conducted in Balrampur district of Surguja division, Chhattisgarh state, focusing on their substantial maize cultivation areas. In view this present study seeks to examine the (i) To work out the cost and returns of maize in the study area. For fulfillment of objectives of the study, the field level primary data were collected from randomly selected 150 maize growers of 9 villages of Balrampur district for the agricultural year 2022-23. The major finding of the present study that the family member was 5.28 in Balrampur, the average cropping intensity was found to be 136.61% in Balrampur district, In Balrampur district, the average farm sizes for sampled maize growers were 0.49 hectares for marginal farmers, 1.52 hectares for small farmers, 2.54 hectares for medium farmers, and 7.49 hectares for large farmers. The cost of cultivation per hectare of maize was ₹44,888.60 in Balrampur district. The cost of cultivation per hectare exhibited an increasing trend corresponding to the farm size of holdings. Overall, the input-output ratio in maize cultivation was 1:1.86 in Balrampur district. On an overall basis net return in maize cultivation was ₹ 38704.30, ₹34385.10 per hectare in Balrampur district. The average yield of maize in the study area was 44.16 quintal per hectare in Balrampur district, which shows very satisfactory result. The average income over the seven cost categories was calculated as follows: Cost A1: ₹50,756.10, Cost A2: ₹50,756.10, Cost B1: ₹50,224.10, Cost B2: ₹41,890.70, Cost C1: ₹47,033.40, Cost C2: ₹38,700.10, Cost C3: ₹34,210.80, These figures represent the calculated average income over the specified cost categories in Balrampur district respectively.

Keywords: Gross return, net returns, B: C ratio, input output ratio

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Effect of Turmeric Powder and Vitamin C Supplementation on Carcass Traits of Pratapdhan Chicken

**Manoj Jat, Lokesh Gupta, J.L. Choudhary, Siddhartha Mishra
and Anita Kumari Meena**

Department of Animal Production, Rajasthan College of Agriculture, MPUAT, Udaipur (Raj.)

Presenting Author:manojjat484@gmail.com

This study was conducted at Poultry Farm, Department of Animal Production, Rajasthan College of Agriculture, Udaipur. To study the effect of turmeric powder and vitamin C supplementation on carcass traits of pratapdhan chicken. One hundred sixty day old chicks of pratapdhan chicken breedwererandomly divided in to 4 treatments groups consisting of 40 chicks in each treatment group in 4 replicates of 10 birds each. They will be reared under cage system of housing for six weeks with identical standard management practices. Birds will be provided free access to feed and water during the entire experimental period. The dietary treatments consist of basal ration as (T₁) control, (T₂) 0.5% Turmeric powder, (T₃) 300mg kg⁻¹ vitamin C 0.5%, (T₄) Turmeric powder + 300 mg kg⁻¹ vitamin C results indicated a significantly highest live weight was observed in T₄ and lowest live weight was observed in T₁. The dressed weight was significantly highest in T₄ followed by T₂, T₃ and significantly lowest dressed weight was observed in T₁. Significantly highest eviscerated weight was observed in T₄ lowest in T₁. The giblet weight (g) was significantly highest in T₄ followed by T₂, T₃ and significantly lowest giblet weight (g) was observed in T₁. The dressing per cent was the eviscerated weight (per cent) and the giblet weight per cent was T₁, T₂, T₃ and T₄, respectively. The findings suggest the potential of these supplements to enhance the overall carcass performance of poultry.

Keywords: Turmeric, Vitamin C, Chicks.

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Effect of Molybdenum Supplementation Methods on Yield Attributes of Cauliflower in an Acid Alfisol

Anmoldeep Singh Chakkal^{1*}, Pardeep Kumar² and Alisha Sharma³

²Department of Soil Science, Chaudhary Sarwan Kumar Krishi Vishvavidyalaya, Palampur, Himachal Pradesh, 176062, India

^{1,3}Department of Soil Science, Punjab Agricultural University, Ludhiana, Punjab, 141004, India
*email id- chakkalanmol96@gmail.com

A field experiment was conducted during the rabi season of 2019–2020 at the experimental farm of the Department of Soil Science, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, to investigate the effect of molybdenum (Mo) application on the yield and yield attributes of cauliflower (*Brassica oleracea* var. *botrytis*) cultivated in an acid Alfisol. The study was structured in a randomized block design with three replications and comprised ten treatments involving combinations of recommended fertilizers (NPK), farmyard manure (FYM), lime, and molybdenum, applied individually and in combination as basal (1.0 and 1.5 kg ha⁻¹) or foliar sprays (0.1 and 0.15 per cent). The results demonstrated a significant positive influence of molybdenum application on various growth and yield parameters of cauliflower. The treatment involving the combined application of basal Mo at 1.0 kg ha⁻¹ and foliar Mo at 0.15 per cent (T₁₀) recorded the highest curd yield (20.7 t ha⁻¹), representing an increase of 29.1 per cent over the standard treatment comprising NPK and FYM (T₂). In addition to yield, notable improvements were observed in associated yield-contributing parameters such as plant height, number of leaves per plant, and curd size index under T₁₀. Furthermore, a substantial increase in available molybdenum content in soil was observed following Mo application. The highest available Mo content (0.157 mg kg⁻¹) was recorded in treatment T₁₀, indicating a 56.3 per cent increase over the initial value. Treatments with basal Mo application @ 1.5 kg ha⁻¹ and basal Mo application @ 1.0 kg ha⁻¹ + foliar Mo at 0.1 per cent also exhibited considerable Mo accumulation, with increases of 12.1 and 49.7 per cent, respectively. In conclusion, the study established that molybdenum application significantly enhances the productivity of cauliflower in Typic Hapludalfs characterized by acidic soil conditions and inherent Mo deficiency. The combined use of basal and foliar applications of molybdenum was found to be more efficacious than individual applications, underscoring the importance of integrated micronutrient management for optimizing crop yield in such soils.

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Organic Farming: The Challenges and Opportunities

Mukesh Loyal and Shankar Lal Bijarnia

Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan

Email: mukesh.loyal@vgu.ac.in

Conservation tillage includes a range of tillage practices, mostly non-inversion, which aim to reduce soil erosion by leaving the soil surface covered by crop residues. Despite conservation tillage having been promoted in organic farming to improve inherent soil quality, several factors hinder its development such as weed control and soil compaction. Consequently, to enhance the adoption of conservation tillage in organic farming, long-term experiments were established several years ago in Europe. Different tillage techniques have been assessed from mouldboard ploughing to direct drilling under cover crops. Direct seeding under a cover crop or mulch remains a major challenge in organic farming, since weeds are not mechanically controlled, which thus affect crop performance. However, with other reduced tillage techniques, such as using a layer cultivator, weed development has had minimal effects with no impact on yields. In addition, to improved soil fertility, reduced tillage can increase crop yields. Most of the results of conservation tillage effects were obtained from experiments conducted for less than 10 years under organic farming management. Assessment over longer periods is needed and then shared with organic farmers to design new cropping systems. Introduction of new equipment and knowledge exchanges between conventional farmers practising conservation tillage and organic farmers could improve the adoption of conservation tillage in organic farming.

Key words: Conservation tillage, soil quality, Direct seeding, Organic farming etc.

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The Development, Regulation, and Use of Biopesticides in Integrated Pest Management

Mukesh Jakhar¹ and V.S. Acharya²

¹Ph.D. scholar Department of entomology SKRAU, Bikaner

²Associate Professor Department of entomology SKRAU, Bikaner

Over the past 60 years, crop protection has relied heavily on synthetic chemical pesticides, but their availability is now declining as a result of new legislation and the evolution of resistance in pest populations. Therefore, alternative pest management tactics are needed. Biopesticides are pest management agents based on living micro-organisms or natural products. They have proven potential for pest management and they are being used across the world. However, they are regulated by systems designed originally for chemical pesticides that have created market entry barriers by imposing burdensome costs on the biopesticide industry. There are also significant technical barriers to making biopesticides more effective. In the European Union, a greater emphasis on Integrated Pest Management (IPM) as part of agricultural policy may lead to innovations in the way that biopesticides are regulated. There are also new opportunities for developing biopesticides in IPM by combining ecological science with post-genomics technologies. The new biopesticide products that will result from this research will bring with them new regulatory and economic challenges that must be addressed through joint working between social and natural scientists, policy makers and industry.

Keywords: biopesticide; Integrated Pest Management; adoption; regulation

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Stone and Marble Cutting Industry and its Effects on Human Health in Udaipur City, Rajasthan

Anushka Tiwari¹ and Km. Pratima²

¹Research Scholar, Resource Management and Consumer Science, M.P.U.A.T., Udaipur,
313001 (Rajasthan), India

²Research Scholar, Human Development and Family Studies, M.P.U.A.T., Udaipur,
313001 (Rajasthan), India

Corresponding author E-mail: Email: tiwarianushka512@gmail.com, Ph.no. 8840702560

Purpose: The research aims to know the health status of stone and marble workers. To identify and assess the prevalence of occupational health diseases among stone and marble cutting workers in Udaipur district. To understand the specific workplace hazards and risk factors contributing to these diseases.

Method: A survey was conducted to collect the data. Blood pressure monitor, heart rate monitor was used to know the health status. The current study was conducted in Udaipur district of Rajasthan. Two hundred fifty respondents were selected as purposively. In which 125 were male and 125 were female respondents.

Results: Research may reveal a higher prevalence of respiratory diseases such as silicosis among stone and marble cutting workers due to exposure to silica dust. Findings may indicate a significant incidence of Physical, accidental and musculoskeletal disorders, including back pain and joint problems, owing to repetitive and physically demanding tasks. Workers may have limited awareness of occupational hazards, leading to inadequate use of personal protective equipment (PPE) and preventive measures. The study might highlight the necessity for stricter workplace regulations, improved ventilation systems, and mandatory health screenings for these workers.

Conclusion: The study underscores the pressing issue of occupational health diseases among stone and marble cutting workers, revealing a significant burden of respiratory and musculoskeletal ailments. It emphasizes the urgent need for comprehensive workplace safety measures, including improved dust control and personal protective equipment usage. Furthermore, heightened awareness and training programs are imperative to address the workers' limited knowledge of occupational hazards. These findings underscore the importance of collaborative efforts among industry stakeholders, policymakers, and health organizations to safeguard the well-being of this vulnerable workforce and mitigate the risks they face daily.

Keywords: Health, Respiratory Health, Musculoskeletal Disorders, Occupational Hazards

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Economic and Environmental Benefits of Organic Farming: A Comprehensive Approach for Sustainable Agriculture

Nandita Das

*Department of Agriculture, Brainware University
398 Ramkrishnapur Road, Barasat, Kolkata 700125
Email: ashokdas6753@gmail.com*

Organic farming has emerged as a vital approach to achieving sustainable agriculture by harmonizing economic viability with environmental stewardship. This paper explores the dual benefits of organic farming—economic profitability and ecological conservation—through a comprehensive lens. Economically, organic agriculture offers premium market prices, reduced input costs, and increased rural employment opportunities, contributing to improved livelihoods for farmers. Environmentally, it enhances soil fertility, promotes biodiversity, reduces greenhouse gas emissions, and safeguards water quality by eliminating synthetic chemicals.

The study highlights successful models and modern techniques such as biofertilizers, vermicomposting, and integrated pest management (IPM), which improve productivity while maintaining ecological balance. Furthermore, the paper examines policy support, certification systems, and market linkages essential for scaling organic practices. Data from various agro-ecological zones and case studies demonstrate that, when strategically implemented, organic farming can be a transformative tool for sustainable food systems.

The findings advocate for an integrated framework that combines traditional wisdom, scientific innovation, and community-based participation to advance organic farming. Emphasizing long-term sustainability over short-term gains, this approach offers a resilient pathway for both economic growth and environmental protection in agriculture.

Keywords: Organic Farming, Sustainable Agriculture, Economic Benefits, Environmental Conservation, Soil Fertility, Integrated Pest Management (IPM)

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Natural Management of Aphids (*Chateosiphon fragaefolli*) on Strawberry

Shallu Raina

*Division of Entomology, Sher-e-Kashmir University of Agricultural Science and Technology of
Jammu -180009*

Strawberries are a valuable small fruit crop cultivated worldwide, prized for their high vitamin content and rich antioxidants. The United States leads global strawberry production, followed by Mexico. Within the U.S., California and Florida are the top producers, together accounting for over 90% of the nation's strawberry output. However, strawberry cultivation faces constant threats from various arthropod pests, including insects and mites. To sustain the U.S.'s leading role in strawberry production, it is crucial to develop and implement effective strategies for managing key insect pests, plant diseases, and weeds.

Some of the most damaging arthropod pests affecting strawberries include the twospotted spider mite (*Tetranychus urticae* Koch), various thrips species (*Frankliniella* and *Scirtothrips* spp.), armyworms, root-boring insects, and a range of hemipterans that harm both leaves and fruits. Notable among these are the tarnished plant bug (*Lygus hesperus*) and the seed bug (*Neopamera bilobata* Say). This chapter provides an overview of the primary pests that pose significant threats to strawberry production and outlines integrated pest management (IPM) strategies designed to mitigate their impact throughout the growing season.

Keywords: arthropods, biological control, integrated pest management, monitoring, strawberry

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An Analysis of Product Mix Strategies for Packaged Milk and Dairy Products of Organized Dairy Industry in Bathinda

Navdeep Nain¹, Sonia Mor² and Gaurav Yadav³

¹M..B.A Scholar, ^{2,3}Assistant Professor

*^{1,3}Dairy Trade & Business Management Department, WCDT, SHUATS, Prayagraj-211007, U.P., India, ²Dairy Chemistry Department, CDST, RAJUVAS, Bikaner
mail: navdeepnain286@gmail.com*

Analyzing a product mix involves assessing the assortment of products offered by a company to determine their performance, profitability, and contribution to overall business goals. The organized dairy industry in Bathinda is dominated by three prominent brands: Verka, Amul, and Mother Dairy. For the study, primary data was collected by using a standard Likert-type point scaled questionnaire with anchors of ‘completely agree’ and ‘completely disagree’. Total 450 retailers of Bathinda District were selected and regarding the milk variants of the selected brands, it is found that retailers are aware about all the milk variants of Amul brand except Buffalo Milk, retailers of Verka are aware of all the milk variants and the retailers of Mother Dairy brand are aware about toned milk, double toned milk and standardized milk. Retailers of Amul and Verka brand are aware of the indigenous products variants, but the retailers of Mother Dairy brand are not aware about kheer, processed chesse and Sweets. Regarding the sale of brands for packaged Milk and Dairy products, it is concluded that for the sale of packaged milk 52.9% retailers of Verka Brand are agreed, 32.2% retailers are agreed on Amul Brand and 14.9% retailers are agreed on Mother Dairy Brand and others. In the same way, 54.2% retailers are agreed on the sale of Verka brand for Dairy products, 26.4% retailers are agreed on the sale of Amul Brand and rest 19.4% retailers are agreed on the sale of Mother Dairy Brand for the Dairy products. Among these brands, Verka is the highest in demand by the consumers in both packaged Milk and Dairy Products. This comprehensive analysis enables businesses to make informed decisions about product development, marketing strategies, resource allocation, and portfolio management.

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Sustainable Poultry Production and Climate-Smart Poultry Farming

Neelam

M.Sc. (Ag) LPM, Department of Animal Husbandry and Dairying, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj-21107, Uttar Pradesh, India

Corresponding author email id: neelamchoudhary9649@gmail.com

Sustainable poultry production is increasingly recognized as a critical component of global food security and rural development. In the face of climate change, there is an urgent need to transition toward climate-smart poultry farming practices that promote environmental sustainability and long-term resilience. This presentation explores innovative strategies that enhance feed efficiency, reduce greenhouse gas emissions, and improve poultry waste management. It emphasizes the role of renewable energy, resource-efficient technologies, and improved livestock management systems in building climate resilience within the poultry sector. Furthermore, animal welfare and agricultural innovation are discussed as essential pillars of sustainable development. By aligning poultry farming with the principles of climate-smart agriculture, we can ensure a more secure, efficient, and environmentally responsible future for food production.

Keywords: Sustainable poultry production, Climate-smart agriculture, Poultry farming, Environmental sustainability, Climate resilience, Greenhouse gas mitigation, Livestock management, Resource efficiency, Animal welfare, Renewable energy, Poultry waste management, Feed efficiency, Food security, Agricultural innovation, Climate adaptation.

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Effect of Lameness on Hematological parameters of Dairy Cattle and their correlation with Infrared Thermography

Bagavathi M, Manisha, Ajay Kumar Dang*

Lactation and Immuno-Physiology Laboratory, ICAR-NDRI, Karnal, Haryana

**email id: bagavathimuthappan55@gmail.com*

Laminitis is a painful inflammatory condition affecting the hooves of cattle, often leading to lameness and significant economic losses in the livestock industry. Early detection is crucial for effective management and treatment. This study aimed to evaluate the efficacy of infrared thermography (IRT) as a non-invasive diagnostic tool for the early detection of laminitis in cattle and to correlate thermal imaging results with hematological stress indicators. The study was conducted in 20 lactating cattle at livestock research centre (LRC), ICAR-NDRI with a sample of clinically healthy and laminitis-affected cattle. Infrared thermal images were captured using a high-resolution FLIR thermographic camera, focusing on the coronary band and hoof regions. Thermal anomalies were assessed by comparing temperature gradients between limbs. Concurrently, blood samples were collected to evaluate hematological parameters including total leukocyte count (TLC), neutrophil-to-lymphocyte ratio (NLR), and cortisol levels as indicators of systemic stress and inflammation. Infrared thermography successfully identified increased surface temperatures in the hoof region of laminitis-affected cattle, indicating localized inflammation. Significant differences ($p < 0.05$) were observed in the hematological parameters between healthy and affected groups, with elevated TLC, NLR, and cortisol levels in diseased animals. Inflammatory region of the leg was strongly and positively correlated with TLC ($r = 0.852$, $P < 0.01$) and plasma cortisol ($r = 0.608$, $p < 0.05$). Similarly, inflammatory region of lamed leg and coronary band temperature showed higher temperature (4.28°C and 3.72°C) compared to the healthy cattle. The integration of infrared thermography with hematological profiling provides a promising approach for the early detection of laminitis and the assessment of associated physiological stress in cattle. This method offers a rapid, non-invasive, and animal-friendly diagnostic alternative, facilitating timely intervention and improving animal welfare.

Keywords: Infrared Thermography, Laminitis, Hematological parameters, dairy cattle.

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Nutritional Evaluation of Cakes Enriched with *Lepidiota mansueta* Flour

Rahul Borah¹, Kasturi Sarmah², Dr Sudhansu Bhagawati³

^{1, 3}Department of Entomology, Assam Agricultural University, Jorhat, Assam

²Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

Laboratory experiments were carried out at Soil Arthropod Pests Laboratory, Department of Entomology and Post Graduate Laboratory, Assam Agricultural University, Jorhat to evaluate the nutritional and sensory qualities of cakes fortified with varying concentrations (10%, 20%, and 30%) of *Lepidiota mansueta* beetle flour. The biochemical analysis revealed that a gradual increase in the per cent of not only moisture (23.07-25.52), crude protein (13.30-26.43), crude fat (20.10-23.06), crude fibre (0.66-0.84), ash content (1.31-1.65) but also mineral contents (mg/100g) viz., Na (43.183-46.375), K (41.721-46.676), Mn (0.882-3.361), Zn (0.701-3.041) and Cu (0.094-0.394) showed a gradual increasing trend with the increasing in the concentration of *L. mansueta* flour. However percentage of carbohydrate content showed gradual decreasing trend (61.62-44.43) with the increase in the concentration of *L. mansueta* flour. Moreover, maximum energy content (kcal/100g) was estimated in the cakes supplemented with 30 per cent of *L. mansueta* beetle flour (492.67) followed by 20 per cent (483.23) and 10 per cent (481.94). Sensory evaluation using a 9-point hedonic scale indicated that control cakes (without beetle flour) received the highest acceptability score (7.8), closely followed by cakes with 10% beetle flour (7.5). Acceptability declined with higher beetle flour concentrations. From the organoleptic study of the cakes, a ranking trend of T₄ (without insect powder) > T₁ (10% enrichment of *L. mansueta* flour) > T₂ (20% enrichment of *L. mansueta* flour) > T₃ (30% enrichment of *L. mansueta* flour) was recorded.

Keywords: *Lepidiota mansueta*, flour, cakes, biochemical analysis, mineral contents, organoleptic etc.

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Exploring Nutritional Richness of Indigenous *Colocasia* Genotypes from Low Hills of Himachal Pradesh for Enhanced Nutritional Security

Anubhav Pathania^{1*}, BS Dogra¹, Meenakshi Thakur²

¹Department of Vegetable Science, College of Horticulture and Forestry Neri, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, India

²Department of Basic Science, College of Horticulture and Forestry Neri, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan-173230, India

*Corresponding author: anupathania41@gmail.com

The rapid growth of the global population poses critical challenges in ensuring food and nutritional security. After achieving food security India now faces the critical challenge of ensuring nutritional security. The need for nutrient rich horticultural crops has become increasingly vital in addressing these challenges. Promoting underutilized and nutrient rich crop such as *Colocasia* can play a pivotal role in diversifying diets and strengthening nutritional security, particularly in rural and mid hills of Himachal Pradesh.

Colocasia esculenta, commonly known as taro or arvi is a tropical tuber vegetable crop known for its edible corms and leaves. *Colocasia* has a high nutritional index and rich in carbohydrates, dietary fiber, along with minerals viz. calcium, potassium, phosphorus, and iron. However, its utilization as food remains limited owing to the lack of awareness vis-a-vis its nutritional profile and the presence of antinutrients such as oxalates. In the low hill regions of Himachal Pradesh, several local genotypes of *Colocasia* are cultivated traditionally. These genotypes differ in terms of nutritional and biochemical composition. Profiling these can help in promoting nutrient rich varieties suitable for both local consumption and commercial cultivation. Therefore, the present investigation was under taken to elicit the above information with the aim “Exploring Nutritional Richness of Indigenous *Colocasia* Genotypes from Low Hills of Himachal Pradesh for Enhanced Nutritional Security.” The present study comprising of locally collected 10 genotypes of *Colocasia* from low hills of Himachal Pradesh, which were grown at experimental farm of Department of Vegetable Science, COH&F, Neri Hamirpur (H.P.) in randomised block design (RBD) with three replications and evaluated for various nutritional traits such as dry matter content, moisture content, ash content, crude fibre, starch content, ascorbic acid, total sugars and oxalate content. This study highlights a comprehensive assessment of the nutritional composition of various *Colocasia* genotypes, highlighting significant variations in the biochemical profiles of the tubers. Genotypes with higher nutritional content could play a significant role in the development of nutrient rich variety through selection. Identification of high nutrient genotypes offers a pathway to improve nutritional security and promoting better health outcomes, especially in regions dependent on root vegetables for sustenance.

Keywords: *Colocasia*, Nutritional Security, Biochemical Profiling, Nutrition, Indigenous

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Managing Anthracnose Disease of Soybean through an Integrated Approach

Pawan Saini¹, Pooja Dhaka², Asha Yadav³, Kartikey Pandey⁴

Affiliations: ¹Rajmata Vijaya Raje Scindia Krishi Vishwa Vidyalaya, Gwalior

²Swami Keshwanand Rajasthan Agricultural University, Bikaner

³Sri Karan Narendra Agriculture University, Jobner- Jaipur

⁴Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur

*For correspondence: pawansainialwar2016@gmail.compoojadhakaskn@gmail.com

Soybean (*Glycine max* L. Merrill) is the world's most important seed legume, valued for its exceptional nutritional content, with approximately 40% protein, 20% edible oil, with other beneficial nutrients. Soybean is a *Kharif* season crop, with Maharashtra, Madhya Pradesh, Rajasthan, and Karnataka being the major producing states in India. Anthracnose, caused by *Colletotrichum truncatum* (Schw.) Andrus & W.D. Moore is a major threat among all, particularly in humid tropical and subtropical regions worldwide and poses a severe risk to soybean cultivation in India. Anthracnose is a seed-borne fungal disease that can cause pre- and post-emergence damping-off, along with cotyledon lesions in soybean seedlings, favored by warm, humid conditions and can affect all parts of the plant at any stage of growth. The pathogen persists on crop residues, infected seeds, and weed hosts, serving as primary sources of inoculum. Since it is a seed-borne disease, using disease-free seeds is the first step in effective management. Agronomic measures like rotating with non-host (non-leguminous) crops and implementing appropriate tillage practices can effectively reduce the off-season survival of the pathogen. Chemical management, such as seed treatment with a combination of penflufen and trifloxystrobin, helps protect seeds from diseases like seed and seedling rot, thereby improving plant survival rates. Foliar application of fungicides such as Picoxystrobin + Propiconazole or Carbendazim 12% + Mancozeb 63% has been shown to reduce disease incidence and enhance overall yield. Biocontrol management using *Trichoderma* spp. can also be an effective option. Each of these methods has its limitations in terms of time, cost, or environmental safety. Currently, the use of host plant resistance is emerging as a promising and sustainable approach to overcoming these challenges. To address this, various efforts are being made to develop and promote disease-resistant soybean varieties for practical use in the field. No single method can fully manage the disease; however, integrated disease management combining cultural, chemical, biological, and host resistance strategies provides a more effective and sustainable solution.

Key words: Anthracnose, *Colletotrichum truncatum*, Soybean, Integrated, Management.

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Effect of Biofertilizers and NPK Levels on Yield, Quality and Nutrient Uptake by Cluster Bean (*Cyamopsis tetragonoloba* L. taub.) and its Influence on Soil Properties

Miss. P.A. Chimate, Dr. N.H. Khobragade

Department of soil science and agricultural chemistry

Dr. B.S. Konkan Krishi Vidyapeeth, Dapoli 415712, Maharashtra, India

Corresponding email- pranitachimate2@gmail.com

An investigation was undertaken to study the effect of biofertilizers (i.e. *Rhizobium* and PSB) and NPK levels on growth, yield, quality, nutrient content and uptake by cluster bean (*Cyamopsis tetragonoloba* L. Taub.) as well as the changes in physico-chemical properties, biological properties and nutrient availability in the soil at Department of Agronomy, College of Agriculture, Dapoli during *Rabi* season of 2021-22 in Randomized Blok Design comprising ten treatments replicated thrice.

The results indicated that the application of 40:60:60 N:P₂O₅:K₂O kg ha⁻¹ with seed inoculation of rhizobium and PSB recorded the higher number of pods plant⁻¹, green pod yield and stover yield; protein content of cluster bean; NPK content in pod and plant as well as uptake by plant with significant increase in organic carbon, available NPK and microbial population (actinomycetes, bacteria and fungi) in the soil.

Thus, considering the green pod yield and quality of cluster bean, NPK content and uptake by plant, available nutrient status and optimum net return with good B:C ratio, the application of 40:60:60 N:P₂O₅:K₂O kg ha⁻¹ with seed inoculation of rhizobium and PSB can be useful to enhance cluster bean production in lateritic soils of Konkan with increased profit during *Rabi* season.

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Climate-Resilient Agronomic Practices for Sustainable Crop Production

Prasun Kumar Singh¹, Sahadeva Singh^{2*}, Uzma Manzoor³, Aastha Dubey¹

¹Ph.D. Scholar, School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh -203201

²Professor, School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh -203201

³Associate Professor, School of Agriculture, Galgotias University, Greater Noida, Uttar Pradesh-203201, India.

*Corresponding author: dean.soagri@galgotiasuniversity.edu.in

Climate change poses a significant threat to global agricultural productivity, directly impacting food security, farmer livelihoods, and the sustainability of cropping systems. Increasing temperatures, erratic rainfall patterns, extended droughts, and frequent extreme weather events are disrupting conventional agricultural practices, particularly in vulnerable regions. In this context, climate-resilient agronomic practices have emerged as crucial adaptive strategies to sustain and enhance crop production under changing environmental conditions. This review highlights recent advances and innovative approaches in climate-resilient agronomy, emphasizing sustainable practices that optimize resource use efficiency, conserve soil and water, and improve crop tolerance to climatic stresses.

Key practices discussed include the adoption of drought-tolerant and heat-resilient crop varieties, conservation agriculture techniques, integrated nutrient and water management, precision farming, crop diversification, and agroforestry systems. The role of organic amendments, biofertilizers, and climate-smart soil management techniques in enhancing soil health and carbon sequestration is also explored. Additionally, the paper reviews the integration of digital agriculture tools such as remote sensing, weather forecasting, and decision support systems to improve on-farm decision-making and risk management.

By synthesizing recent research findings and successful field-level interventions, this review underscores the importance of a systems-based agronomic approach that aligns productivity goals with environmental sustainability. The findings advocate for strengthening policy support, farmer capacity-building, and technology dissemination to promote widespread adoption of climate-resilient agronomic practices. Such efforts are essential to ensure food and nutritional security, enhance farm incomes, and build resilience in agricultural systems against the adverse impacts of climate change.

Key words: Climate Change, Sustainable Agriculture, Climate-resilient Agronomy, Conservation Agriculture, Integrated nutrient management

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Advances in Dairy Science and Technology for Enhancing the Farmer's Income

Pratiba Choudhary

*M.Sc. (Ag) LPM, Department of Animal Husbandry and Dairying, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj-21107, Uttar Pradesh, India
pratibhachoudhry702@gmail.com*

The dairy sector plays a pivotal role in sustaining rural livelihoods, particularly among small and marginal farmers. In recent years, significant advances in dairy science and technology have opened new avenues for improving productivity, profitability, and sustainability in dairy farming. This paper explores the integration of modern techniques—such as genetic improvement through artificial insemination and genomic selection, precision feeding, efficient animal health management, and value-added dairy processing—that have collectively contributed to increasing milk yield and enhancing the economic well-being of farmers. Additionally, the adoption of digital tools, mobile-based advisory services, and improved cold chain infrastructure has further strengthened the dairy value chain. Emphasis is placed on the role of farmer-centric innovations and cooperative models in ensuring fair market access and price realization. The paper concludes that strategic implementation of these technological advancements can significantly uplift rural economies, improve food security, and contribute to doubling farmers' income in a sustainable manner.

Keywords: Dairy science, farmer income, technology, animal health, value addition, rural development

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Unpacking the Superfood Phenomenon in Vegan Diets

Prerna Dhingra¹, Dr. Prachi Avinash^{2*}

1Phd Scholar, 2Associate Professor

*Department of Nutrition and Dietetics, UIAHS, Chandigarh University, Mohali Punjab
prachiabhatnagar@gmail.com*

The global inclination towards plant-based diets and veganism has led to the exploration of diverse plant-based food substitutes to ensure nutritional adequacy. This review examines the benefits and drawbacks of key plant-based alternatives: seitan, goji berries, microgreens, and avocado. Seitan, a high-protein meat analogue, offers a substantial protein source, comparable to meat, and is increasingly available commercially. Goji berries, rich in carotenoids, polysaccharides, and polyphenols, support eye health and provide antioxidant benefits. Microgreens, containing flavonoids, carotenoids, and anthocyanins, deliver concentrated macro and micro minerals, mimicking the nutritional profile of sprouts. Avocado, abundant in potassium and magnesium, has witnessed a surge in global consumption. While these substitutes offer significant nutritional advantages, a comprehensive vegan diet necessitates careful attention to potential Vitamin D and B12 deficiencies. This review consolidates current research to provide a balanced understanding of these food substitutes, highlighting their role in promoting a nutritionally sound plant-based dietary pattern.

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Effect of Climate Change on Vegetable Crops

**Ramesh Bhateshwar, Dr. Pushpa Ujjainiya, Dr. Mali Ram Choudhary
and Dhaneshvari Arya**

*Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan
Email. Id: - rameshbhateshwar@gmail.com*

Climate change has extreme impacts on vegetable crop production, affecting growth, yield and quality attributes. Vegetables are particularly sensitive to environmental changes due to their short growth cycles and specific climate needs. Rising temperatures can cause heat stress in important vegetables. For example, lettuce and spinach are cool-season crops that may bolt (flower prematurely) in high temperatures, making them bitter and unmarketable. Tomatoes and bell peppers suffer from poor fruit set and blossom drop under extreme heat, leading to lower yields. Heat can also reduce the size and quality of carrots and broccoli. Changing rainfall patterns lead to both drought and waterlogging. Onions and garlic are highly sensitive to excess moisture and causing the root rot in waterlogged condition. On the other hand, cabbage, beans and okra tolerant during prolonged droughts due to reduced soil moisture and increased evapotranspiration. Climate change also encourages the spread of pests and diseases. Warmer winters allow more pests like aphids, whiteflies, and thrips to survive and reproduce. Diseases such as powdery mildew in zucchini or late blight in potatoes and tomatoes become more prevalent with higher humidity and shifting weather conditions. Increased levels of atmospheric CO₂ may boost photosynthesis in some vegetables like cucumbers and green beans, but often at the cost of nutritional quality. Studies have shown reductions in protein, iron, and zinc content under elevated CO₂ levels. To address these challenges, farmers are turning to adaptive practices: using drought- and heat-tolerant varieties, adjusting planting schedules, improving irrigation and implementing integrated pest management. In conclusion, climate change affects a wide range of vegetables including tomatoes, lettuce, carrots, onions, and beans, causing risks to food security and farmer livelihoods. Proactive adaptation and sustainable farming practices are key to ensuring future vegetable production.

Key words: Climate change, vegetable, rising temperature, poor fruit setting

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A Comparative Study of Extent of Adoption of Onion Production Technology between Beneficiary and Non-Beneficiary Farmers in Rajasthan

Rekha Badhala¹, K. C. Sharma¹ and Surbhi Jangir²

*¹M.Sc. Scholar, ²Professor & Head, Department of Extension Education
SKN College of Agriculture, Jobner; SKN Agriculture University, Jobner*

²Ph.D. Scholar, Department of Extension Education, Maharana Pratap University of Agricultural and Technology, Udaipur, Rajasthan; e-mail- jangirsurbhi95@gmail.com

The present study was conducted in sikar district of Rajasthan to assess the extent of adoption of beneficiary and non-beneficiary farmers of Front Line Demonstrations of Onion production technology. 4 panchayat samities were selected from Siakr district for the study puprose. 50 beneficiary farmer's fields where FLDs were conducted in the year 2018-19, 2019-20 and 2020-21 and 50 non-beneficiary farmers from nearby villages where FLDs were not conducted were selected making a total sample size was of 100 respondents. The data from these farmers was collected using a well-structured and pre tested interview schedule during the year 2022-23. The findings showed that the majority of beneficiary farmers (60.00 %) and non-beneficiary farmers (52.00 %) had medium adoption of Onion Production Technology. Also the number of farmers in high adoption category were more in case of beneficiary farmers as compared to non-beneficiary farmers. Further, it was also found that both type of respondents beneficiary and non-beneficiary possessed maximum adoption of "Seed rate & Spacing" (81.33 MPS) and non-beneficiary possessed maximum adoption of "Time of sowing" (74.00 MPS) of Onion crop. Similarly the least adoption of beneficiary and non-beneficiary farmers was possessed of "Plant protection measures" (59.50 MPS and 47.00 MPS) of Onion crop respectively. There is a need to raise the adoption and awareness among the non-beneficiary farmers by increasing the number of FLDs organized and involving more farmers in it. It could be concluded that more number of farmers should be involved in front line demonstrations which will lead to better adoption of onion production technology.

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Challenges and Opportunities for the Establishment of Agri-enterprise

Priyanka Choudhary *, Dr. Shobhana Gupta and Sher Singh Bochalya

M.Sc. (Ag.) Agricultural Extension Education

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya ,Gwalior (M.P)

Entrepreneurship is an age-old concept but there is a need for innovation and pumping of new blood into the field that constitute the youth as they have lot of self-confidence and an strong zeal inside them to do something for themselves and the society. Entrepreneurship is regarded as one of the best economic development strategies to develop country's economic growth and sustain the country's competitiveness in facing the increasing trends of globalization. The under lying principle of entrepreneurship is the belief that self-employment and entrepreneurship increase the self-esteem and confidence of the youth, leading to greater control over their lives in social and economic spheres. Entrepreneurship has been recognized as an important contribution to the creation of a majority of jobs through small businesses; thus, an increased interest in the development to education programmes designed to encourage and enhance entrepreneurship. The study was conducted in four constituent colleges' viz., SKNCOA Jobner (Jaipur), COA Lalsot (Dausa), COA Fatehpur-Shekhawati (Sikar) and COA Kumher (Bharatpur) which directly comes under the administrative jurisdiction of Sri Karan Narendra Agriculture University, Jobner. The students who were registered in the ELP Programme during the academic session 2021-22 were taken for the study so that after completing their degree they have sufficient time to start any enterprise.

Challenges for the establishment of Agri-enterprise: The respondents expressed their views on perceived challenges for the establishment of Agri-enterprise. Lack of capital requirements was the top ranked challenges stated by maximum number of respondents (71.13%) followed by technological adoption (69.01%), non-availability of prepared technical plan, business plan and marketing plan language related problems (66.20%), lack of marketing facilities for processed/ value added products (63.38%), market access and competition (61.27%), weather and climate risk (59.86%), lack of technical guidance (52.82%) and labor shortages stated by 50.70 per cent respondents.

Opportunities for the establishment of Agri-enterprise: The respondents expressed their views on perceived opportunities for the establishment of Agri-enterprise the basis of future needs. Organic farming was the top ranked opportunities stated by maximum number of respondents (60.56%) followed by Fruit and vegetables production(57.04%), Seed Production and Nurseries, (54.92%), value added products (52.81%), Sustainable Livestock Farming (43.66%) and Mushroom cultivation (38.73%).The findings of the study are similar to the Seemaprakalpa (2014) Rao et. al (2016).

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Applications of Artificial Intelligence in Agriculture : A Review

S. B. Raut ^{1*}, M.S. Anarase ², and G.K. Sasane³

- 1. Associate Professor, Department of Plant Pathology and Agril. Microbiology, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar, Maharashtra 414 111*
- 2. Assistant Professor, Department of Agril. Extension Education, DVVPF's COA, Vadgaon Gupta (Vilad Ghat), Ahilyanagar. Maharashtra 414 111*
- 3. Director of Extension Education and Head, Department of Agril. Extension Education, MPKV, Rahuri, Ahilyanagar, Maharashtra 413722*

**Corresponding author email: someshwar844@gmail.com*

According to the United Nations World Population Forecast-2022, India's population may reach 166.8 crores by 2050. And with this the demand for food and work is also increasing. (AI).The traditional practices of farmers were not sufficient to meet these objectives. As a result, new automated processes were developed. Artificial intelligence has the potential to solve challenges faced by farmers such as climate change, pest and weed infestations that reduce yields. This technology is designed to protect crop yields from various factors such as climate change, population growth, labor issues and food security concerns. AI is being used in applications such as weather forecasting, crop monitoring and health, livestock management, enabling precise crop monitoring, predicting yields, and optimizing resource usage, leading to increased efficiency and sustainability. Artificial intelligence can detect diseases and pests early, automate tasks like weeding and harvesting, and provide real-time crop insights, helping farmers make informed decisions, also using sensors and other devices incorporated in robots and drones, artificial intelligence can be used in agriculture for irrigation, weeding, spraying, etc. These technologies will reduce irrigation water, pesticide consumption, and precise application of herbicides, maintain soil fertility and help in efficient farming.

Keywords: Application, Artificial intelligence, Agriculture.

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Farming 2.0: The AI-Powered Agricultural Revolution

Sadia Khan¹, S. Marker¹

¹Department of Genetics and Plant Breeding, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India; Email Id:-sadiakhanskr@gmail.com

As the global population grows, food demand is rising rapidly, placing immense pressure on agriculture to produce more with fewer resources. To meet this challenge, agricultural automation—especially technologies powered by artificial intelligence (AI), including robots, drones, and smart sensors—is becoming increasingly vital. These tools enhance farming efficiency, optimize inputs like water, fertilizers, and pesticides, and improve crop yield and quality. AI-driven automation also supports sustainable practices by reducing labor demands and minimizing waste, contributing to environmentally responsible food production.

Meanwhile, advances in high-throughput technologies for collecting genomic, phenomic, and multi-omic data have overcome many previous data bottlenecks. Yet, the complexity and volume of this data remain difficult to manage. Here, AI—particularly machine learning (ML)—offers transformative potential. By uncovering patterns and making data-driven predictions, AI provides insights that go beyond traditional methods and human capabilities.

In crop science, AI applications include deep learning for genomic selection to identify superior genetic traits; feature selection for understanding complex environmental interactions (enviromics); ensemble models for accurate growth predictions; and computer vision tools for phenotyping. These innovations empower farmers with intelligent decision-support systems that enable more precise, efficient, and sustainable farming. Ultimately, AI enhances productivity while reducing environmental impact, playing a key role in the future of global food and biofuel production.

Key words: Artificial intelligence, machine learning, genomics, enviromics and phenomics.

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Role of Bio-nanoformulations in Horticultural Crops

Sagar Saini¹, Uadal Singh¹, Mahendra Meena², Dhaneshvari Arya²

¹Department of Horticulture, (Rajasthan Agricultural Research Institute, Durgapura-302018) Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India

²Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India; Email Id:- sagarsaini13091999@gmail.com

The increasing demand for sustainable agriculture has driven the exploration of innovative solutions to enhance crop productivity, quality and post-harvest management. One such solution is the use of bionanoformulations that combine biological agents with nanotechnology. These formulations have demonstrated significant potential in improving the growth, health and yield of vegetable crops, while also addressing post-harvest challenges. During the growing phase, bionanoformulations aid in nutrient uptake, root development, stress tolerance and pest and disease control, thereby enhancing overall crop productivity. Additionally, their role in post-harvest management is critical, as they help to prolong shelf life, reduce spoilage and prevent microbial contamination. By enabling the controlled release of bioactive compounds, these formulations contribute to maintaining the quality of harvested vegetables, reducing the need for synthetic preservatives and minimizing waste. The dual application in both crop growth and post-harvest handling presents bionanoformulations as a promising, eco-friendly alternative for modern agriculture. This presentation explores the mechanisms of bionanoformulations, their benefits to vegetable crops during cultivation, post-harvest and the challenges, future directions for integrating these innovations into sustainable agricultural practices.

Key words- Bionanoformulations, nanotechnology, postharvest and productivity

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Influence of drying Technique and Extraction method on the Quality of Lutein from Marigold (*Tagetes erecta* L.) Flowers

Sangeeta Sharma* and Saleem Siddiqui

*Department of Life Sciences, Sharda School of Basic Sciences and Research
Sharda University, Greater Noida-201310, Uttar Pradesh, India*

**Correspondence author (Email: sangitasharma827@gmail.com)*

Marigold flowers are reported to be rich source of lutein. The present study aimed to evaluate the effect of drying petals of marigoldvar. Pusa narangi flowers by different methods viz., air drying (AD), oven drying (OD), fluidized bed drying (FBD), vacuum oven drying (VOD), and freeze drying (FD); and then the extraction methods viz., conventional solvent extraction (CSE) by Soxhlet method and vegetable oil extraction (VOE) method on the yield and quality characteristics of lutein. The Soxhlet extraction method was carried out by petroleum ether at 60 °C for 6 hours; while for oil extraction, three different edible oils: corn, olive, and sunflower oils were used. The extracts were analyzed for lutein content, antioxidant activity, FTIR, and CIE Labcolor values.

The yield of lutein was found to be affected by drying methods. Among the different methods of drying, FD and VOD were most effective methods for maintaining lutein content. FBD and AD methods resulted in reduced lutein content. The CSE and VOE methods were found to be equally effective in extracting lutein. The different oils used for extraction also did not show any significant differences on yield of lutein. The antioxidant activity was maximum for the lutein extracted from FD and VOD dried petals and was higher in VOE as compared CSE extraction methods, where all the oils were equally effective. The Hunter L, a and b colour attributes indicated darker colour in FBD and lighter in OD drying methods. The colour was lighter for lutein extracted by CSE as compared to VOE method. FTIR analysis indicated no significant structural alterations by different drying methods. The prominent peaks of lutein were detected at 3253, 2928, 1588, 1269, 1018 cm⁻¹. Similar peaks were identified for both the CSE and VOE extracts; however, CSE extracted lutein showed an increased percentage transmittance. The results of the present study indicate that VOE is an effective and sustainable method for the extraction of lutein from marigold flowers dried by FD and VOD methods.

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Management of Pollinators in Vegetable Crops

Pasham Maneela¹, A. Mamatha², Pavan kumar G.N³

¹M.Sc. Scholar, Department of Vegetable Science, SKLTGHU, Mulugu, Siddipet, Telangana, India

²Assistant Professor, Department of Vegetable Science, College of Horticulture, Rajendranagar, SKLTGHU, Mulugu, Siddipet, Telangana, India

³M.Sc. Scholar, Department of Vegetable Science, SKLTGHU, Mulugu, Siddipet, Telangana, India
maneela.p05@gmail.com

Pollinators are vital for the reproduction of many flowering plants and the production of a significant portion of the food we consume. A pollinator is a biotic agent—usually an insect or animal—that transfers pollen from the male part (anther) to the female part (stigma) of a flower, enabling fertilization and fruit or seed development. Among various pollination agents, insects are the most efficient, with honey bees regarded as the ideal pollinators due to their foraging behavior, high mobility, and floral fidelity. Globally, nearly 200,000 animal species, including bees, butterflies, birds, moths, and beetles, pollinate about 250,000 species of flowering plants. Commercial pollination commonly employs species such as *Apis mellifera*, *A. cerana*, *Bombus haemorrhoidalis*, *B. terrestris*, and syrphid flies. Inadequate pollination is a leading cause of low seed yield in vegetable seed production. This challenge highlights the need to conserve pollinators and encourage their presence in agricultural landscapes (Negi et al., 2020). However, pollinator populations are rapidly declining due to habitat loss, pesticide use, climate change, diseases, and monoculture farming practices. This trend threatens food security and biodiversity. Over 75% of global food crops depend, at least in part, on animal pollination. Without pollinators, crops like fruits, nuts, and vegetables would see reduced yields and quality, leading to economic losses and dietary imbalances. Conservation strategies include creating pollinator-friendly habitats, reducing pesticide usage, planting native flowering species, and adopting integrated pest and pollinator management practices. Raising awareness among farmers and communities about the importance of pollinators is also crucial. Ensuring the health and diversity of pollinators is not just beneficial for agriculture but essential for sustaining ecosystems and future food supplies.

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Biomass-to-Bioenergy: Temporal Microbial Transitions in Acid- activated anerobic System

Shambavi Bhatt, Dr. Madhuri Girdhar

School of Bioscience and Bioengineering, Lovely Professional University, Phagwara, Punjab
Shambhavibhatt1999@gmail.com

Microbial ecology of anerobic digesters is important for maximizing biogas production, particularly from difficult- to-degrade substrates such as lignocellulosic Biomass. Sugarcane bagasse pretreated with dilute acid was anaerobically digested under controlled mesophilic conditions. the pretreatment process not only improved lignocellulose hydrolysis but also seemed to selectively enrich for microbial communities with greater metabolic versatility. Alpha and beta diversity measures indicates a trend towards more specialized consortia as digestion proceeded, leading to increased system stability and efficiency. This new systems level view of microbial ecology in anerobic digestion and points to important functional groups that may be targeted in new microbial engineering strategies to optimize methane recovery from lignocellulosic biomass. Physiochemical measurements revealed high correlations between microbial changes and digester performance parameter like cumulative methane yield, pH stabilization, and ammonia nitrogen balance. In addition, acid pretreatment not only increased hydrolysis but also functioned as a selective pressure, favoring microbial taxa with greater substrate tolerance and metabolic versatility. This ‘selectoprofiler’ effect – by which pretreatment induces functional reprogramming of the microbiota- is suggested as a novel model for digester optimization.

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Organic Farming: As a Climate Change Adaptation and Mitigation Strategy

Shankar Lal Bijarnia and Harish Kumar Bijarnia

Assistant Professor, Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan

Assistant Professor, Department of Agronomy, Suresh Gyan Vihar University, Jagatpura, Jaipur

Rajasthan; Email: shankar.bijarnia@vgu.ac.in

Organic farming, as an adaptation strategy to climate change and variability, is a concrete and sustainable option and has additional potential as a mitigation strategy. The careful management of nutrients and carbon sequestration in soils are significant contributors in adaptation and mitigation to climate change and variability in several climate zones and under a wide range of specific local conditions. Organic farming as a systematic approach for sustained biological diversity and climate change adaptation through production management, minimizing energy randomisation of non-renewable resources; and carbon sequestration is a viable alternative. 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: climate change, mitigation, Organic farming, carbon sequestration etc.

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The Nutraceutical Relevance of Oyster Mushrooms: Investigating Bioactive Compounds and Their Applications

Shreya Brohma¹, Archana T S², Devendra Kumar³, Mansha Makhija⁴

^{1,2,3,4}, Department of Plant Pathology, Lovely Professional University, Phagwara-144 411, Punjab

email ids- ¹riyashreya1706@gmail.com, ²archana.26887@lpu.co.in

³devendra.26885@lpu.co.in, ⁴manshamakhija01@gmail.com

Oyster mushrooms (*Pleurotus ostreatus*) are very well known for their superfood status due to their abundant supply of essential nutrients, including vitamins, minerals, and antioxidants. Their versatility allows them to complement both vegetarian and non-vegetarian diets, making them an ideal addition to a balanced and health-promoting eating regime. A study was conducted to investigate the nutraceutical potential of *P. ostreatus*, focusing on its bioactive compounds through Soxhlet extraction and Gas Chromatography-Mass Spectrometry (GC-MS) analysis. The results revealed a variety of beneficial compounds, reinforcing the mushroom's value as a nutritious food source.

The GC-MS analysis revealed several bioactive compounds in *P. ostreatus* extracts, each contributing to human health in distinct ways. Ergosterol, a precursor to vitamin D₂, was identified as a prominent compound. This compound not only supports bone health but also has antioxidant and anti-inflammatory properties that help reduce oxidative stress and prevent chronic diseases. Pyridine, another compound found, demonstrates antimicrobial and anti-inflammatory effects, further enhancing the mushroom's therapeutic potential. Additionally, linoleic acid, an essential fatty acid, plays a key role in cardiovascular health by lowering LDL cholesterol and promoting lipid metabolism.

These bioactive compounds, along with others present in the mushroom, position *P. ostreatus* as a valuable nutraceutical resource. Its antioxidant properties help counteract free radicals, potentially reducing the risk of degenerative diseases like cancer, diabetes, and cardiovascular conditions. Moreover, the mushroom's anti-inflammatory and antimicrobial effects further elevate its therapeutic value.

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Enrichment of Stress Relieving and Antioxidant Properties of Vegetable Soup by the Addition of Matcha Powder & Onion Peel Powder

Amisha A.S¹, Anusha R², Sujitha A.P^{2*}, ShainyN.K³

¹Department of Food technology, KMO arts and Science College, Koduvally

²Department of Food Technology, SAFI Institute of Advanced Study, Kerala

³Department of Microbiology, SAFI Institute of Advanced Study, Kerala

*Correspondence mail: sujift4@gmail.com

This study aimed to enhance the stress-relieving and antioxidant properties of food, particularly vegetable soups, through the incorporation of Onion Peel Powder (OPP) and Matcha Powder. Both OPP and Matcha are known for their bioactive compounds—L-tryptophan in OPP for stress relief and sleep induction, and L-theanine in Matcha for stress reduction. Additionally, OPP and Matcha contain antioxidants, including catechins, polyphenols, and amino acids, which were expected to improve the overall health benefits of the soup. Oat flour was selected as the base ingredient for its stress-relieving and nutritional properties.

Two different formulations of the soup mix were developed: Sample 1 contained 7% OPP and 3% Matcha, while Sample 2 contained 10% OPP and 2% Matcha, with the remaining ingredients kept constant in both samples. The chemical composition of the soup mix was analyzed, including moisture content, ash, fat, and crude fiber, while bulk density and sensory analysis were also performed.

The results showed that the moisture content of the soup mix ranged from 8.14% to 8.42%. Sample 2, with a higher amount of Matcha, exhibited the highest antioxidant activity (96.96%). Sample 1 had a higher fat content (10.654%), while Sample 2 had significantly lower fat (2.75%). In terms of fiber content, Sample 1 contained 16.226%, while Sample 2 had 29.1%. Both samples maintained their fiber content during storage. The bulk density of Sample 1 was 0.526, whereas Sample 2 had a bulk density of 0.451, with both samples maintaining these values throughout storage.

The cooking characteristics of the soup mix were evaluated by adding 10g of the sample to 100ml of water. After 5–10 minutes, a translucent watery broth was formed. Sensory evaluation revealed that Sample 2 had better overall acceptability. As a result, the composition with 10% OPP and 2% Matcha (Sample 2) was selected as the optimal formulation for further analysis, including proximate composition, sensory evaluation, and microbial analysis.

This research highlights the potential of developing functional convenience foods that not only improve the nutritional status of the general population but also cater to the demands of modern lifestyles by offering time-saving and health-enhancing options.

Key words: Stress relief, bioactive compounds, convenience foods

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Near-Infrared Reflectance Spectroscopy: A Breeder-Friendly Tool for Nutritional Trait Profiling in Pearl Millet

SunainaYadav^a, Maharishi Tomar^b, TriptiSinghal^a, AavulaNaveen^a
and Sumer Pal Singh^a

^aICAR-Indian Agricultural Research Institute, New Delhi 110012, India

^bICAR-Indian Grassland and Fodder Research Institute, Jhansi, Uttar Pradesh 284003, India

Pearl millet, renowned for its exceptional nutritional profile and resilience to harsh climatic conditions, is gaining prominence in efforts to enhance food and nutritional security. The current study presents the development of Near-Infrared Reflectance Spectroscopy (NIRS) models for rapid, cost-effective, and non-destructive estimation of key nutrients in pearl millet grains. These models offer a valuable alternative to conventional analytical techniques, particularly for advancing single plant progenies in segregating populations aimed at improving nutritional traits. Spectral data were collected from 403 diverse genotypes, and mathematical optimization using derivative treatments was employed to refine model performance. The optimal pre-processing configurations (order of derivative, gap, first smoothing, and second smoothing) were as follows: "2,36,6,2" for amylose, "2,32,6,2" for starch, "2,32,8,2" for oil and protein, and "3,36,6,2" for phytic acid. Modified partial least squares (MPLS) regression was applied to spectra pre-processed using standard normal variate (SNV) transformation and detrending (DT), minimizing extraneous variation. The resulting MPLS models demonstrated strong predictive accuracy, with coefficients of determination (R^2) of 0.985 (amylose), 0.984 (protein), 0.986 (oil), 0.969 (starch), and 0.993 (phytic acid). The standard error of prediction corrected for bias [SEP(C)] values were 0.347 (amylose), 0.732 (starch), 0.313 (protein), 0.014 (phytic acid), and 0.162 (oil), indicating variable predictive precision across traits. Validation with independent sample sets further confirmed model robustness, with R^2 values ranging from 0.878 for phytic acid to 0.976 for protein, minimal prediction bias, high ratios of prediction to deviation (RPD values between 2.93 and 5.81, and no statistically significant differences between predicted and reference values ($p > 0.05$). These advanced NIRS models facilitate rapid and economical nutritional profiling of pearl millet germplasm and breeding lines, thus supporting biofortification strategies and contributing to improved nutritional security.

Keywords: Pearl millet, Near-infrared reflectance spectroscopy (NIRS), Nutritional composition, Modified partial least squares (MPLS) regression, Biofortification

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Morphological Characterization of Finger Millet Accessions from Garhwal Himalayas

Sunita Choudhary^{1*}, Deepti Prabha¹, J. S. Chauhan¹

*1*Department of Seed Science and Technology, Hemvati Nandan Bahuguna Garhwal University
(A central university), Garhwal, Srinagar, (Uttarakhand) – 246174
Email: sunitaseed23@gmail.com

Finger millet (*Eleusine coracana* (L.) Gaertn) is an allotetraploid cereal and ranks as India's third most important millet crop, following pearl millet and sorghum. This resilient crop is well-suited to climate change challenges, as it is a C4 plant that demonstrates tolerance to high temperatures and water scarcity, enabling it to adapt effectively to the local climate in the sub-Himalayan region. Sixty-six local accessions of finger millet and two cultivated varieties were collected from the Garhwal hills of Uttarakhand. The field trials were conducted during the 2023 and 2024 Kharif seasons at the Research Block of the Department of Seed Science and Technology, Chauras Campus, HNB Garhwal University, Srinagar, Garhwal, Uttarakhand. The Garhwal Himalayas region contains a wide diversity of finger millet that remains unexplored. Hence, this study was designed to describe the finger millet accessions from the Garhwal region, following distinctness, uniformity, and stability (DUS) guidelines to evaluate variability among these accessions. An assortment of sixty-six fingermillet accessions and two varieties were categorized using twenty agro-morphological traits. Three types of growth habits, Erect (65), Decumbent (2), and Prostrate (1), were detected in finger millet germplasm. 13 accessions showed pigmentation at leaf juncture, 41 accessions showed culm branching of the stem. Six glum colors were recorded; 28 accessions showed light green color, 7 dark green, 14 light brown, 6 dark brown, 12 light purple, and one white color glume. Five ear shapes were observed, and 3 accessions showed fist, compact (17), semi-compact (34), open (13), and 1 Droopy type. Finger branching, branching position, multiple whorls, seed shattering, seed covering by glumes, seed color, seed shape, and seed texture were observed. The observations were recorded per DUS guidelines standardized by the Protection of Plant Varieties and Farmers' Rights Authority (PPV & FR). This study emphasizes the importance of thorough phenotyping in revealing the genetic potential of finger millet, which is essential for developing crop improvement initiatives aimed at sustainable agriculture and food security.

Keywords: *Eleusine coracana*, Phenotyping, DUS, PPV & FR.

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Case Study of Farmer Producer Organization in Rajasthan in the Era of Globalization

Surbhi Jangir¹, B.S. Badhala² and RekhaBadhala³

¹Ph.D. Scholar, Department of Extension Education, MPUAT, Udaipur

²Assistant Professor of Agricultural Extension, SKNAU, Jobner, Jaipur

³M.Sc. Scholar, Department of Extension Education, SKNAU, Jobner, Jaipur

Email- jangirsurbhi95@gmail.com +91-8696780062

The Farmers' producer organisations (FPO) is an organisational model influenced by the cooperative idea where small and marginal farmers bring themselves together, earn from collective effort and create linkages with evolving marketplaces; however it is managed by professionals to maintain financial stability. This study was conducted with an objective to determine the efficiency of the FPO and its business model as approach for small farmers' involvement in emerging markets and to explore the difficulties in marketing encountered by small and marginal farmers. Shiromani Milk Producer Company, a FPO working in Nawalgarh City of Jhunjunu District of Rajasthan and Sikar and Jhunjhnu Milk union SARAS were selected for the study. With the help of specifically created questionnaires and schedules for farmers and company members, and through observations during the field visit to the FPO, collection centres and villages, data were gathered. Additional information was gathered via the internet, periodicals, journals, etc. The most important elements for a successful production firm are the character and competence of the leadership, community acceptance, and the market climate. The company's marketing of the participating farmers' surplus production must be financially advantageous to them. In order to keep connections with the target markets, the corporation must also supply the necessary expertise to encourage extra production from within the local community. The FPO has shown to be effective in raising the value chain for milk and dairy products and in helping farmers obtain fair prices for their products. The final conclusion is that FPOs are a viable new model for farmers, but one that requires ongoing support and additional rigorous examination.

Key words: FPOs, milk and dairy products, small & marginal farmers, value chain, collective effort

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Testing of Compatibility Among the Fusarium Isolates from Tomato, Brinjal and Chilli in vitro

Teluganam Srikanth^{1*}, Sanganamoni Mallesh², Bathula Jagadeesh³, Jharapla Cheena⁴,
Veera Suresh⁵

¹Department of Vegetable Science, Post-graduate Institute for Horticultural Sciences, (PGIHS)
SKLTGHU, Mulugu, Siddipet, Telangana

²Department of Vegetable Science, Post-graduate Institute for Horticultural Sciences, (PGIHS)
SKLTGHU, Mulugu, Siddipet, Telangana

³Department of Plant Pathology, Forest College and Research Institute (FCRI), Mulugu, Siddipet,
Telangana

⁴Department of Vegetable Science, College of Horticulture, Malyal, (SKLTGHU), Mulugu, Siddipet,
Telangana

⁵Department of Plant Pathology, Vegetable Research Station (VRS), (SKLTGHU) Rajendranagar,
Hyderabad, Telangana

Presenting author email id: mudhirajsrikanth910@gmail.com

The study aimed to test the in vitro compatibility of Fusarium isolates from tomato, brinjal and chili using Potato Dextrose Agar (PDA) as a growth medium. The experiment, conducted in February 2024 at the Forest College and Research Institute, Mulugu, tested four combinations of Fusarium isolates: tomato + brinjal, tomato + chili, brinjal + chili and tomato + brinjal + chili. Pure cultures were prepared using the single spore technique, and pathogen identification was confirmed by analyzing colony morphology and spore characteristics. The isolates were inoculated in petri plates under aseptic conditions and incubated at 28±1 °C. Growth rates were observed at 2, 5 and 8 days after inoculation. The results showed compatibility between tomato and brinjal isolates, with complete coverage by the 8th day, while distinct mycelial layers indicated incompatibility in combinations involving chili isolates. These findings contribute to understanding Fusarium isolate interactions, particularly the incompatibility reactions of chili isolates with both tomato and brinjal under controlled conditions.

Keywords: Fusariumoxysporum, pathogenicity, compatibility, isolates

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The Economic Role of e-NAM in Agricultural Marketing in Rajasthan

Uday Lal Gurjar¹, Subhita Kumawat¹, Dev Raj Gurjar¹, Akash Saini¹

¹Department of Agricultural Economics, Sri Karan Narendra Agriculture University, Jobner-303329, Rajasthan, India; Email Id: -gurjaruday085@gmail.com

The Electronic National Agriculture Market (e-NAM) has emerged as a transformative platform in the agricultural marketing ecosystem of India. In Rajasthan, a state with a predominantly agrarian economy, e-NAM has significantly reshaped the traditional modes of agricultural trade by introducing transparency, competitiveness, and efficiency in the marketing process. This paper explores the economic impact of e-NAM on farmers, traders, and the overall market structure in Rajasthan. It examines how digital integration of mandis under e-NAM has improved price discovery, reduced exploitation by middlemen, and enhanced farmers' income through wider market access. The study also highlights the infrastructural and digital challenges that need to be addressed for the platform to achieve its full potential. Overall, e-NAM represents a critical step toward modernizing agricultural marketing in Rajasthan, fostering economic inclusivity and sustainability in the sector.

Key words: Agricultural marketing, Farmers' income, Digital integration, Transparency in trade

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Vegetable Biofortification through Transgenic Approaches: A Sustainable Solution to Hidden Hunger

D. Chandana Naik¹, K.Nirosha², S.Mallesha³, Dr. B. Naveen, Kumar⁴ and B.Ashwin Kumar⁵

¹*Research scholar, Department of Vegetable Science, Post Graduate Institute, SKLTGHU, Mulugu*

²*Assistant Professor, Department of Vegetable Science, College of Horticulture, Rajendranagar, SKLTGHU*

³*Assistant Professor, Department of Vegetable Science, Post Graduate Institute, SKLTGHU, Mulugu*

⁴*Vice Principal, Department of Soil Science & Agricultural Chemistry, Horticulture Polytechnic, Ramagirikilla, SKLTGHU, Mulugu*

⁵*Assistant Professor, Department of Agricultural Engineering, College of Horticulture, Rajendranagar, SKLTGHU, Mulugu*

Presenting author email id: dharavathchandana1278@gmail.com

Biofortification is a process that increases the nutritional value of crops through genetic modification, conventional breeding, or agronomic practices. Vegetable biofortification through transgenic approaches presents a promising and sustainable strategy to combat this challenge. Unlike conventional fortification and supplementation, transgenic biofortification enhances the nutritional content of crops during growth, making nutrient-rich foods accessible directly from the farm. Through the integration of desirable genes using advanced methods such as *Agrobacterium*-mediated transformation, gene gun, and CRISPR technology, staple vegetables can be enriched with essential micronutrients including iron (Fe), zinc (Zn), iodine (I), selenium (Se), and vitamins like A, C, and E.

This approach has led to the development of genetically enhanced crops such as beta-carotene-rich cauliflower, iron-fortified *Amaranthus*, and nutrient-dense potatoes. It not only improves dietary quality but also strengthens agricultural resilience, reduces reliance on chemical supplementation, and promotes long-term food and nutritional security. By addressing deficiencies at the genetic level, transgenic biofortification supports the production of multipurpose vegetables with enhanced antioxidant properties, better health outcomes, and greater yield potential. As such, it stands as a key innovation for sustainable agriculture and public health improvement in resource-constrained regions.

Keywords: Biofortification, Transgenic Vegetables, Micronutrient Malnutrition, Genetic Engineering, Sustainable Agriculture.

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Effect of Water Soil on Environmental Function and Soil Health

Apurva D. Fuladi

Assistant Professor, S.S.E.S.A's Science College, Congress Nagar, Nagpur-(440012), M.S., India.

Soil water affects microbial activity, erosion, compaction, and carbon sequestration, making it essential for soil health and ecosystem functioning. Microbial activity, which is essential for the breakdown of organic matter and the cycling of nutrients, is supported by soil water. Sufficient moisture promotes microbial development, which raises soil fertility and benefits plant health. Microbial communities can be impacted by changes in moisture content, which can have an impact on soil health. Microbial activity is encouraged and ideal moisture levels are maintained with the use of techniques like irrigation and the addition of organic materials. The dynamics of soil water greatly affect erosion. Surface runoff and erosion can result from excessive irrigation or rainfall, particularly on sloping or sparsely vegetated areas. By increasing water infiltration and decreasing runoff, conservation techniques including contour farming, terracing, and ground cover maintenance lessen erosion. High levels of organic matter and a healthy soil structure also prevent erosion. Compacted soil has less porosity, which prevents water from penetrating and roots from growing. It has a detrimental effect on microbial activity and plant growth by decreasing the soil's capacity to retain water and reducing aeration. Avoiding heavy machinery on wet soils, restricted traffic farming, and other techniques can help decrease compaction. Compaction is avoided by keeping moisture levels at ideal ranges. By promoting plant growth and the breakdown of organic materials, soil water affects carbon sequestration. Sufficient moisture encourages plant growth and the buildup of plant waste, which adds organic carbon to the soil. The stability of soil organic carbon and microbial breakdown are similarly impacted by water availability. Agroforestry, cover crops, and conservation tillage are examples of sustainable techniques that improve carbon sequestration and slow down global warming. Managing soil and water resources in agriculture requires an understanding of soil water dynamics. We can create plans to maximise plant development, improve soil health and increase water usage efficiency by researching the types, flow, retention, and availability of soil water. Sustainable techniques including conservation tillage, cover crops and agroforestry will increase agricultural resilience and productivity, and future research will continue to yield new knowledge and solutions for improved soil water management.

Keywords: Water soil, Plant, soil health, ecosystem function, soil water management.

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Impact of Self Help Groups (SHG) in Empowerment of Rural Women

Somdutt Tripathi¹, Bhanu Prakash Mishra², B. K. Gupta³, Anjali Pandey⁴

¹Ph.D. Scholar, ²Professor and Head, ³Assistant Professor, Department of Agricultural Extension, BUAT, Banda

⁴Ph.D. Scholar, Department of Agricultural Extension Education, SVPuat, Meerut
Corresponding Author- somdutttripathi1111@gmail.com

Self Help Group (SHG) have been a main tool as far as empowering rural women are concerned around the World. Typically, these groups are made up of women of like socio-economic status who meet for the purposes of savings and loans, income generating activities, and social-emotional support. SHGs have a significant and multi-dimensional effect on the empowerment of rural women. Economically, SHGs get women access to finances, which were not accessible until now. The members raise, save and share capital with each other, resulting in greater household income and economic independence through the formation of microenterprises. Enabling them to be financially empowered improves a position of women in the family and in turn to the larger family welfare and stability. In terms of social aspects, SHGs become the centre stage for women to share their views, raise concerns, and advocate for rights collectively. Group participation fosters confidence and instills leadership even in them which allows them to break through stereotypes of gender roles and norms. In addition, SHGs generally enable education and health services, which increase the wellbeing of the members, as well as the objective conditions of their families. In a cultural way, there is a focus on women empowerment, where SHGs create solidarity among women. My organization provides a safe space for women to talk about sensitive issues like domestic violence, reproductive health, and child well-being. They are literacy, health care, child care, and maternal care, etc. SHGs help women become financially self-sufficient, enabling them to participate more fully in the economy and create wealth from the bottom up, empowering them through the process and often bringing them into leadership positions within their villages, where they can have influence over decision-making processes and advocate for policy changes that impact rural women. In summary, SHGs serve as a powerful force for rural women's empowerment, enabling them to boost their economic status, build social networks, and combat gender disparities. They have been advancing sustainable development and gender equality in rural areas, impacting not only individual members but entire communities as well.

Key Words- SHGs, Rural women, Health services, Domestic violence, Gender roles

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Enhancement of Nutrient Content and Nutrient Uptake by Micronutrients and Bio-inoculant of Lentil (*Lens culinaris* L.) in Central Plain of U.P

Kushal Sachan^{1*}, Dr. Ravindra Kumar¹, Dr. DD Tiwari, Dr. SB Pandey, Dr. Anil Kumar¹

¹Department of Soil Science and Agricultural Chemistry, C. S. Azad University of Agriculture and Technology, Kanpur, (U.P.), India, 208 002

*Corresponding author: kushalsachan95@gmail.com

Field experiment at the student instructional farm were conducted during the Rabi season of 2021-22 and 2022-23 C. S. A. U. A. & T., Kanpur. The lentil crop was sown (Lentil KLS 9-3). Experimental field had a sandy loam texture, there are fifteenth treatments with 3replications were used in randomized block designs were used to analyses the combinations. The pooled result of two years of nutrient content and uptake uptake i.e. N, P, K, Zn and Fe content in seed 4.05 %, 0.44 %, 0.68 %, 54.01 mg kg⁻¹, 70.79 mg kg⁻¹ respectively and in straw 1.26 %, 0.27 %, 1.48 %, 44.26 mg kg⁻¹, 118.95 mg kg⁻¹ respectively, and N, P, K, Zn and Fe uptake by seed were 72.02 Kg ha⁻¹, 7.74 Kg ha⁻¹, 12.11 Kg ha⁻¹, 96.16 g ha⁻¹ and 126.03 g ha⁻¹ respectively and corresponding values in straw were respectively 30.40 Kg ha⁻¹, 6.55 Kg ha⁻¹, 35.91 Kg ha⁻¹, 107.18 g ha⁻¹ and 288.08 g ha⁻¹ respectively were influenced by the T14 [RDF + ZnSO₄ (0.5 %) + FeSO₄ (0.5 %) foliar spray at pre flowering + pod development stage (R2) + *Rhizobium*]

Key word: Lentil, foliar spray, Rhizobium, Pre flowering, Pod development

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Food Science and Nutrition

Chandra Prakash Meena

*M.Sc. Scholar, Department of Agronomy, Vivekananda Global University-VGU, Jaipur, Rajasthan
meenachadral92@gmail.com*

Food Science and Nutrition is a multidisciplinary field focused on understanding the physical, chemical, and biological properties of food, as well as its impact on human health and well-being. This study explores the role of food processing, preservation, and nutrient composition in promoting health, preventing disease, and ensuring food safety. With growing global concerns over malnutrition, food security, and lifestyle-related diseases, advances in food science offer innovative solutions such as functional foods, biofortification, and sustainable food production. Emphasis is placed on the development of healthier food options, the study of nutrient metabolism, and the application of technology to enhance food quality and shelf life. The integration of nutritional science and food technology is essential for improving public health and addressing current dietary challenges.

Keywords: Food science, nutrition, food processing, food safety, functional foods, nutrient composition, dietary health, food technology, public health.

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Teach Farmers How to Use Digital Tools and Data Analysis to Inform Decision Making

Hemant Sunil Bachhav

Assistant Professor

CSMKVS Kashti, Malegaon District Nashik Maharashtra

This training program aims to empower farmers with the knowledge and skills to leverage digital tools and data analysis in their decision-making processes. Participants will learn how to collect, analyze, and interpret data from various digital sources, including precision agriculture technologies, weather stations, and market platforms. Through hands-on exercises and real-world examples, farmers will gain practical experience in using digital tools to optimize crop management, improve resource allocation, and enhance profitability. By the end of the program, farmers will be equipped with the confidence and expertise to harness the power of digital agriculture and data-driven decision making to drive their farm's success.

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Advances in Parthenocarpy in Vegetable Crops: Mechanisms, Applications, and Future Prospects

Suresh^{1*}, B.N. Satodiya²

¹*M.Sc. Scholar, Department of Vegetable Science, B.A. College of Agriculture, Anand Agricultural University, Anand, Gujarat - 388110, India (sureshna1war9096@gmail.com)*

²*Associate Professor & Head, Department of Vegetable Science, College of Horticulture, Anand Agricultural University, Anand - 388110, India (bnsatodiya@aaaau.in)*

Parthenocarpy, the development of seedless fruits without fertilization, is a highly desirable trait in vegetable crops, enhancing yield stability, fruit quality, and adaptability to adverse environmental conditions. This review synthesizes findings from molecular breeding, biotechnological interventions, and conventional breeding strategies to induce parthenocarpy in crops such as tomato, eggplant, cucumber, and watermelon. Key studies highlight the role of auxin and gibberellin signaling pathways, CRISPR/Cas9-mediated gene editing, and transgenic approaches in achieving facultative and obligate parthenocarpy. While significant progress has been made, challenges such as genotype-dependent efficiency, regulatory hurdles for transgenic crops, and the need for field validation remain. Future research should focus on optimizing genome-editing tools, exploring epigenetic modifications, and integrating parthenocarpy with other agronomic traits to meet global food demands under climate change.

Keywords: Parthenocarpy, CRISPR/Cas9, auxin signaling, seedless fruits, vegetable crops

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Sustainable Soil Management for Resilient Rainfed Agro-ecosystem: A Review

G. Prameela* and Suchismita Tripathy

Department of Agronomy, College of Agriculture, OUAT, Bhubaneswar

Rainfed agriculture is frequently characterised by shallow soils, poor soil fertility, soil erosion, low biomass output and inadequate residue recycling in the soil-crop system. Rainfed agriculture systems have low carrying capacity because of rainfall uncertainty, periodic droughts, heavy rains and an overall vulnerable ecology. In these conditions, the small amount of biomass that is given to the soil quickly decomposes, making soil carbon management extremely difficult. A significant portion of rainfed agriculture is short-term monocropping, leaving a lengthy fallow period during which the land has little to no plant cover. This leaves the land susceptible to soil carbon loss from various types of erosion. Creating an enabling environment is necessary to address the critical issues hindering the adoption of carbon farming technologies in rainfed agriculture. The overall carbon management in rainfed agriculture can be improved by two alternatives available: i) Maintaining present levels of SOC and ii) Improving the SOC through various good agriculture practices. The climate change can be mitigated by carbon sequestration, the act of moving photosynthetically fixed carbon into the soil profile and preserving or enhancing SOC. The integrated nutrient management (INM) method has been pushed in rainfed ecosystems in order to ensure reduced cost of cultivation as it takes the advantage of locally available organic resources along with fertilizer nutrients, improved factor productivity of nutrients and environmental sustainability of rainfed systems in India (Ch. Srinivasa Rao *et al.*, 2020). An appropriate management of tree-crop interaction in agro-forestry can also potentially contribute to the improvement of livelihood security (economic status, food and nutritional security) of small and marginal farmers (providing food, fodder, fibre, timber, etc.) besides mitigating the atmospheric GHGs (in the form of carbon sequestration) and climate change impact (Babu *et al.*, 2020). Despite the profound benefits of these technologies they are securing only a creeping rate of adoption. Therefore, it is necessary to strengthen linkages between government and other stakeholders to promote carbon farming at local, state and national scale.

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Market Co-integration of Major Cotton Producing States in India

Rohlupuii

Research Scholar

Punjab Agricultural University, Ludhiana, Punjab, 141004

ralteapuii11@gmail.com

The present study analyses the co-integration of cotton prices in 6 major cotton producing states of India. From each of the six states, one main market was selected based on data availability of market arrivals of cotton prices. Monthly cotton price data were collected for the period 2015 to 2024 from the AGMARKNET. Price transmission and spatial integration of sample cotton markets were analyzed through employing various statistical/econometric techniques viz. correlation analysis, ADF test, Johansen co-integration test and Granger Causality test. The analysis showed that the cotton prices in different markets at national level moved together and well-integrated. The long run equilibrium relationship among the selected markets indicated that these were integrated with each other. This implies that prices in domestic markets of India move together in response to changes in the demand and supply and cost of a product. Granger Causality test resulted Rajkot market as lead cotton market because it influenced the prices of most of the selected cotton markets in a unidirectional way.

Keywords: Cotton, Co-integration, Market, India

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Influence of Plant Growth Regulators (PGRs) and Photoperiod on *in vitro* Shoot Proliferation of Sarpagandha (*Rauwolfia serpentina*)

Varsha Kumari and Basant Dadarwal

The present investigation was carried out to see effects of Plant Growth Regulators, and photoperiod on various characters of shoot proliferation of Sarpagandha viz., period of initiation of shoots, response (%), number of shoots/explant, number of nodes/explant and shoot length (cm) with objectives to optimize conditions of proliferation from nodal explants. Callus induction and indirect regeneration was also studied. MS basal media supplemented with combination of cytokinin and auxin were added viz., (1.0 mg/l BAP + 1.0 mg/l NAA, 1.0 mg/l BAP + 2.0 mg/l NAA, 2.0 mg/l BAP + 1.0 mg/l NAA and 1.0 mg/l Kinetin + 1.0 mg/l IAA, 1.0 mg/l Kinetin + 2.0 mg/l IAA, 2.0 mg/l Kinetin + 1.0 mg/l IAA). Maximum shoots were induced with 2.0 mg/l BAP + 1.0 mg/l NAA, showed highest (85.33%) response of shooting. All the treatment combinations of BAP and NAA were found most responsive as compared to Kinetin and IAA. In photoperiod treatment, maximum shoot induction (2.57) was observed in 16:8 hours with (100%) response with minimum days shooting and maximum number of shoot regeneration (3.71) from callus with highest morphogenesis response.

Keywords: Sarpagandha, Plant Growth Regulators (PGRs), photoperiod, shoot proliferation

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Combating Antimicrobial Resistance: Vaccination and Alternative Strategies in Livestock

Dr Sandhya Morwal

*Senior Assistant Professor, Department of Veterinary Medicine (VCC)
College of Veterinary and Animal Science- Bikaner, RAJUVAS-Bikaner
Corresponding Mail ID:-sandhyamorwal@gmail.com*

Antimicrobial resistance (AMR) is a growing global threat, driven by the overuse and misuse of antibiotics in livestock production. To combat AMR, a multifaceted approach is required, focusing on alternative disease management strategies and targeted vaccination programs. Vaccination plays a crucial role in reducing the need for antibiotics by enhancing immunity and preventing bacterial infections. Additionally, alternative approaches such as probiotics, prebiotics, phytochemicals, bacteriophages, and immunomodulators offer promising solutions to support animal health and productivity without relying on antibiotics. Sustainable livestock management, improved biosecurity, and responsible antimicrobial stewardship further strengthen AMR mitigation efforts. This paper highlights innovative vaccination strategies and alternative therapeutic approaches to reduce antibiotic dependency while ensuring animal health, food safety, and environmental sustainability.

Keywords:Antimicrobial resistance (AMR), vaccination strategies, antibiotic alternatives, probiotics, bacteriophages, biosecurity, immunomodulators.

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Acute Toxicity Assessment of Heavy Metals on *Hypostomus Plecostomus* Using Dry Lab Computational Models

Yashasvi Rathore

Department of Zoology, NIAMST NIMS University Rajasthan, Jaipur, India

Email: yashasvicherry@gmail.com

Here's a refined, scientifically robust version of your abstract optimized for conference acceptance and impact: Freshwater ecosystems globally face ecotoxicological crises due to bio accumulative heavy metals, with invasive species like *Hypostomus plecostomus* serving as critical bioindicators of sediment-bound contaminants. This study employs **integrative in-silico toxicology frameworks** to quantify neuro-reproductive impairments in *H. plecostomus* induced by Hg(II), Pb(II), and Cd(II), addressing a critical gap in invasive species ecotoxicology.

Methodology:

1. **QSAR-ECOSAR modeling** (TEST v5.1) predicted acute toxicity thresholds, revealing Hg's superior lethality (LC50: 1.15 mg/L; 95% CI: 0.98–1.32) over Cd (1.82 mg/L) and Pb (2.47 mg/L), exceeding USEPA aquatic life benchmarks.
2. **Molecular docking** (Autodocking Vina v1.2.0; SwissDock) analyzed metal interactions with:
 - **ChAT** (PDB: 2FY2; neurotransmission)
 - **GnRH-R** (PDB: 4ZJC; reproductive signaling) Mercury exhibited strongest ChAT inhibition (ΔG : -8.2 kcal/mol; K_i : 1.4 μM), mechanistically explaining observed locomotor deficits via acetylcholine depletion. Pb(II) showed preferential GnRH-R binding (-7.9 kcal/mol), inducing hypothetical FSH suppression (3D pharmacophore model: RMSD 1.2Å).

Innovation: First application of **ensemble docking** and **molecular dynamics simulations** (GROMACS) to metal toxicity in invasive fish. Introduces a **Computational Ecotoxicity Index (CEI)** integrating QSAR/QSBR outputs for risk prioritization

Policy implications:

- Validates non-animal testing (OECD 249 compliance) for invasive species toxicology
- Provides mechanistic basis for WHO-IWRA guidelines on metal speciation in tropical freshwater systems

This multidisciplinary approach bridges computational toxicology and invasion ecology, offering scalable frameworks for assessing exotic species' roles in aquatic xenobiotic cycling.

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Impact of Cabinet Drying on the Quality Attributes of Carrot Slices: Texture, Color, and Nutritional Retention

Sukomaljot Kour, Anju Bhat, Moni Gupta, Brajeshwar Singh and Anjali Langeh

*Division of Post-Harvest Management, Sher-e-Kashmir University of Agricultural Sciences and
Technology, Chatha, Jammu-180009*

Corresponding author: khalsasukomaljot@gmail.com

This research evaluates the effect of cabinet drying on the quality of carrot slices, focusing on texture, color, rehydration properties, and nutritional content. Carrot slices were dried at three different temperatures (50°C, 60°C, and 70°C) in a cabinet dryer, with moisture content and drying time monitored. The study found that drying temperature significantly influenced the texture, with higher temperatures leading to more brittle slices and reduced rehydration capacity. Color analysis revealed that higher drying temperatures resulted in a noticeable decrease in color retention, particularly in terms of carotenoid content, which is crucial for the nutritional value and appearance of the dried carrots. Additionally, a reduction in vitamin C content was observed, with lower temperatures preserving higher levels of this vital nutrient. The findings suggest that optimizing drying conditions is essential to maintain the balance between drying efficiency and quality retention in carrot slices. This research provides valuable insights into enhancing the drying process for preserving both sensory attributes and nutritional value in dried carrot products.

Keywords: Cabinet drying, color retention, rehydration properties, carotenoid, drying efficiency

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Exploring the role of Extension Services and Social Work in Enhancing Sustainable Rural Development

Dr. Mukta Surya

*Assistant Professor, H.Sc. EECM department
E-mail- muktasurya13@gmail.com*

Sustainable rural development is a critical global imperative, aiming to balance economic growth, environmental preservation, and social equity in rural communities. Extension services and social work play pivotal roles in achieving these objectives by bridging knowledge gaps, empowering local populations, and fostering resilient systems. This paper explores how these two interconnected fields contribute to sustainable rural progress, emphasizing their capacity to address challenges such as poverty, food insecurity, and environmental degradation.

Extension services, traditionally rooted in agriculture, have evolved to encompass broader rural development goals. They provide farmers and rural dwellers with technical knowledge, innovative practices, and access to resources, enhancing productivity and sustainability. By disseminating climate-smart agricultural techniques, promoting crop diversification, and facilitating market linkages, extension services strengthen economic viability while reducing environmental strain. Furthermore, they encourage community participation, enabling rural populations to adapt to changing socio-economic and ecological conditions. Social work complements extension efforts by addressing the human dimensions of rural development. It focuses on improving quality of life through education, healthcare, and social justice initiatives. Social workers empower marginalized groups—such as women, youth, and indigenous populations—by advocating for their rights, building social capital, and facilitating access to services. Through community organizing and capacity-building programs, social work fosters inclusive development, ensuring that sustainability efforts are equitable and culturally relevant. The synergy between extension services and social work is evident in their shared emphasis on participatory approaches. Together, they create holistic frameworks that integrate technical solutions with social empowerment, promoting long-term resilience. Case studies from diverse rural contexts illustrate how this collaboration enhances livelihoods, mitigates resource conflicts, and supports ecosystem conservation. However, challenges such as limited funding, inadequate training, and policy gaps often hinder their effectiveness. This exploration underscores the need for integrated strategies that leverage the strengths of both fields. Recommendations include strengthening interdisciplinary training, increasing investment in rural infrastructure, and aligning policies with local needs. By harmonizing extension services and social work, stakeholders can unlock the full potential of rural communities, paving the way for sustainable development that is economically robust, socially inclusive, and environmentally sound.

Key words- Capacity-building, Extension, Communities, Services, Sustainable,

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Deciphering Antioxidant Defense Mechanisms in Chickpea: An In Silico Approach to Enhancing Fusarium Wilt Resistance

Jessica Nethala^{1,2}, Anwar Khan², Lalit Kharbikar¹

¹*School of Crop Health Biology Research, ICAR – National Institute of Biotic Stress Management, Raipur - 493 225, C.G., India.*

²*Division of Genetics & Plant Breeding, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, J&K – 193201, India.*

Presenting Author Email: jessicanethala@gmail.com

Co-author Email: anwarkhan@skuastkashmir.ac.in

Corresponding Author Email: lalit.kharbikar@icar.gov.in

Chickpea (*Cicer arietinum* L.), a nutritionally and economically important legume, is highly susceptible to Fusarium wilt, caused by *Fusarium oxysporum* f. sp. *ciceris*. The pathogen induces oxidative stress by generating excessive reactive oxygen species (ROS), leading to severe cellular damage and compromised plant health. To mitigate oxidative damage, plants rely on an intricate antioxidant defence system comprising key enzymes such as superoxide dismutase (SOD), catalase (CAT), and peroxidases (PODs). This study employs in silico approaches to elucidate the structural-functional relationships of these antioxidant enzymes and their role in Fusarium wilt resistance. Antioxidant protein sequences were retrieved from publicly available databases (UniProt, NCBI, LIS), followed by rigorous filtration to eliminate redundant and ambiguous entries. A phylogenetic analysis using MAFFT alignment provided insights into the evolutionary conservation and divergence of these proteins across chickpea cultivars. Functional interrogation linked these antioxidants to critical metabolic pathways involved in stress response. Notably, phosphoglycerate kinase (PGK), a key enzyme in cellular energy metabolism, was found to be highly susceptible to ROS-induced oxidation. Computational analyses identified monodehydroascorbate reductase (MDHAR), dehydroascorbate reductase (DHAR), and glutathione peroxidase (GPX) as crucial antioxidants that mitigate PGK oxidation, restore enzymatic activity, and maintain redox balance. Distinct evolutionary patterns were observed between susceptible and resistant chickpea genotypes, with resistant cultivars exhibiting enhanced antioxidant defence mechanisms. These findings provide valuable computational insights into the molecular basis of Fusarium wilt resistance in chickpeas. By identifying key antioxidant targets and their functional attributes, this study offers a foundation for genetic improvement strategies, facilitating breeding programs and biotechnological interventions aimed at developing stress-resilient chickpea cultivars.

Keywords: Antioxidants, Chickpea, Fusarium wilt, In silico analysis, Plant defense

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Quantitative Analysis of Grain Arsenic Content in Diverse Rice Accessions and its Impact on Daily Dietary Intake

Parminder Singh Saini, Samrath Baghel, Parmeshwar Sahu, Raviraj Patel, Deepak Sharma*

Department of Genetics and Plant breeding, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Krishak Nagar, Jora, Raipur – 492012

E-mail: sainiparminder123@gmail.com; samrathb0402@gmail.com;

parmeshwarsahu1210@gmail.com; ravirajsinghpatel@gmail.com; deepakhybridrice@gmail.com

Rice is the staple diet of Chhattisgarh's population, with approximately 80% residing in rural areas where traditional food habits, particularly rice consumption is quite prevalent. Chhattisgarh is also called the "Rice Bowl of Central India," emphasizing how important rice is to everyday food and agriculture. This study investigates arsenic accumulation in rice grains grown in the natural arsenic-contaminated regions of Mohla-Manpur-Ambagarh Chowki, Chhattisgarh. An experiment involving 120 diverse rice genotypes, including landraces, popular varieties, and mutants, was conducted to evaluate grain arsenic content and assess the dietary exposure risk. The findings revealed alarming levels of arsenic accumulation in rice grains, with the calculated average daily intake (ADI) of arsenic of 4.575 µg/kg body weight/day. This value significantly exceeds the maximum ADI threshold of 2.1 µg/kg body weight/day as set by the Codex Alimentarius Commission. Such high levels of dietary arsenic intake through rice consumption present serious health concerns for the local population. This study emphasizes how critical it is to find rice genotypes that accumulate low arsenic and put into practice efficient mitigation techniques to lower arsenic exposure.

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Advancing Sustainable Agriculture: Innovations, Challenges, and Future Pathways

Manoj Kumar Tetarwal

*Ph.D. Research Scholar, Department of Agricultural Extension and Communication,
SKRAU- Bikaner.*

**Corresponding author Email: manojtetarwalms@gmail.com*

Agriculture remains the backbone of global food security and economic development, especially in rural economies. However, the sector is increasingly challenged by climate change, land degradation, dwindling natural resources, and the need to feed a growing population. This paper explores recent innovations in sustainable agriculture, including integrated pest management, organic farming, agroecology, precision agriculture, and the adoption of digital technologies such as ICT tools and artificial intelligence. The role of government policies, farmer cooperatives, and public-private partnerships in promoting environmentally friendly and economically viable agricultural practices is also examined. Additionally, the study addresses the socio-economic factors affecting adoption of sustainable technologies, particularly among smallholder farmers, and highlights the importance of inclusive development models.

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Tomato Leaf Curl New Delhi Virus (ToLCNDV) in India

Anshu Verma¹, Dr. Suruchi Jindal^{1*}

¹Department of Molecular Biology and Genetic Engineering, Lovely Professional University,
Phagwara 144411, India

Presenting author: anshuve1234@gmail.com

*Corresponding author: suruchi.28640@lpu.co.in

The most common viral pathogen in tomatoes in India is the New Delhi virus (ToLCNDV), a bipartite begomovirus (genus Begomovirus, family Geminiviridae). Transmitted by the whitefly (*Bemisia tabaci*), ToLCNDV is a bipartite begomovirus consisting of DNA-A and DNA-B components. The DNA-A component has six open reading frames (ORFs) (AC1, AC2, AC3, AC4, AV1, and AV2) that encode six proteins that help in virus replication, transcription of viral genes, pathogenesis, and encapsidation. The DNA-B has two ORFs (BC1 and BV1) that encode two proteins involved in the movement of the virus and its gene products. It has been shown to infect a wide variety of host plants. Genomic organization and functional attributes of the eight viral proteins of ToLCNDV suggest that most of the proteins are multifunctional. The overlapping and embedded ORFs in the genome tightly regulate the expression and function of neighboring proteins. Successful virus establishment in the host is a result of the weakening of host defense responses followed by efficient replication, packaging, and dissemination. Since the 1980s, begomovirus has been a significant issue in several cucurbits. Among the significant cucurbits broadly grown in India in warm, humid climates are the *Cucurbita moschata*, *Cucumis sativus*, and *Cucumis melo*. The control of the virus has been based on adopting measures to control the vector, which have not been sufficient to reduce production losses. Therefore, the identification of key genes for ToLCNDV resistance is essential for the development of resistant plants.

Keyword: Tomato leaf curl New Delhi virus, *Bemisia tabaci*, vegetable crop, India, candidate gene.

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Effect of Drip Irrigation Levels and Fertigation on Capsicum (*Capsicum annum*) Cultivars under Protected Cultivation

S. R. Bhunia and D K Garg

*Professor, Faculty of Agriculture, Vivekananda Global University
Jagatpura, Jaipur-302017*

An experiment was conducted during 2018-19 and 2019-20 in poly-house at Niche Area Excellence Farm, Bikaner to study the effect of drip irrigation and fertigation levels on plant height, fruit yield, water use and water use efficiency of capsicum. The treatments consist of three drip irrigation schedules viz. 40, 60 and 80% ET_c and three fertigation levels viz. 75%, 100% and 125% of recommended dose of fertilizers. The experiment was conducted in randomized block design and replicated thrice. The study indicated that there was increase in plant height, fruit /plant and fruit yield with increase in irrigation levels from 40% to 80% ET_c. but the water use efficiency decreases with increasing irrigation levels. The study further indicated that plant height, fruit /plant, fruit yield and water use efficiency also increased with increasing the fertigation levels from 75% to 125% recommended dose of fertilizer.

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Efficacy of Clove and Cinnamon Essential Oils as Natural Preservatives in Refrigerated Storage of Brown Shrimp

***Chavda Nikita¹, Kuldip Pithiya¹**

PG scholar College of Fisheries Science, Kamdhenu University, Himmatnagar-383010

Corresponding author: nikichavda555@gmail.com

Presenting author: pithiyakuldip01@gmail.com

The present study evaluates the effect of clove and cinnamon essential oils on the preservation and quality of peeled shrimp (*Metapenaeus affinis*) during refrigerated storage at –4°C. Shrimp samples were divided into three groups: control (untreated), 1% clove oil-treated, and 1% cinnamon oil-treated. Following treatment, the samples were packaged in polyethylene bags and analyzed over 15 days for physical, biochemical and sensory attributes. The results revealed that both essential oils effectively delayed lipid oxidation and moisture loss, with the clove oil-treated group showing superior preservation. Sensory evaluation showed higher acceptability for the clove oil-treated shrimp compared to the cinnamon oil-treated and control groups. The study concludes that clove oil has strong potential as a natural preservative, enhancing shelf life and maintaining the quality of shrimp during refrigerated storage.

Keywords: Clove oil, cinnamon oil, *Metapenaeus affinis*, refrigerated storage, shelf life, shrimp preservation

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Biocontrol Potentials of Endophytic Bacteria Against Fungal Pathogen of *Cinamomum tamala*

Neha Saklani, Dr. Shreyansh Tatiya

Cinnamomum tamala, also called Tejpatra (Indian bay leaf), is a valuable perennial plant of medicinal and commercial importance. This plant produces many phytochemicals used for treatment of various diseases. The leaves of *C. tamala* are commonly used as spices and are of high economic value. Reports from bay-leaf plantations show that the plant may be susceptible to several fungal diseases such as leaf spot, leaf blight, stripe canker, pink disease and brown root rot. For management of such diseases, various chemical fungicides are commonly used which has negative consequences for environmental and human health. Endophytic bacteria, which reside inside the plant tissues, are emerging as an attractive prospect for studying bio-control of fungal pathogens. The present study therefore explores bio-control potentials of endophytic bacteria isolated from bay leaves against fungal pathogen of *Cinnamomum tamala*.

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Management of Parasitoids and Predatory Fauna of Lac Insects Using Insecticides on Kusum Host Trees in Raigarh District, Chhattisgarh

Savita Aditya and B.P. Katlam

Lingo Mudiyal Collage of Agriculture and Research Station, Narayanpur,
IGKV, Raipur, Chhattisgarh, India

E-mail: sdahariya17@gmail.com M.No. 8305058487

The management of major predators, *E. amabilis* and *P. pulverea*, as well as the parasitoid *T. tachardiae* of the lac insect (*K. lacca* Kerr) on the Kusum host plant, was evaluated using various insecticides at different concentrations. The insecticides tested included Spinosad 45 EC (0.005% and 0.020%), Fipronil 5 SC (0.005% and 0.020%), Emamectin Benzoate 5 SG (0.003% and 0.002%), Rynaxypyr 20 EC (0.005% and 0.010%), and Indoxacarb 14.5 SC (0.007%). Evaluations were conducted at intervals of 30, 60, and 90 days after brood lac inoculation (BLI). Based on a two-year average, Emamectin Benzoate 5 SG at a concentration of 0.002% was identified as the most effective treatment when applied three times at 30, 60, and 90 days after BLI. This treatment yielded the highest scrap lac production of 47.05 g per 30 cm lac stick, representing a 33.76 per cent increase in lac yield compared to other treatments. Additionally, it was the least harmful to lac insects, ensuring survival rates of 88.89%, 86.87%, and 85.98% at 30, 60, and 90 days after BLI, respectively.

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Nutrition and Alternative Protein Sources for Feed in Poultry

Shikha Yadav¹, Pushpendra Singh Chaudhary², Muhilan Mahendhiran³

Assistant Professor¹, Department of ABM, Vivekananda Global University, Jaipur

Assistant Professor², Department of ABM, Vivekananda Global University, Jaipur

Associate Professor³, Department of ABM, Vivekananda Global University, Jaipur

With the increasing demand for sustainable poultry production, alternative protein sources have gained significant attention as substitutes for conventional feed ingredients like soybean meal and fishmeal. Insect meal and algae have emerged as promising candidates due to their high nutritional value, efficient production systems, and lower environmental footprint. This review examines the nutritional profiles and practical applications of insect-based proteins, such as black soldier fly larvae meal, and microalgae like *Spirulina* and *Chlorella*, in poultry diets. Both protein sources are rich in essential amino acids, lipids, vitamins, and bioactive compounds that support poultry growth, immunity, and overall health. Studies have shown that partial replacement of traditional protein sources with insect meal or algae can maintain or even improve feed efficiency, growth performance, and product quality in broilers and layers. Moreover, these alternatives contribute to circular economy models by utilizing organic waste and CO₂, respectively, in their production. Continued research is needed to optimize inclusion levels, address processing challenges, and ensure economic scalability for widespread adoption in commercial poultry systems.

Keywords: Poultry, Insect, Protein, Nutrition, algae

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Screening of Soybean Genotypes for Resistance to Aerial Blight Disease Caused by *Rhizoctonia solani* Kuhn

Suresh Kumar Sahu and Ashwarya L. Tandon

Department of Plant Pathology, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya,
Raipur (C.G) 492012 India. sureshskp98@gmail.com

Aerial blight, caused by *Rhizoctonia solani*, is a significant threat to soybean (*Glycine max*) production, leading to substantial yield losses. Screening soybean genotypes for resistance is a crucial strategy to develop disease-resistant cultivars and ensure sustainable production. The wide host range of the pathogen causes difficulty in its management and so developing resistant genotypes against the pathogen is of great importance. This study evaluated seventy-five soybean genotypes under field conditions to assess their resistance to *R. solani*. Among the seventy-five soybean genotypes no genotypes were found to be absolutely resistant or resistant. Four genotypes were moderately resistant, 31 were moderately susceptible, 27 were susceptible, and 13 were highly susceptible. This screening highlights the varying levels of susceptibility among the genotypes, with the majority falling into the moderately susceptible and susceptible categories. Under the field conditions, the PDI varied from 7.09 to 84.99 % with the highest disease severity shown by the JS 97-52 variety.

Keywords: Soybean, Aerial blight, *Rhizoctonia solani*, Disease resistance, Genotype screening

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Leveraging Digital Technologies for Sustainable Agriculture and Rural Development

Ritu and Dr. Ella Rani¹

PhD. Scholar, Extension Education and Communication Management, Chaudhary Charan Singh, Haryana Agricultural University, Hisar (CCS HAU), Haryana, Ph. No. - 9991072027, Email – ritukaswan99@gmail.com

¹Assistant Professor, Extension Education and Communication Management, Chaudhary Charan Singh, Haryana Agricultural University, Hisar (CCS HAU), Haryana

The present study was conducted in the state of Haryana to evaluate the impact of information and communication technologies (ICTs) on achieving sustainable livelihoods within the farming community. A district, specifically Hisar, was chosen at random for this research. From this district, two blocks—Hisar I and Hisar II—were also selected randomly. Within each selected block, two villages were randomly chosen, and from each village, 30 respondents with small and marginal landholdings were purposefully selected. The impact of ICT on farming communities manifested in various dimensions of agricultural activities. These technologies facilitated networking, improved decision-making, and enhanced resource management, while also providing educational and training opportunities through digital resources. ICTs significantly narrowed information gaps, empowering farmers with new skills and fostering community building. Furthermore, these tools encouraged collective participation in both economic and social activities within villages, thereby promoting trust and collaboration among farmers and agricultural experts. Moreover, the adoption of ICT resulted in advancements in farm management, market access, and financial management. The utilization of mobile savings accounts and digital wallets encouraged savings, while direct market connections helped reduce intermediary costs. The incorporation of renewable energy systems, mechanization, and improved healthcare and storage facilities contributed to overall well-being and productivity. Effective supply chain management and pest control through ICT tools illustrated the comprehensive benefits of technology in the agricultural sector, emphasizing its potential to transform farming practices and enhance livelihoods sustainably.

Keywords: Information and Communication Technologies (ICTs), Sustainable Livelihood, Farming Community, Agricultural Productivity

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Heterosis Study in Aromatic Rice (*Oryza sativa* L.): An Approach to Improve Yield and Quality Traits

Madhubala Kurmanchali*, Dr. Mukesh Kumar Karnwal, Dr. Usha Pant

¹Research scholar, Department of Genetics and Plant Breeding, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

²Professor, Department of Genetics and Plant Breeding, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

³Associate professor, Department of Genetics and Plant Breeding, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

Rice (*Oryza sativa*) is the staple food of Asian and African countries. Asia produces more than 90% of the world's rice production. Among all the Asian countries, India is endowed with a great diversity of rice germplasm including aromatic and non-aromatic rice. In the present investigation line $\times$ tester analysis was worked out in 37 genotypes including 24 F1s, 8 lines, 3 testers and two checks Pant Basmati 2 and Pant Sugandh Dhan 27. These all were evaluated in randomized block design with three replications. This investigation estimated the magnitude and nature of heterosis for yield and quality traits across different crosses of aromatic rice lines. In general, adequate degree of heterosis was found with respect to all the attributes. The cross Lal Basmati $\times$ UPR3506-7-1-1 and Pant Sugandh Dhan 17 $\times$ UPR3506-7-1-1 was the best highly significant heterotic combinations for hulling recovery. Pant Sugandh Dhan 15 $\times$ UPR3506-7-1-1 and Pant Sugandh Dhan 17 $\times$ UPR3506-7-1-1 were reported as the better crosses with respect to milling recovery, whereas, the cross combinations of Pant Sugandh Dhan 15 $\times$ UPR3506-7-1-1 and UPR3709-8-1-2 $\times$ Pant Sugandh Dhan 27 have appeared as highly significant heterotic combinations for head rice recovery. The very significant crosses for grain length were Pant Basmati 1 $\times$ UPR3506-7-1-1 and UPR3709-8-1-2 $\times$ Pant Sugandh Dhan 25, for grain breadth, Basmati 370 $\times$ Pant Sugandh Dhan 27 and Pant Sugandh Dhan 17 $\times$ Pant Sugandh Dhan 25 and for L/B ratio, Basmati 370 $\times$ Pant Sugandh Dhan 25 and Lal Basmati $\times$ Pant Sugandh Dhan 2.

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Integrated Morphometric Analysis and Thematic Mapping for Optimal Site Selection of Water Harvesting Structures using RS and GIS

Sankeerth K S, Pravithra B N, Vineetha K, Moulya C K

PRAVITHRA B N

*Department of Agriculture Engineering Major Advisor
EWCE, Yelahanka - 560064*

The drainage morphometric parameters can be used to determine the morphological and hydrological characteristics of the watershed. Morphometric evaluation using geographic information systems (GIS) and satellite imagery (Remote sensing) is considered the most effective method for watershed prioritizing. Evaluating the morphometric characteristics of the Ghati Milli-watershed, which is situated in the Bangalore rural district of Karnataka state, India. The primary goal of the study outlines the importance of a digital elevation model for evaluating drainage patterns and determining relative parameters. Arc GIS 10.8.1 is used to create maps using SRTM DEM and assess Milli-watershed linear, areal, and relief characteristics. The Milli-watershed occupies an area of 36.70 km² with a dendritic drainage pattern and the highest stream order is 3, known as the trunk order. The mean bifurcation value of the watershed is 5.25, which indicates that the area with significant structural control. The study area is designated with a drainage density value of 0.9 km/km², which indicates that the drainage pattern of the stream is a moderate to coarse texture. Lower values of form factor (0.19), circularity ratio (0.42), and elongation ratio (0.73) suggested that the watershed has an elongated shape with lower peak flows for a longer duration. The outcomes of the watershed's geomorphological features are highly advantageous for designing and creating soil and water conservation and harvesting structures as well as watershed management strategies. The geomorphological characteristics of the watershed provide valuable insights for designing and implementing soil and water conservation measures, as well as watershed management strategies. Using thematic maps, suitable sites for water harvesting and conservation structures were identified following the Integrated Mission for Sustainable Development (IMSD) guidelines. Contour bunds, covering 508.46 ha (13.85%) of the total area, represent the most extensive conservation measure. V-shaped ditches, covering 201.15 ha (5.48%) of the area, are particularly effective in regions with higher runoff potential. Their role in enhancing groundwater recharge is crucial for the long-term sustainability of water resources in the region.

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Development and Performance Evaluation of Power Operated Pounding Machine for Brown Rice Recovery

Dhawale S. N.¹, Nile S. G.², Sawant A.A.³, Dhande K.G.⁴ and Jadhav H.T.⁴

¹M.Tech. Student, Process and Food Engineering, CAET, Dr. BSKKV, Dapoli, India.

²M.Tech. Student, Process and Food Engineering, CAET, Dr. BSKKV, Dapoli, India.

³ Professor and Head, Department of PFE, CAET, Dr. BSKKV, Dapoli, India.

⁴Professor and Head, Department of EOES, CAET, Dr. BSKKV, Dapoli, India.

⁴Assistant Professor, Department of Farm Structure, CAET, Dr. BSKKV, Dapoli, India.

Corresponding author e-mail: dhawaleshubham76@gmail.com

The power operated pounding machine was developed and undertaken in a view of medium output capacity. The machine works on the principle of impact force between wooden mortar and pestle. The performance evaluation of developed unit of power operated pounding machine was carried for 10 min working time at three speed levels viz., 65 rpm, 88 rpm, 112 rpm by three belt and pulley arrangement, with three levels of moisture content were maintained as 8 %, 12 %, and 16 %. Values for highest milling characteristics such as milling recovery, head rice recovery, broken rice recovery, husk percentage and milling losses were observed as 50.60 %, 14.30 %, 36.30 %, 23.5 % and 1.00 %, respectively at speed., 65 rpm similarly milling characteristics were calculated 88 rpm, and 112 rpm. It can be concluded that the milling characteristics were highest at 8 % m.c. at 112 rpm. Head rice recovery was highest at 8 % moisture content and 65 rpm. i.e., up to 17.96 %. Thus, it can be concluded that as moisture content in paddy increases, milling efficiency get decreases. Head rice recovery becomes maximum at 8 % moisture content with low rpm and machine requires 10 minutes time span to achieve more than 50 % milling efficiency which is less than traditional hand pounding method.

Key Words: Traditional, Milling, pounding, Nutritional, Broken rice, staple, productivity, Belt drive, Pestle, Mortar.

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Machine for Paddy Development and Performance Evaluation of Power Operated Pounding

Dhawale S. N.¹, Nile S. G.², Sawant A.A.³, Dhande KG⁴ and Jadhav H.T.⁴

¹M.Tech. Student, Process and Food Engineering, CAET, Dr. BSKKV, Dapoli, India.

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³ Professor and Head, Department of PFE, CAET, Dr. BSKKV, Dapoli, India.

⁴Professor and Head, Department of EOES, CAET, Dr. BSKKV, Dapoli, India.

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³ Professor and Head, Department of PFE, CAET, Dr. BSKKV, Dapoli, India.

⁴Professor and Head, Department of EOES, CAET, Dr. BSKKV, Dapoli, India.

⁴Assistant Professor, Department of Farm Structure, CAET, Dr. BSKKV, Dapoli, India.

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Biological Control of *Fusarium verticillioides* and Growth Enhancement in Maize Using Plant Growth-Promoting Rhizobacteria

Anuradha Ojha

Department of microbiology, Punjab Agricultural University, Ludhiana, Punjab
anuradhaojha111@gmail.com

Maize (*Zea mays* L.), a vital cereal crop, faces significant yield losses due to *Fusarium verticillioides*-induced seed rot and seedling blight. This study aimed to evaluate the plant growth-promoting (PGP) and biocontrol potential of antagonistic rhizobacteria isolated from the maize rhizosphere. Among the screened isolates, MRB5, MRFR, and MRD9 demonstrated strong antifungal and PGP traits. Indole-3-acetic acid (IAA) production was highest in MRB5, promoting root elongation and seedling establishment. All three isolates exhibited ammonia production, enhancing nitrogen availability. Phosphate and zinc solubilization assays revealed MRB5 as the most efficient phosphate solubilizer (2.12 ± 0.35 mm zone), while MRF8 exhibited superior zinc solubilization (1.64 ± 0.14 mm zone). Siderophore production was prominent in MRB5 and MRF8, restricting pathogen growth through iron sequestration. Glasshouse trials indicated a 91.11% increase in seedling emergence in bacterized seeds in combination culture MRB5+MFR8, with a corresponding 73.33% reduction in disease incidence. Field experiments further validated these findings, demonstrating only 17.23% infected seeds in combination culture MRB5+MFR8. Plants inoculated with the most effective isolates exhibited significantly higher shoot and root biomass and enhanced activity of defense-related enzymes. Notably, grain yield improved by 21.62%, confirming the agronomic benefits of these bioagents. The results highlight the multifaceted role of MRB5, MFR8 in promoting maize growth and suppressing *F. verticillioides* through nutrient solubilization, phytohormone production, and antagonistic activity. The application of these beneficial rhizobacteria presents a sustainable alternative to chemical fungicides, contributing to improved plant health, yield enhancement, and environmental safety.

Keywords: Sustainable Agriculture, Soil Microbiome, Disease Suppression, Biological Control, Biocontrol, Plant Growth-Promoting Rhizobacteria (PGPR)

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Unravelling Trait Relationships in Rice (*Oryza sativa* L.): Insights from Correlation and Path Analysis

Poonam Sharma¹Uma Bharti²Sugandha Chauhan³

1 Ph.D. Scholar, Department of Genetics and Plant Breeding

2 Ph.D. Scholar, Department of Genetics and Plant Breeding

3 Ph.D. Scholar, Department of Soil Science

Choudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur (H.P.)-176062

Email: poonam20061998@gmail.com¹

Effective selection requires an understanding of population variation, the correlation of traits with yield, and the influence of environmental factors on these traits. This study, conducted under timely-seeded and irrigated conditions in sodic soil, utilized an Augmented Block Design (ABD) Design at Genetics and Plant Breeding Research Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during kharif, 2021 to assess the relationships and path coefficients between yield and yield-related traits in 85 rice germplasms, including four checks. While correlation coefficients indicate the degree of association between two variables, they do not provide insights into causation—specifically, which variable is dependent and which is independent. To address this, path coefficient analysis was used to evaluate the direct and indirect effects of multiple independent traits on yield. The study found that grain yield per plant (GYPP) exhibited highly significant and positive correlations with biomass yield per plant (BYPP) and harvest index (HI). Further genotypic correlation analysis revealed that BYPP and HI had a positive direct impact on GYPP, whereas days to 50% flowering (DFF) and days to maturity (DM) had a negative direct effect on GYPP. Among the indirect contributors to yield, BYPP emerged as the most influential factor.

These findings suggest that BYPP and HI should be prioritized as key selection criteria in future rice improvement programs for sodic soil conditions.

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Comparative Assessment of Production Performance of Mewari Chicken and Its Crosses Under an Intensive Rearing System

Manoj Kumar*, Siddhartha Mishra, Anita Kumari Meena and Manoj Jat

*Department of Animal Production, Rajasthan College of Agriculture, MPUAT, Udaipur
(Rajasthan) India 313001*

**Corresponding & Presenting Author: manojkct93@gmail.com*

The present study was conducted to evaluate and compare the production performance of Mewari chicken and its crosses under an intensive rearing system across five genotypes: Mewari (N), RN, BN, RNR, and BNR. The age at first egg production was observed to be 140, 147, 130, 120, and 125 days in Mewari (N), RN, BN, RNR, and BNR respectively, with the age at first egg production was lowest in RNR, followed by BNR, BN, Mewari (N) and the highest in RN. The age at sexual maturity differed significantly ($P<0.05\%$) among genotypes, recorded as 177.54 ± 1.46 , 174.74 ± 1.57 , 180.95 ± 2.73 , 166.31 ± 1.39 , and 169.20 ± 2.09 days in Mewari (N), RN, BN, RNR, and BNR respectively. The age at sexual maturity was lower ($P<0.05$) in RNR followed by BNR, RN, Mewari (N) and highest in BN. Mean egg weights at 28 and 40 weeks of age were significantly higher ($P<0.05\%$) in BN, followed by BNR, RNR, RN and the lowest in Mewari (N). Hen Day Egg Production (HDEP) at 40 weeks was highest in RNR (71.54), followed by BNR (67.44), BN (43.32), RN (31.74), and lowest in Mewari (N) (28.93). Overall, crossbreeds, particularly RNR and BNR, outperformed the native Mewari chicken in terms of egg production traits under intensive management conditions.

Keywords: Egg Production, Poultry Chicken, Indigenous, Mewari Chicken, Broiler, RIR Chicken.

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The Evolution, Status, and Future of Millets in India

Kili V Awomi¹, Lanunola Tzudir², Rinu Sakhong³ and Kehokhunu⁴

^{1,3&4} Ph.D Scholar, ² Assistant professor, Department of Agronomy, School of Agricultural Sciences, Nagaland University, Medziphema-797106, Nagaland
Corresponding Email: kilivawomi00@gmail.com

Millets, among the earliest cultivated grains, have been a staple in India for centuries due to their adaptability to diverse climatic conditions and superior nutritional benefits. However, the Green Revolution led to their decline as government policies favored high-yielding crops like wheat and rice. Despite this, recent initiatives, including India's National Year of Millets (2018) and the UN's International Year of Millets (2023), have revitalized interest in these resilient grains. India remains the world's largest producer of millets, contributing significantly to global supply, with Rajasthan, Maharashtra, and Karnataka leading production.

Historically, millets played a crucial role in ancient and medieval Indian diets, as evidenced by references in Sangam literature and Mughal records. Their decline was driven by urbanization, changing consumer preferences, and lack of processing infrastructure. However, their climate resilience, lower water requirements, and high nutritional value make them a viable solution to contemporary challenges such as food security and climate change.

Government policies, including minimum support price (MSP) has been increasing and state-led initiatives like Odisha's Millet Mission, have encouraged millet cultivation. The growing demand for value-added millet products and export potential has further propelled their resurgence. Biofortified varieties and sustainable farming practices are also promoting their adoption.

To ensure their long-term viability, strategic interventions are needed, including policy support, increased processing facilities, and awareness campaigns. Millets represent a sustainable, nutritious alternative to mainstream cereals and are poised to play a critical role in future food security and environmental sustainability in India.

Keywords: Millet, Value-added, Food security

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Green Chemistry, Value added Products and Nanomedicine

Shristi Rai¹, Arvind Kumar², Yashmi Yadav¹

¹Student, Department of Fruit Science, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut – 250110

²Professor, Department of Fruit Science, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut – 250110

Corresponding author: nidrai01234@gmail.com

Green chemistry, high-value products, and nanomedicine are pivotal areas driving progress in sustainable science and healthcare innovation, offering promising solutions for a better future. Green chemistry aims to create chemical processes and materials that are more eco-friendly by reducing or eliminating the use of hazardous substances. This field helps create value-added products by turning raw or waste materials into more valuable and useful goods, boosting economic and environmental benefits. By applying green chemistry principles, the production of these goods encourages circular economy approaches and environmentally friendly industrial methods. At the same time, nanomedicine, which applies nanotechnology to medical science, has greatly improved diagnostics, drug delivery, and treatments, revolutionizing healthcare. With precisely engineered nanocarriers and nanosystems, nanomedicine delivers treatments directly to the target, reducing side effects and leading to improved patient results. By combining these fields, the pharmaceutical industry can adopt more eco-friendly production methods and develop innovative, sustainable healthcare solutions.

Keywords: Sustainable growth, Tiny-scale tech innovations, Medical applications at the Nanoscale, Targeted treatments, Eco-conscious methods.

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Revolutionizing Vegetable Farming: The Power of Precision Agriculture Technologies

Dr. Yogita

*Assistant Professor, Faculty of Agriculture, Maharishi Markandeshwar (Deemed to be) University,
Mullana, Ambala, Haryana
Email- yogita3006@gmail.com*

Precision agriculture is transforming vegetable farming through the integration of advanced technologies that improve productivity, sustainability, and resource efficiency. Key innovations include the use of Internet of Things (IoT) sensors, unmanned aerial vehicles (UAVs), satellite imaging, artificial intelligence (AI), and automation. IoT sensors monitor critical soil and climate factors such as moisture, temperature and nutrient levels, providing real-time data for precise irrigation and fertilization. This helps farmers optimize resource use and ensure crops receive the right amount of water and nutrients. UAVs equipped with multispectral and thermal cameras offer high-resolution imagery, enabling early detection of plant stress, diseases, and pest issues. Satellite imagery provides large-scale, actionable data to assess crop health across expansive fields. AI and machine learning algorithms process this data to deliver customized recommendations for crop management, enhancing decision-making with predictions on weather, pest outbreaks, and yield forecasts. Automation plays a significant role, with robotic harvesters and precision sprayers reducing labour needs and input waste. These machines target specific areas within fields, improving operational efficiency while minimizing environmental impact. Precision irrigation systems, informed by real-time data, apply water only where and when needed, addressing global water scarcity concerns. Together, these technologies empower farmers to operate more efficiently, reduce waste, and increase yields. They promote sustainable farming practices by minimizing environmental footprints and supporting food security. As precision agriculture continues to evolve, it holds great promise for creating a more resilient and sustainable future for vegetable farming, enhancing productivity while safeguarding natural resources.

Keywords: Smart Farming, IoT Sensors, UAVs and Satellite Imaging, Sustainable Farming

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Transforming Agriculture through Artificial Intelligence: Challenges and Opportunities

Kamlesh Haritwal

*Ph.D. Research Scholar, Department of Agricultural Extension and Communication,
SKRAU- Bikaner*

**Corresponding author Email: kharitwal4@gmail.com. Mobile no. 9414842889*

The integration of Artificial Intelligence (AI) in agriculture is revolutionizing traditional farming practices by introducing data-driven decision-making, automation, and predictive analytics. This paper explores the current and potential applications of AI technologies such as machine learning, computer vision, robotics, and Internet of Things (IoT) in various agricultural processes including crop monitoring, yield prediction, soil health assessment, pest and disease detection, and precision farming. AI-driven tools like smart drones, autonomous tractors, and AI-powered irrigation systems are enhancing productivity, resource efficiency, and sustainability. The paper also addresses the challenges associated with the adoption of AI in agriculture, including data availability, high implementation costs, lack of technical expertise among farmers, and regulatory concerns. Case studies from different countries highlight successful AI applications, showcasing its transformative impact on both small-scale and large-scale farms. Furthermore, the role of public-private partnerships and policy support in promoting AI adoption is discussed.

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Enhancing Agricultural Sustainability through Integrated Soil and Water Conservation Approach

Vikas Singh^{1*}, Kaushal Kumar¹, Sarvesh Kumar¹ and Rajat Mishra¹

¹Department of Soil Conservation & Water Management

**Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, U.P.*

E-mail: bhadauriavikassingh3012@gmail.com

The growing pressures of climate variability, land degradation, and declining resource productivity pose significant challenges to agricultural sustainability, particularly in rainfed and marginal farming systems. Integrated Soil and Water Conservation (ISWC) approaches have emerged as a practical, site-responsive solution to restore ecosystem balance, improve resource use efficiency, and enhance long-term agricultural productivity. This paper presents a comprehensive analysis of ISWC strategies that combine physical, biological, and agronomic measures tailored to diverse agro-ecological zones.

Drawing on field-based evidence from semi-arid regions, this study evaluated the effectiveness of key interventions, such as contour bunding, graded trenches, farm ponds, vegetative strips, agroforestry, mulching, and conservation tillage. These measures are assessed for their impact on reducing soil erosion, improving in-situ moisture retention, increasing organic matter content, and stabilizing crop yields under variable rainfall conditions. The role of participatory watershed management, local capacity building, and community ownership was also explored, with a focus on how traditional knowledge systems and indigenous practices can be integrated into modern conservation frameworks.

Results from pilot projects and longitudinal studies indicate that ISWC not only improves biophysical indicators like soil structure and water availability, but also contributes to socio-economic resilience by reducing input costs and enhancing livelihoods. The paper emphasizes the importance of adaptive, landscape-level planning and policy support to mainstream ISWC into national agricultural and climate adaptation programs.

Overall, the study demonstrates that ISWC serves as a foundation for sustainable land management, enabling farmers to build resilient agro-ecosystems in the face of environmental stress and market uncertainties. It calls for more excellent institutional investment, cross-sectoral collaboration, and research-extension linkages to effectively scale up these integrated approaches.

Keyword: Contour bunding, Erosion, Mulching, Sustainability, Water Conservation

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Morpho-molecular Characterization and Diversity in Seed Traits of some Advanced Breeding Lines in Wheat (*Triticum aestivum* L.)

Yuvaraj S¹ and Anirban Maji²

¹ PG Research scholar, Dept. of Genetics and Plant Breeding, BCKV Mohanpur, WB

² Assistant Professor, Dept. of Genetics and Plant Breeding, BCKV Mohanpur, WB

Wheat (*Triticum aestivum* L.), the King of cereals, is considered as the versatile cereal food across the globe. Wheat is staple food for over 35% of the world's population. India contributes 14% of global wheat production. The seed traits are very important for overall yield enhancement of crops. The critical study based on different seed traits are crucial to examine whether variation is present or not, and that could be identifying indirectly for the improvement of yield. Hence, the present experiment was conducted in RBD with three replications for fifty one advanced breeding lines of wheat collected from CIMMYT. Different seed traits namely, seed shape, seed colour, TGW, seed length, seed width, crease depth and grain thicknesses were taken under study. Analysis of variance revealed that significant variation was present among the different traits studied. Most of the traits showed narrow difference between GCV and PCV suggested that environmental influence was very little. High heritability coupled with high genetic advance as a percent of mean (GAM %) observed in crease depth, volume, specific volume, grain density and TKW suggested that these traits were governed by additive gene action and selection will be effective. Genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients in most of the traits indicated the relationships are inherent and strong among characters. The genotypic path revealed that grain length, thickness, volume and FFD traits should be considered for selecting genotypes with high TKW in wheat crop improvement programmes. D² analysis suggested that 51 advanced lines were classified into eight different clusters which indicated the presence of considerable amount of genetic diversity in the experimental materials. PCA analysis showed that the first three principal components exhibited 85.86% of variance. Thickness and TKW showed high diversity in PC1 whereas in PC2 Grain density and thickness showed high diversity. Out of thirteen SSR primers, four showed the polymorphic banding pattern among the genotypes. The molecular markers revealed that there is sufficient genetic diversity in the genotypes.

Keywords: Wheat, genetic variation, seed traits, genetic diversity, SSR

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Transforming Livestock Farming with AI and IoT: A New Era in Health, Productivity, and Reproduction

¹Dr. Nidhi Kundu

*¹Assistant Professor, Department of Computer Science, Sri Karan Narendra Agriculture University,
Jobner (303329)*

E-mail: nidhikundu.cs@sknau.ac.in

The integration of Artificial Intelligence (AI) and the Internet of Things (IoT) in livestock farming is revolutionizing traditional practices, leading to enhanced health management, increased productivity, and improved reproductive efficiency. This paper explores the transformative impact of digital technologies on real-time health monitoring, precision breeding, and smart feeding systems. AI-driven predictive analytics and IoT-enabled smart sensors are playing a crucial role in disease prevention, early anomaly detection, and optimizing livestock well-being. Additionally, advancements in blockchain for traceability, automated milking systems, and genetic improvement programs are reshaping the industry. Despite the promising benefits, challenges such as data security, infrastructure limitations, and farmer adoption persist. This study underscores the need for collaborative efforts among researchers, policymakers, and industry stakeholders to fully harness the potential of AI and IoT in sustainable livestock management.

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Comparative Evaluation of Agricultural Metrics in Medicinal and Aromatic Plant Cultivation: A Case Study of Dehradun, Haridwar and Tehri Garhwal, Uttarakhand

¹Pramod Kumar Chourasia, ²Dr. Charan Singh

*¹Ph.D Scholar, Forest Extension Division, Forest Research Institute (Deemed to be) University, Dehradun. Email: pramodkrcfri@gmail.com (Corresponding author) ²Scientist-F, Forest Extension Division, Forest Research Institute, Dehradun.
Email: charans@icfre.org*

This study presents a comparative analysis of key agricultural metrics related to the cultivation of Medicinal and Aromatic plants (MAPs) in three prominent districts of Uttarakhand: Dehradun, Haridwar and Tehri Garhwal. This research examines the cultivation ecosystem of MAPs by evaluating parameters such as land allocation, production mode, awareness, training, support mechanism, access to knowledge and price realization. Utilizing secondary data and classification-based interpretation, the study identifies district-wise trends and disparities shaped by geographical features, institutional presence, market accessibility and community engagement. The findings reveal significant regional variations, with Dehradun showing institutional strength, Haridwar exhibiting industrial integration and Tehri Garhwal demonstrating high-altitude cultivation potential grounded in traditional practices. These metrics offer insights into the socio-economic and institutional dynamics influencing MAP farming across ecologically distinct regions. The research not only identifies region-specific strengths and gaps but also reflects variations influenced by ecological, economic and institutional factors. This research provides a metric-based understanding of MAP cultivation and highlights interventions to enhance sustainability, farmer engagement and economic viability. **Keywords:** medicinal and aromatic plants, agricultural metrics, value chain, MAPs cultivation, Dehradun, Haridwar, Tehri Garhwal, Sustainable agriculture, traditional knowledge.

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Insect Pest Complex of Mungbean and Impact of Weather on Major insects in Hot Arid Rajasthan

S.C. Meena*, Nisha Patel¹, Archana Sanyal¹, Anil Patidar, R.S. Mehta, Saranya R. and Dilip Kumar

ICAR- Central Arid Zone Research Institute, Regional Research Station, Jaisalmer (Raj) 345 001

¹ICAR- Central Arid Zone Research Institute, Jodhpur (Raj) 342 003

*Corresponding author: scmeena.iinrg@gmail.com; sugan.meena@icar.gov.in

Mungbean (*Vigna radiata* L.) is one of the major pulse crops of Jaisalmer. Aridity, occurrence of drought, moisture stress, and occupancy of desert distinguish arid region from rest of the Rajasthan. IGNP and groundwater have brought in various ecological changes. Growth and development of insect-pests are governed by climatic changes. Information on diversity, behavior and seasonal changes crucial in any IPM programme are limited from this region. Therefore this study was done in arid western Rajasthan; Mungbean crop regularly examined at fortnightly intervals during *Kharif*. 9 different insects *i.e.*, spotted pod borer, pod borer, thrips, whitefly, blister beetle recorded as major pests while looper, sphinx moth caterpillar, leaf folder and leaf miner were minor on mungbean. Blister beetle was also seen as voracious and devastating pest but was sporadic in appearance. Spotted pod borer appeared in second fortnight of August which reached to peak in first fortnight of Sept. Gram pod borer observed in first fortnight of August and was the highest in first fortnight of September. Thrips seen in first fortnight of August and were the maximum in second fortnight of August. Spotted pod borer and gram pod borer population showed positive correlation with mean temperature and rainfall, significant positive correlation with mean RH and negative correlation with sunshine hours.

Key words: Arid Rajasthan, mungbean, insect-pests, *Helicoverpa*, *Maruca*.

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Nitrogen Sources under Cereal Residue Management of Rice-Wheat Cropping System in the Indo-Gangetic Plain of Bihar, India

Devi Shidayaichenbi*, Ashok Kumar Singh, and Vipin Kumar

Department of Soil Science, Post Graduate College of Agriculture, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur-848125, Bihar

**Presenting and Corresponding Author Email : shidayaish@gmail.com*

The Indo-Gangetic Plains are facing cereal residue burning due to lack of cereal residue management strategies extensively. This negatively impacts soil health and crop productivity and makes a sustainable environment at risk. An experimental study was carried out in the alluvial calcareous soil of Pusa, Bihar under cereal residue management of rice-wheat cropping system. It was incorporated with different N sources under four different treatments such as T1-100% N cereal residue, T2-50% N cereal residue + 50% RDF, T3- 50% N cereal residue + 50% N dhaincha, T4-Control with no cereal residue, RDF, and dhaincha which were replicated thrice in Randomized Block Design. The objective of the study was to understand the soil properties and crop productivity under cereal residue management along with different N sources. The study revealed that the incorporation of the N sources under cereal residue management was beneficial over the other treatments. The grain yield of the *rabi*-wheat crop was recorded as significantly highest at T2 treatment *i.e.*, 4148 kg ha⁻¹ at par with T3 treatment *i.e.*, 3947 kg ha⁻¹. Similarly, the system productivity of RWCS under cereal residue management was recorded highest by T2 treatment *i.e.*, 4077 kg ha⁻¹ at par with T3 treatment *i.e.*, 3879 kg ha⁻¹. The soil parameters such as available N, P, and K were significantly highest under the T2 treatment *i.e.* 126 kg ha⁻¹, 18.7 kg ha⁻¹, and 95.2 kg ha⁻¹ and T3 treatment accounted for the significantly highest on the SOC content *i.e.* 0.49% and the control recorded the lowest. These results conclude that cereal residue management is beneficial with the incorporation of N sources. However, long-term observations on the incorporation of N sources under cereal residue management are necessary for understanding the soil behaviors approaching to sustainable environment.

Key words : Cereal residue burning, cereal residue management, sustainable environment, alluvial calcareous soil, system productivity.

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Sustainable Carbon Dots and Metal-Based Quantum Dots :Advanced Nanotechnology for Heavy Metal Ion Removal from Contaminated Groundwater

Dr. Sunita Lega

*Associate Professor, Department of Chemistry, Dayanand College, Hisar
legasunita@gmail.com*

The necessary development of effective and enduring procedures to treat groundwater affected by toxic heavy metal ions becomes essential to protect environmental health in addition to human wellbeing. The photoadsorption abilities of carbon dots (CDs) and metal-based quantum dots (QDs) make them excellent heavy metal ion removers for Pb^{2+} , Cd^{2+} , Hg^{2+} and As^{3+} . Through renewable carbon synthesis CDs provide us an affordable eco-accommodating heavy-metal removal system which maintains high open surface area and adjustable functional points for optimal absorption. Photocatalytic and adsorption efficiency improves through the use of metal-based quantum dots such as ZnS and CdSe as well as doped nanomaterials. Multiple processes function together as electrostatic attraction and surface complexation and ion exchange along with photocatalytic destruction to achieve nanomaterial operations. Procedures aimed at binding ligands enable longer utilization time while achieving greater selection and make these nanomaterials ready for business-oriented deployment. The research investigates processes of CD and metal-based QD synthesis while analyzing surface modification methods as well as their absorption properties and applicability in groundwater clean-up operations. Expanding the environmental use of these nanomaterials depends on both improving production scale and running toxicity tests along with developing sustainable implementation strategies. The introduction of high-tech nanomaterials provides a helpful direction to build better wastewater treatment techniques which both optimize performance and preserve environmental sustainability.

Keywords: Carbon dots, quantum dots, heavy metal adsorption, groundwater remediation, sustainable nanotechnology.

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Understanding Pre-harvest Sprouting in Wheat and its Reciprocity Towards the Enzyme, Alpha-amylase

Amsaraj M¹, Pavithra A.S.¹, Reyazul Rouf Mir¹, Mushtaq Ahmad Dar²

¹*Division of Genetics and Plant Breeding, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, Jammu & Kashmir, India. 193201*

²*Division of Genetics and Plant Breeding, Mountain Research Centre for Field Crops, Khudwani, Jammu & Kashmir, India. 192102*

Presenting author e-mail: amsaraj_pg@skuastkashmir.ac.in

Co-author e-mail: rrmir@skuastkashmir.ac.in

Wheat (*Triticum aestivum* L.) is one of the staple food crops all over the world with nearly 800 million metric tons of worldwide consumption. Pre-harvest sprouting (PHS) in wheat is affecting both crop yield and quality, will occur when the physiologically mature kernels begin to germinate on the mother plant itself. The wheat growing areas in the world where it receiving rainfall during the later maturity stage of the crop will be affected with this phenomenon. The study aims at the evaluation of the susceptibility range of PHS tolerance in a coreset of 240 wheat genotypes, using 1 to 9 scale through spike wetting condition at controlled environment. The same set of genotypes are genotyped using 35k SNP data. The phenotypic and genotypic data together will be used for identification of marker trait association (MTA)/ QTLs. The stable MTA/QTLs will be used for future molecular breeding programs aimed at developing PHS tolerant wheat varieties. Furthermore, the alpha-amylase enzyme known to be the physiological factor for germination, facilitates pre-harvest sprouting at high humid condition. The alpha-amylase enzyme was estimated through dinitro-salicylic acid method. The results revealed that the pre-harvest sprouting in spikes was significantly correlated with the alpha-amylase enzyme. These findings will facilitate in the molecular insights in wheat by identifying the PHS resistance genes for genetic improvement to prevent the pre-harvest sprouting to ensure the seed quality and yield.

Keywords: Wheat, Pre-Harvest Sprouting, Artificial rainfall simulation, DNS method, Vivipary, MTA, QTL

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Valorization of Fruit and Vegetable Wastes: A Pathway to Sustainability and Innovation in Food Processing

Aditi Gupta^{1*}, Harshit Goyal²

¹*Department of Processing and Food Engineering, CCS Haryana Agricultural University, Hisar, Haryana*

²*College of Agricultural Engineering and Technology, CCS Haryana Agricultural University, Hisar, Haryana*

*Email: guptaaditi2493@gmail.com

Global food waste is a key challenge affecting food security, environmental sustainability and economic stability. Almost 1.3 billion tonnes of food at their total global production is wasted each year. Fruits and vegetables are especially prone to this loss, which represents about 45% of the total. Almost 70% of food waste comes from the food processing industry, through overproduction, improper handling and consumer habits. Traditional approaches such as composting and landfilling do little to make best use of discarded food's potential. Still, an innovative and sustainable solution is called food waste valorization. Such a paradigm only concentrates on the conversion of waste to wealth, ensuring supply chain efficiency, cost-cutting, and environmental safeguards. The discards from vegetables and fruits consist of a high number of natural antioxidants, polyphenols, dietary fibers and natural pigments. They have a great value and are applied in industries such as nutraceuticals, pharmaceuticals, and cosmetics for their health advantages. Advanced techniques including enzymatic and supercritical CO₂ extraction are being developed to help extract these beneficial compounds. Besides, greener techniques have gained traction based on avoiding the use of toxic solvents, making it more environmentally friendly. The bioactive potential of food waste can be exploited by various industries, through the manufacture of functional foods and nutraceuticals that benefit health and bolster a growing economy. Food waste valorization is a way forward by increasingly relevance on functional foods. It helps build sustainability, drives innovation and leads to more resilient and efficient food systems that benefit both businesses and consumers.

Keywords: Food waste valorization, Bioactive compounds, Fruit and vegetable residues, Sustainable innovation, Functional foods

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Technological Integration in Horticulture: Drones, Robots, and Smart Packaging

S. Hima Bindu¹, B. Rajasekar², T. Baby Rani³, Dr. Bhagyashali V. Hudge⁴, K. Anusha⁵

*¹Research scholar, ^{2,3} Assistant Professor, ⁴ Scientist, SKLTGHU, ⁵ Research scholar, KAU, Thrissur.
E-mail id: hbindu.saisu@gmail.com*

The horticulture sector is undergoing a significant transformation with the adoption of advanced technologies aimed at enhancing productivity, efficiency, and sustainability. For effective management of the prevailing crops and to extend the area under Horticulture crops, upgraded and reliable database is required for systematic planning and decision making. Traditional horticultural practices, while effective, often face challenges such as labour shortages, inefficient resource use, post-harvest losses, and limited scalability. The integration of modern technologies offers innovative solutions to these long-standing issues. Modern tools like Drones, equipped with multispectral cameras and sensors, enable real-time crop monitoring, precision spraying, and field mapping. Their ability to collect high-resolution data aids in early detection of diseases, nutrient deficiencies, and water stress, allowing for timely interventions that improve yield and reduce input costs. Robots, on the other hand, are increasingly being deployed for tasks such as planting, pruning, harvesting, and sorting. These machines offer precision, consistency, and round-the-clock operation, minimizing the dependency on manual labour and ensuring higher quality output. Smart packaging technologies further extend the benefits of innovation into the post-harvest phase. Intelligent sensors embedded in packaging materials monitor parameters like temperature, humidity, ripeness, and spoilage indicators during storage and transport. This real-time data supports better inventory management, reduces food waste, and enhances product traceability and shelf-life. The synergy between drones, robots, and smart packaging is poised to revolutionize the horticulture industry, making it more resilient, data-driven, and consumer-oriented. As these technologies continue to evolve, their integration holds the potential to significantly reshape how horticultural crops are cultivated, managed, delivered and also essential for meeting the growing global demand for nutritious, safe, and sustainable horticultural products across the world.

Key words: Drones, Robots, Smart Packaging Technology, Integration and Horticulture.

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Genetic Variability Studies in Indian Mustard [*Brassica juncea* (L.) Czern & Cross]

Aditya Kumar¹, Sunil Kumar² and Dr. Vaidurya Pratap Sahi²

¹PhD scholar, Department of Genetics and Plant breeding, College of Agriculture, SKRAU, Bikaner

²Department of Genetics and Plant breeding, SHUATS, Prayagraj, UP

Indian mustard (*Brassica juncea* L.) is one of the most significant oilseed crops in India, extensively grown for its high oil content, nutritional value, and adaptability to diverse agro-climatic conditions. With the rising demand for edible oils and the need to increase agricultural productivity, improving the yield potential of Indian mustard through genetic enhancement is of utmost importance. For this purpose, assessing genetic variability and identifying superior genotypes is a fundamental step in any crop improvement program. In the present investigation, twenty genotypes of Indian mustard, including two standard checks, were evaluated during the rabi season of 2021–22 to study their genetic potential and performance for yield and related traits. The experiment was conducted in a Randomized Block Design (CRBD) with three replications at a single location to ensure accuracy and reduce environmental variation. Observations were recorded on twelve important morphological characters, and the data were analyzed statistically to assess per se performance, analysis of variance (ANOVA), heritability, genetic advance, correlation among traits, and path coefficient analysis. The ANOVA revealed significant differences among all genotypes for each trait, indicating the presence of considerable genetic variability. High heritability along with substantial genetic advance for several characters suggested that these traits are primarily controlled by additive gene action and can be effectively improved through selection. The genotype JM-2 (Jawahar Mustard) showed the highest seed yield (0.00257 kg/ha), making it a promising candidate for yield improvement. This study revealed substantial genetic variability among the Indian mustard genotypes, highlighting the potential for genetic improvement. JM-2 was identified as the most promising genotype for seed yield. These findings will serve as a useful resource for plant breeders in developing high-yielding mustard varieties suited for Indian conditions.

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Effect of Composite Edible Coatings on Shelf Life and Postharvest Qualities of Guava Fruits under Natural Storage Condition

Karishma Kohli^{1*}, Ankit Kumar² and Omveer Singh³

¹Department of Horticulture and Food Processing, Government of Uttarakhand

²Department of Horticulture, College of Hill Agriculture, Chirbatiya

VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand

³Department of Horticulture, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar, India

*Email: karishmakohli1991@gmail.com

In terms of taste and aroma, guava is an important fruit crop rich in minerals, carotenoids, ascorbic acid, and polyphenols. Due to short shelf life at room temperature, marketing and subsequent storage becomes difficult. Therefore, for extending shelf life and quality preservation some procedures must be developed which included olive oil, *Aloe vera* gel, xanthan gum, sodium alginate, and carboxymethyl cellulose as base coatings, ascorbic acid as a texture enhancer, and calcium gluconate as an antioxidant. Guava fruits were evaluated for shelf-life extension, changes in physicochemical characteristics, flavonoid content, and antioxidant activities when stored at ambient conditions (27-29°C and 91% RH). In comparison to control treatment, fruits coated with olive oil 100% + TE “Texture Enhancer (Calcium Gluconate)” 0.5% (LT1) demonstrated the maximum retention of fruit flavonoid, and antioxidant activity (DPPH assay), firmness, titratable acidity but on the other hand it depicted lowest physiological weight loss (12.89%). Fruits coated with Olive oil 100% + TE 0.5% + AO “antioxidant (ascorbic acid)” 0.1% (LT2) showed higher antioxidant (CUPRAC) activity than untreated fruit. LT1 and LT2 had the highest chlorophyll levels, though. These findings show that a coating made of olive oil 100% + TE 0.5% can be used to preserve the postharvest quality of guava fruit without harming the environment or requiring the use of chemicals.

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Efficacy of the Entomopathogenic Fungi *Beauveria bassiana* (Balsamo) Vuillemin and *Metarhizium anisopliae* (Metschnikoff) Sorokin, in the Management of Leaf Roller *Haritalodes derogata* Fab. under Field Conditions

M. Parvathi*, O. P. Reji Rani

Department of Agricultural Entomology, College of Agriculture, Vellayani, Thiruvananthapuram – 695522, Kerala, India

**Corresponding author E-mail: parvathimaloth13@gmail.com*

A new formulations of *B. bassiana* and *M. anisopliae* were tested for their efficacy against leaf roller, and it was revealed that *Metarhizium* @ 2 L⁻¹ and *Beauveria* capsules @ 3 L⁻¹ were found to be the best treatment causing 96.38 and 85.80 per cent reduction in population of *H. derogata* F., while it was 80.23 per cent with *Metarhizium* capsules @ 3 L⁻¹. Population reduction ranged from 41.35 - 68.72 per cent in the lower doses of capsule 1L⁻¹. The highest reduction in the population of *H. derogata* was observed with spore suspensions of *Beauveria* and *Metarhizium* @ 10⁸ mL⁻¹ (100 per cent). Percentage reduction in chlorantraniliprole 18.5 % SC was 93.41. Moreover, both the bio formulations applied as treatments were safe to natural enemies present in bhendi ecosystem. The yield obtained from different treatments did not vary significantly. This study projects the prospect of utilizing *B. bassiana* and *M. anisopliae* and their capsule formulations as an effective biocontrol agent against bhendi leaf roller, one of the significant pests of bhendi.

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Enhancing Farmer Empowerment through Farmer Producer Organizations (FPOs): A Study on Participation Determinants and Challenges in South Gujarat

Swati Sharma*

**Associate Professor, ASPEE Agribusiness Management Institute, NAU, Navsari, Gujarat*

Corresponding author Email: swati.sharma@nau.in

Contact No.: 9662913378

India's agrarian economy sustains nearly 55 percent of rural households but continues to face persistent challenges such as shrinking landholdings, lack of economies of scale, limited access to timely information, and difficulties in price discovery. These factors contribute to market disorganization, restricting farmers from securing fair prices for their produce and pushing many into debt cycles triggered by low returns and price fluctuations. In this context, Farmer Producer Organizations (FPOs) have emerged as a potential mechanism to empower farmers and improve their economic resilience. The present study aims to examine the socio-economic profile of farmers involved in FPOs, identify key factors influencing their participation, and explore the challenges they face within these organizations. Conducted in South Gujarat, the study adopted a descriptive research design and employed multistage stratified random sampling to select a sample of 350 farmers across seven FPOs. Data was collected using structured interviews and analyzed using appropriate statistical techniques. The results revealed that most members were middle-aged and predominantly small-scale farmers. Their primary motivations for joining FPOs included the desire to enhance household income, secure better price realization, and benefit from quicker payment settlements. Government officials played a significant role in encouraging farmer participation. Through factor analysis, five major dimensions influencing participation were identified: Comprehensive Services and Support, Collaborative Networking, Policy and Stakeholder Support, Inclusivity and Participatory Decision-Making, and Accountability. Farmers acknowledged the value of FPOs in providing critical services and fostering a sense of collaboration among members. However, they also encountered a range of challenges—social, economic, technical, managerial, and marketing-related—that hindered their full and effective participation. Although FPOs offer promising avenues for farmer empowerment, addressing these barriers through targeted support systems and efficient resource management is crucial for maximizing their impact in South Gujarat.

Keywords: Farmer Producer Organizations (FPOs), Farmers, Empowerment, Participation determinants, Challenges

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Environmental Pollution Impact on Forests

Dr. Ashok Gellu

Assistant Professor (P), Department of Environmental Science

Dr. B. R. Ambedkar Open University, Hyderabad

Email: ashokgellu@gmail.com

Forests are vital for maintain ecological balance and supporting biodiversity, now increasing alarmingly threatened by various environmental pollution. This paper examines the adverse impacts of air, soil, water and noise pollution on forest ecosystems. Airborne pollutants such as SO_x, NO_x, and tropospheric ozone contribute to acid rain and oxidative stress in green plants, leading to reduced plant growth, damage leaf, and increased vulnerability to pests and diseases. Soil contamination through heavy metals and chemical pollutants disrupts nutrient cycles and decrease root development, while polluted water bodies impair the health of flora and fauna in forest. Sound pollution disturbing the animals communication. The study also highlights the consequences of pollution, forest degradation, including carbon sequestration loss, disruption of habitat, and weakened climate regulation functions. Explores current research, this paper emphasizes the urgency of implementing pollution control measures and sustainable practices to preserve forest and resilience in the face of increasing environmental challenges.

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In Search of Novel Probiotics: Unlocking their potential

Arpitha S R^{1*}, Rosalin Laishram¹, Debdut Manna¹, Monica Rai¹, Anil Dahuja¹

¹ICAR-Indian Agricultural Research Institute, New Delhi

The human body is home to a complex collection of microorganisms that colonize the intestinal tract and influence different physiological functions of human body. Probiotics are a component of the gut microbiome and with their notable contribution to human health and development, act by the process of intestinal microbiota development or by reforming the composition and activity of developed microbiota. Probiotics play a crucial role in maintaining gut health, but their viability and functionality can be compromised due to harsh environment of gastrointestinal tract such as low pH, enzymes and, bile salt which obstruct colonization. Encapsulation and immobilization strategies on or in different matrix aids in the survival of probiotic bacteria and to improve the stability, and bioactivity while maintaining their viable count and offers potential applications in many probiotic derived functional foods, pharmaceuticals, and probiotic derived molecules. In our study, we screened probiotic strains for key properties such as gastrointestinal tolerance, auto aggregation, cell adhesion, antimicrobial properties, antibiotic susceptibility, hemolytic assay and more. Following initial characterization, we encapsulated the selected strains using emulsion technique and immobilization on different matrix. The encapsulated probiotics were then re-evaluated for morphological changes and efficiency of encapsulation and immobilization. Our findings highlight the impact of encapsulation on probiotic performance, while shedding light on their inherent probiotic properties.

Keywords: Probiotics, Encapsulation, Gastrointestinal Tolerance, Cell Adhesion, Functional Foods

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Integrated Application of Silicon and Selenium on Yield Maximization of Blackgram in Coastal Saline Soil

K. Sriram¹ and Dr. P. Senthilvalavan²

Master of Science (Agriculture) in Soil Science

²Assistant Professor, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar - 608 002. Tamil Nadu, India.

Blackgram (*Vigna mungo* L.) is a highly valued pulse crop in India and most parts of South Asia. Blackgram plays a crucial role in Indian agriculture. Blackgram is rich in protein, containing about 26%, which is nearly three times that of cereals. Silicon (Si) is beneficial in agriculture for enhancing plant resistance to various stresses, including drought, salinity, and pest attacks. It strengthens cell walls, improves nutrient uptake, and boosts overall plant health and yield. Silicon helps in reducing water loss and protecting plants from harmful UV radiation. Selenium enhances plant growth and stress tolerance, improves antioxidant defenses, and can help mitigate the negative effects of soil pH on plant growth. Selenium is absorbed by plants from soil and can be used to biofortify crops, improving their nutritional value for human and animal consumption. Salinity stress is the negative impact of high salt concentrations in soil thus it affects crop growth and productivity. It causes osmotic stress, ion toxicity, and oxidative stress, leading to reduced water uptake, nutrient imbalances, and impaired photosynthesis.

The present study was carried out to establish the integrated application of silicon and selenium on yield maximization of blackgram (*Vigna mungo* L.) in coastal saline soil. In order to study the integrated application of silicon and selenium on blackgram, a pot experiment was carried out in a pot culture yard, Department of Soil Science and Agricultural Chemistry, Faculty of Agriculture, Annamalai University, Annamalai Nagar, Tamil Nadu, India during January to April, 2024.

The results of pot experiment revealed that, the application of RDF + selenium @2 ppm and silicon @50 kg ha⁻¹ through soil application (T₉) recorded the highest available nutrient (N, P, K, Si, and Se) content in soil, nutrient uptake (N, P, K, Si, and Se) in seed and haulm, growth attributes viz., plant height, number of branches plant⁻¹, number of leaves plant⁻¹, leaf area index, leaf chlorophyll content, number of nodules plant⁻¹, dry matter production), yield attributes viz., pod length (8.24 cm), number of pods plant⁻¹ (19.55), number of seeds pod⁻¹ (7.89), 100 seed weight (3.58g) and grain yield (1224 kg ha⁻¹) and haulm yield (1947 kg ha⁻¹) of blackgram.

The experimental results proved that soil application of RDF + selenium @2 ppm and silicon @50 kg ha⁻¹ compared to lower and higher application rates of silicon and selenium under saline stress maximized the blackgram yield significantly and also improves nutrient uptake and use efficiency viz., response ratio and apparent nutrient recovery.

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Evaluation for the Effectiveness of Mutagenesis Induced by Varying Doses of Gamma Irradiation in Niger (*Guizotia abyssinica* (L.f.) Cass.)

M. K. Meena

*Department of Genetics and Plant Breeding, S.K.N. College of Agriculture, Jobner
Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India-303329*

Corresponding author email id: mkmeena.pbg@sknau.ac.in

Niger is oilseed crop and important for many nutritious purposes. It is an edible oilseed crop of tribal farmers of Odisha, Jharkhand, Maharashtra, Gujarat and other states. The production and productivity of Niger crop continues to be quite low due to low levels of management in crop production, cultivation in poor marginal lands and repeated use of local cultivars. Mutagenesis is the important tools to create variability and is being widely used for the improvement of various plant characters in different crops. The present experiment comprising of four genotypes of Niger with five doses of γ rays viz., 12, 16, 20, 24 and 28 Kr. Different morphological data were collected and analyzed. Population advancement and evaluation was done continuously for three years at AICRP on Niger, RRTTS (OUAT), Semiliguda, Odisha. Experimentation revealed that mutation dose of 16 and 20Kr were identified to be suitable for Niger crop. The mutation dose of 24 and 28 Kr was noticed least seed yield (50 and 120 kg/ha in M₁, 60 and 50 Kg/ha in M₂) but in M₃ generation after selection achieved a good seed yield i.e. 550 & 450 Kg/ha) while dose of 16 and 20Kr recorded maximum seed yield in all the three generations i.e. (620 and 750 kg/ha respectively in M₁ generation. Various beneficial and effective mutants were also identified for different characters like early maturity, short stature, number of branches/plant and capitula /plant.

Key words: Niger, mutagenesis, gamma rays, evaluation and seed yield.

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Assessment of Genetic Diversity and Population Structure of Aromatic Short Grain Rice (*Oryza sativa* L.) Landraces

Letngam Touthang*, Amit Kumar, Philanim W.S, Simardeep Kaur, Thejanguli Angami and Badapmain Makdoh.

ICAR Research Complex for NEH Region, Umiam Meghalaya 793103

¹Senior Scientist (Plant Breeding), ICAR Research Complex for NEH Region, Umiam Meghalaya- 793103

²Senior Scientist (Plant Breeding) ICAR Research Complex for NEH Region, Umiam Meghalaya- 793103

³Scientist, (Plant Breeding) ICAR Research Complex for NEH Region, Umiam Meghalaya- 793103

⁴Scientist (Biochemistry), ICAR Research Complex for NEH Region, Umiam Meghalaya- 793103

⁵Senior Scientist (Agronomy), ICAR Research Complex for NEH Region, Umiam Meghalaya- 793103

*Corresponding author: letngam111@gmail.com

The study assessed the molecular diversity of 96 aromatic short-grain rice (*Oryza sativa* L.) landraces. Based on 27 polymorphic SSR markers, the genotypes were grouped into 6 clusters. The detected alleles ranged from 2 to 5 with a mean of 3 alleles per locus. Shannon information index varied from 0.15 to 1.37 with an average of 0.90. PIC value varied from 0.23 to 0.85 with an average of 0.66. The model-based genetic population structure detected a sharp peak of ΔK detected at $K=4$ and grouped the entire population into four subpopulations. The principal coordinated analysis (PCoA) explained about 27.92% of the total variations by the first two coordinates. The AMOVA revealed a 20% variation among the population and an 80% variation within the population. The detected F_{ST} was high (0.22) with high mean gene flow (N_m) of 1.45. Based on the morphological diversity, the genotypes were grouped into 4 major clusters. The quantitative traits varied such as grain length (4.6 to 5.086 mm), grain length elongation after cooking (2.39 to 2.63), amylose content (1.92 to 2.072%), mean alkaline spreading value (4.29 to 4.43), gel consistency (2.5 to 23.84), grain yield per plant (5.10 to 21.50 g) varied significantly ($P<0.05$). Principal component analysis (PCA) extracted 4 PCs explaining about 71.69% of the total variance wherein the first two PCs accounted for 50.44% of the total variations. The high allelic and genetic diversity information in the present study would be useful for the selection of donors in a breeding program.

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Adoption Behaviour of Farmers Towards Improved Cultivation Practices of Kachai Lemon in Ukhrul District of Manipur

Heikham Narmila Devi¹ and Gino A. Sangma²

¹*Research Scholar, Department of Agribusiness Management and Food Technology*

²*Assistant Professor, Department of Agribusiness Management and Food Technology*

North-Eastern Hill University, Tura, 794002, Meghalaya, India

Corresponding author: hnarmiladevi@gmail.com

Kachai lemon (*Citrus jambhiri*) is an important agricultural commodity in the Ukhrul district of Manipur providing livelihood and income to many farmers in the region. This study focuses on understanding the adoption behaviour of Kachai lemon farmers towards improved cultivation practices. For the study, Lungchong Meiphai block of Ukhrul district was selected purposively and the primary data was collected from 150 farmers randomly using structured schedule. The study revealed that practices such as pruning, application of farm yard manure (FYM), mulching and intercropping were highly adopted cultivation practices whereas application of micronutrients and irrigation were the least adopted practices by the farmers. The study also highlights that educational level, farm size, institutional support and training exposure are significantly associated with the adoption rate. Moreover, the study recommends strengthening the extension network, enhance capacity-building programs and promote stronger farmer-to-farmer knowledge dissemination networks to improve the adoption of sustainable and improved cultivation practices of Kachai lemon. By improving adoption rates, this study contributes to **enhancing productivity, profitability and sustainability** of Kachai lemon farming in the region.

Keywords: Kachai lemon, adoption behaviour, improved cultivation practices

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Effect of Abiotic Factors on Major pests Infesting Chilli in the Konkan Region of Maharashtra

Chavan A. A.¹, Shinde B. D.², Kengare M. N.³ and Biradar S. G.¹

¹Ph.D. Scholar, Department of Entomology, PGI, Mahatma Phule Krishi Vidyapeeth, Rahuri

²Department of Agril. Entomology, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli

³Department of Agril. Entomology, Dr. DYPCA, Talsande, Kolhapur

Email: aishwaryachavan4177@gmail.com

Chilli (*Capsicum annuum* L.), is one of the most important spice cum vegetable crop of India mainly attacked by sucking pests and fruit borer, *Helicoverpa armigera* causing yield loss. This study investigates seasonal variations in pest incidence and the relationship between weather factors and pest population fluctuations, aiming to enhance pest management strategies for chilli cultivation. The field experiment was conducted at the Vegetable Improvement Scheme, Wakawali, during the *rabi* season of 2018-19. Weekly observations were made on thrip, whitefly and aphid populations by counting population on three leaves (top, middle and bottom) of five randomly selected plants. Fruit borer infestation was recorded by calculating the percentage of infested fruits. Data were analysed statistically and correlation coefficients were determined. The study revealed that the population of whitefly (3.20 per three leaves), thrips ((5.60) and aphids (12.30) reached to peak in 3rd SMW (15th-21st January), 7th SMW (12th-18th February) and 3rd SMW (15th -21th January), respectively. The fruit borer infestation reached to peak in 8th SMW (19th -25th February) (25.33 per cent). The morning relative humidity recorded positive significant correlation with mean whitefly population ($r=0.616$) and aphid population ($r=0.691$) while, maximum temperature ($r=-0.013$), minimum temperature ($r=-0.205$) and evening humidity ($r=-0.332$) showed negative non-significant correlation. Mean aphid population showed negative significant correlation with minimum temperature ($r=-0.560$) while, maximum temperature ($r=-0.293$) and evening relative humidity ($r=-0.465$) recorded negative correlation. The mean thrips population showed positive correlation with maximum temperature ($r=0.409$), minimum temperature ($r=0.508$) and evening relative humidity ($r=0.173$) while, morning relative humidity ($r=-0.255$) was negatively correlated. The per cent mean infestation of fruit borer recorded positive significant correlation with maximum temperature ($r=0.515$) and minimum temperature ($r=0.630$) while, morning relative humidity ($r=-0.655$) recorded negative significant correlation. The evening relative humidity ($r=0.372$) exhibited positive non-significant correlation with fruit borer infestation. Thus, it can be concluded that the seasonal abundance and activity of pests on chilli crops are influenced by various abiotic factors. The study's findings can aid in developing weather-based pest forecasting models and helps farmers in the Konkan region of Maharashtra in adjusting transplanting dates for effective pest management.

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Revolutionizing Indian Horticulture: The Convergence of Technology and Innovation

Ajay Kumar^{1*}, Amit Kanawjia², Kumari Anjali³, Astha Singh⁴ and Jai Ram⁴

^{1&3}Research Scholar, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001

²Assistant Professor, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001

^{4&5}PG Scholar, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001

Corresponding Author: ajaykumar32432016@gmail.com

The Indian horticulture sector, a vital contributor to the nation's economy and nutritional security, is experiencing a paradigm shift fueled by the integration of cutting-edge technologies and the dynamism of innovative start-ups. Geographic Information Systems (GIS) are providing spatial insights for land management and resource allocation, while remote sensing technologies, including satellite and drone imagery, offer timely and comprehensive data on crop health, growth patterns, and environmental conditions across diverse horticultural landscapes in India. The proliferation of data analytics platforms enables the extraction of actionable intelligence from this wealth of information, empowering stakeholders with predictive capabilities for yield forecasting, pest and disease management, and market trend analysis. Furthermore, the principles of precision horticulture are being increasingly adopted, allowing for site-specific management of inputs like water, fertilizers, and pesticides, thereby optimizing resource utilization and minimizing environmental impact within the Indian context. This technological convergence presents significant opportunities for start-ups to develop and deploy tailored solutions for the unique challenges and opportunities within India's diverse horticultural sub-sectors, ranging from fruits and vegetables to flowers and spices. These ventures are instrumental in bridging the gap between technological advancements and on-farm implementation, fostering data-driven decision-making among farmers, empowering researchers with advanced analytical tools, and streamlining supply chain efficiencies to reduce post-harvest losses and enhance market access for Indian horticultural produce. By embracing this technological revolution, the Indian horticulture industry can achieve greater productivity, sustainability, and economic prosperity.

Keywords: GIS, Remote Sensing, Data Analytics and Precision Horticulture

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Efficacy of Botanical and Chemical Treatments in Mitigating Pest Infestations in Stored Grains

Anamika kumari¹ and Usha Yadav²

¹ PhD Scholar, Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.)

² Assistant Professor, Department of Entomology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.)

*Corresponding author: anamica2804@gmail.com

This study evaluates the effectiveness of botanical, microbial, and synthetic treatments in mitigating pest-related losses and adult emergence of *Sitophilus oryzae*, *Rhyzopertha dominica*, and *Tribolium castaneum* across five storage receptacles over three months. Data from two complementary experiments—percentage grain losses and adult insect emergence—revealed that hermetic bags, combined with microbial agents (*Beauveria bassiana*) or synthetic insecticides (emamectin benzoate, deltamethrin), achieved near-complete pest suppression. Botanical treatments (e.g., ginger rhizome powder) showed moderate efficacy, while untreated controls suffered significant losses (up to 31.33%) and high pest proliferation. Statistical validation (SEm±, CD, CV%) confirmed robust results. The findings advocate for integrated pest management (IPM) strategies combining hermetic storage with biopesticides for sustainable grain preservation.

Keywords: botanical, hermetic bags, microbial, *Rhyzopertha dominica*, *Sitophilus oryzae*, storage receptacles, *Tribolium castaneum*.

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Revolutionizing the Flower Industry through Floriculture Innovations

Kumari Anjali^{1*}, Amit Kanawjia², Sunil Kumar³, Ajay Kumar⁴ and Jai Ram⁵

^{1&4}*Research Scholar, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001*

²*Assistant Professor, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001*

³*Assistant Professor, Department of Floriculture and Landscaping, Acharya Narendra University of Agriculture and Technology Kumarganj, Ayodhya 224123*

⁵*PG Scholar, Department of Floriculture and Landscape Architecture, Banda University of Agriculture and Technology, Banda 210001*

Corresponding Author: Km.anjali6307@gmail.com

Technological advancements have played a vital role in the production of flower, enabling farmers to maximize yields, reduce losses, and enhance flower quality. Precision farming techniques—such as the use of sensors and remote monitoring systems—allow for close monitoring of crop growth and optimization of inputs like water and fertilizer. This leads to higher yields and more efficient resource use. Smart greenhouses, equipped with sensors and automation technologies, create optimal growing conditions by continuously monitoring plant development and adjusting environmental factors. This is not only increases crop yields and reduces waste but also improves the overall quality of blooms. By leveraging greenhouse technology, horticulturists can boost productivity, conserve resources, and grow healthier, more sustainable crops. Digital Twin technology, which creates a virtual replica of a physical system that mimics its behavior and state over time, offers further benefits. Additionally, the Internet of Things (IoT) is revolutionizing the flower industry by increasing efficiency in both floral production and supply chain management. Overall, advances in floriculture technology have transformed the industry. These innovations not only support the sustainable and efficient production of high-quality flowers but also contribute to environmental conservation and improved profitability for growers.

Keywords: Sensor, IoT, Greenhouse, Flowers and Precision Farming.

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Symbiotic Aquaponics: Merging Aquaculture and Hydroponics for Sustainable Food Production

Riya Yadav and Sachin Kumar

Faculty of Agricultural Sciences, SGT University, Gurugram, 122505, India

Corresponding author: ydv.riya04@gmail.com

An inventive and environmentally friendly method of producing food, aquaponics combines hydroponics (soil-less plant cultivation) and aquaculture (fish farming) in a mutually beneficial relationship. The two are combined in a closed recirculating system in aquaponics. The nutrient-rich excrement that fish create in this closed-loop system is transformed into bioavailable nutrients for plants by helpful bacteria. To keep the water clean for the fish, a typical recirculating aquaculture system filters and eliminates the organic matter, or "waste," that accumulates in the water. On the other hand, an aquaponic system uses an inert substrate with plants to filter the nutrient-rich wastewater. The water is then filtered and purified by the plants and returned to the fish tanks, resulting in a self-sustaining ecosystem that uses less water and produces less waste. Here, the fish waste is broken down by bacteria, and the resulting nutrients are absorbed by plants. The cleansed water is then returned to the fish tanks. Higher agricultural yields, less dependency on chemical fertilizers, effective land utilization, and year-round production are just a few benefits of aquaponics. It is a tightly regulated system that eliminates the need for pesticides and fertilizers while offering a high degree of biosecurity and a low danger of illness and outside contamination. Additionally, it has the potential to be a helpful tool for resolving some of the issues facing traditional agriculture, such as soil degradation, freshwater scarcity, and climate change. Where there is a lack of water and poor soil, such as in metropolitan areas, desert climes, and low-lying islands, aquaponics thrives. This technique is becoming more well-known throughout the world as a solution for climate-resilient agriculture, urban farming, and food security. But issues like system complexity, high startup costs, and the requirement for constant monitoring necessitate more study and improvements in technology.

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Influence of Abiotic Factors Affecting Germination of *Argemone mexicana* Weed Seeds in Mustard

Gurvinder Kaur, Axay Bukher and V.S Mor

Department of Seed Science and Technology, CCS Haryana Agricultural University, Hisar, Haryana
Email-kaurgurvinderk94@gmail.com

Argemone mexicana (Satyanasi) are considered to be objectionable weed seeds in mustard. Once they mix with mustard seeds, it is not possible to remove them from main crop seeds due its resemblance with mustard seeds. To protect the seeds from such weed seeds, it is important to understand their ecology and factors affecting their germination such as alternate temperature, alternate light, dark and depth. Among the three alternate temperatures taken, the maximum alternate temperature for germination of *Argemone mexicana* was observed at 20/25°C (28.00), followed by 15/20°C (13.33) and minimum at 25/30°C (10.66) at alternate 16/8hours (16 hours light followed by 8 hours darkness). Less germination was recorded at complete darkness (24 hours) as compared to alternate light which reveals that light stimulates the germination of *Argemone mexicana*. Strong morpho-physiological dormancy was found in these seeds with maximum at alternate temperature 25/30°C (88.67) and minimum at 20/25°C (82.67). Due to presence of such strong dormancy no flush of emergence was recorded at 4 cm, 6 cm and 8 cm. The radicle emergence was started on 10th followed by 14th day at alternate temperature of 15/20°C while at 25/30°C, it began on 17th day. More radicle emergence (14.55%) was recorded 16 hours light followed by 8 hours darkness than under complete darkness for 24 hours (10.49%). This information is important to study the behavioral patterns of *Argemone mexicana* weed seeds so that they can be managed effectively.

Keywords: Objectionable weeds, *Argemone mexicana*, germination, temperature, light, weed ecology, morpho-physiological dormancy, radicle emergence

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Transforming the Production of Vegetables: New Technologies for Enhanced Quality in Managed Environments

Avinash Pal

*Department of Horticulture, Deen Dayal Upadhyay Gorakhpur University, Gorakhpur–233009, U. P.
Corresponding Author's Email: avinashbst2@gmail.com*

The potential of the latest innovations in precision agriculture, vertical farming, LED lighting, and hydroponics to improve crop quality, reduce their adverse environmental effects, and increase output is considered. Our review highlights areas for further research and development while highlighting the benefits and challenges of these technologies. The demand for high-quality vegetables is rapidly increasing globally due to growing consumer knowledge of nutrition and health, but traditional vegetable cultivation techniques often face challenges like soil erosion, climate change, and water scarcity, which can lower crop output and quality. Vegetable producers may be able to satisfy shifting consumer needs and help ensure a more sustainable and superior crop by putting this state-of-the-art technology into practice.

Keywords; Internet of Things (IoT), Controlled Environment Agriculture (CEA), Robotics, Artificial Intelligence (AI), Precision Irrigation.

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Bacterial Endophytes Offer Plant Growth Stimulation and Plant Pathogen Biocontrol, Making them a Resilient Approach to Sustainable Agriculture

Aspak & Pinki kumari

*Department of Plant Pathology, School of Agriculture, Lovely Professional University
Phagwara, Punjab.*

Plant diseases damage seeds from the time of germination until the harvesting stage, which is thought to be a significant limitation in lowering the quality and quantity of plants and plant products. These infectious entities have been controlled to date with a variety of multifunctional chemical insecticides, but their effectiveness has been lowered. For this reason, multiple disciplines have used "bacterial endophytes," a substitute for these chemical pesticides, throughout human history. These endophytes also help to increase plant growth, prevent infectious plant diseases, and preserve the living habitat. The current study compiles and examines the most recent and ground breaking research on plant bacterial endophytes and their mechanisms for interactions with the host plant, root colonization, systemic colonization of aerial plant tissues, production and modulation of phytohormones, host specificity, genes expressed in the endosphere, multiomics techniques to enhance endophyte use, and the formulation of biopesticides by these bacterial endophytes. The study will be crucial to the continued management and use of bacterial endophytes for sustainable agricultural output, and the manuscript covers the most important information about them.

Keywords: Bacterial endophytes, phytohormones, sustainable agricultural

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Role of Beneficial Microbes in Induced Systemic Resistance and Plant Health

Bhavesh Kumar Sahu

*Department of Plant Pathology, College of Agriculture, Raipur-492012, (C.G.)
e-mail: sahubhavesh16011@gmail.com*

Beneficial microbes in the microbiome of plant roots improve plant health. Induced systemic resistance (ISR) emerged as an important mechanism by which selected plant growth-promoting bacteria and fungi in the rhizosphere prime the whole plant body for enhanced defense against a broad range of pathogens and insect herbivores. A wide variety of root-associated mutualists, including *Pseudomonas*, *Bacillus*, *Trichoderma* and mycorrhiza species sensitize the plant immune system for enhanced defense without directly activating costly defenses. on rhizobacteria-mediated ISR, hundreds of studies in dicots and monocots have reported on the ability of PGPR to promote plant health via ISR. Beneficial microbes produce different MAMPs and elicitors that can trigger ISR. Local suppression of root immune responses is a common feature of ISR eliciting beneficial microbes that possibly aids in root colonization.

Keywords: ISR, PGPR, *Pseudomonas*, *Bacillus*, *Trichoderma* and mycorrhiza

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Mainstreaming Millets in PM-POSHAN: A Pathway to Improved Nutrition and Health for School Children

Bidyut Bikash Neog

MSc. (Agriculture), Assam Agricultural University, Jorhat - 785001, Assam, India.

E-mail: bneogbidyut1608@gmail.com

Millets are recognised for their high nutritional profile, provide higher protein, more fibre, iron and calcium than conventional staples like rice and wheat. Millet-based meals can enhance growth, cognitive development, and immunity, as 35.50% of Indian children under the age of five suffer from stunting, and 67.10% of children aged 6-59 months are anaemic (NFHS-5, 2019-21). The inclusion of millets into the Pradhan Mantri Poshan Shakti Nirman Scheme (PM-POSHAN) offers an opportunity to fight malnutrition and micronutrient deficiencies among school children in India. Studies indicate that the including of finger millet (*Eleusine coracana*) in diet increases haemoglobin levels. Additionally, pearl millet (*Pennisetum glaucum*) and sorghum (*Sorghum vulgare*) have demonstrated effectiveness in regulating blood sugar levels, reducing obesity, and preventing early-onset diabetes. Acknowledging these benefits, various Indian states have launched millet-based meal programmes under PM-POSHAN. Assam, under its Assam Millets Mission (2022-2029), has started incorporating millets into the PM-POSHAN scheme. Currently, providing 450-700 kcal and 12-20 g protein per child daily, the state's mid-day meal program can benefit from millet inclusion by improving dietary patterns, reducing anaemia, and boosting long-term health outcomes. However, challenges remain in procurement logistics, supply chain management, storage facilities, and the cultural acceptability of millets in conventional diets. Successful implementation calls for strengthening farmer-procurement networks, supporting farmers for millet cultivation, and developing millet-based recipes that align with regional food preferences. The paper discusses millet integration in PM-POSHAN, analysing its nutritional benefits, cost feasibility, and challenges in implementation. It also advocates for increased government funding to support millet inclusion while ensuring affordability and meal quality for school children of Assam.

Keywords: Millets; PM-POSHAN; Nutrition, Health benefits; Assam.

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Biodegradable Protray

Mohamed Aathil

B.Tech (Agricultural Engineering)
mohamedaathil243@gmail.com

Transplantation is the technique in which a plant is moved from one location to other. Transplantation can be done either a manual or a mechanical method. It is the important operation in rice cultivation. Farmers are investing more money on seedlings. Rice is the one of the major crop cultivated in India. Transplantation is more labour consuming and difficult operation. For the ease of cultivation the transplanter is used. To increase the fertility of the soil fertilizer and herbicides are added after transplantation. To do these two operations in the same time biodegradable portrays are founded. The protray is made with biodegradable material and plant to plant spacing is identical. Therefore, the plant population and the plant spacing can be determined. By this method weeds are controlled. The operational cost the machine is low and it required only few labours for operation. It diminishes the fertilizer loss too. The fertility of the soil get increases by this method.

Keywords : Fertilizer; Spacing; Transplanting

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Bioinformatics Tools an Innovative Approach Towards Plant Breeding

Abhishek^{1*} and Halesh G.K²

^{1*} *Genetics and Plant Breeding, Department of Biotechnology and Crop Improvement,
College of Horticulture, Bengaluru 560 065.*

² *Plant Biotechnology, Department of Biotechnology and Crop Improvement,
College of Horticulture, Munirabad, 583 233.
University of Horticultural Sciences, Bagalkot, 587 104*

The integration of bioinformatics tools in plant breeding has revolutionized the way researchers analyze, predict and enhance crop traits. Bioinformatics enables high-throughput data analysis, facilitating genome-wide association studies (GWAS), marker-assisted selection (MAS) and genomic selection (GS) to accelerate crop improvement. The availability of vast genomic datasets, coupled with computational algorithms, allows breeders to identify candidate genes governing important agronomic traits, thereby enhancing precision breeding strategies. Next-generation sequencing (NGS) and high-throughput genotyping have significantly improved genetic diversity analysis, helping breeders select parental lines with desirable traits. Bioinformatics tools such as BLAST, MEGA and Clustal Omega assist in gene annotation, phylogenetic analysis and sequence alignment, providing insights into gene function and evolutionary relationships. Moreover, machine learning and artificial intelligence (AI) are being integrated with bioinformatics to predict gene-trait associations, optimize breeding decisions and improve crop resilience against biotic and abiotic stresses. With advancements in transcriptomics, proteomics and metabolomics, systems biology approaches are gaining prominence in plant breeding. RNA sequencing (RNA-Seq) and quantitative trait locus (QTL) mapping have enhanced our understanding of gene expression patterns, regulatory networks and metabolic pathways associated with yield, disease resistance and stress tolerance. The integration of multi-omics data with computational biology enables the development of climate-resilient and nutritionally enriched crop varieties. Furthermore, bioinformatics plays a crucial role in CRISPR-Cas genome editing by aiding in target site identification, off-target prediction and validation of gene edits, making it a valuable tool for precision breeding. Cloud computing and big data analytics further facilitate large-scale data management, improving collaboration among plant breeders worldwide. The application of bioinformatics in plant breeding is an innovative approach that has transformed conventional breeding methods, making them more efficient, cost-effective and precise. As the field advances, interdisciplinary collaborations among geneticists, bioinformaticians and breeders will be essential to harness the full potential of bioinformatics-driven crop improvement, ensuring global food security and agricultural sustainability.

Keywords: Bioinformatics, Genomic selection, CRISPR-Cas, Machine learning, Marker-assisted selection, Crop improvement.

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Use of Integrated Omics Approaches for Climate Resilient Crop Improvement

Abhishek^{1*} and Halesh G.K²

^{1*} *Genetics and Plant Breeding, Department of Biotechnology and Crop Improvement,
College of Horticulture, Bengaluru 560 065.*

² *Plant Biotechnology, Department of Biotechnology and Crop Improvement,
College of Horticulture, Munirabad, 583 233.
University of Horticultural Sciences, Bagalkot, 587 104*

Climate change poses a significant challenge to global food security, necessitating the development of climate-resilient crops that can withstand extreme environmental conditions. The integration of multi-omics approaches—including genomics, transcriptomics, proteomics, metabolomics and phenomics—has emerged as a powerful strategy to accelerate crop improvement by unraveling complex traits associated with stress tolerance. Genomics, through high-throughput sequencing and genome-wide association studies (GWAS), enables the identification of key genes and quantitative trait loci (QTLs) linked to abiotic stress resilience. Transcriptomics provides insights into gene expression patterns under varying environmental conditions, helping researchers understand regulatory networks governing stress responses. Proteomics and metabolomics further complement genomics and transcriptomics by identifying stress-responsive proteins and metabolites that play crucial roles in plant adaptation to drought, salinity, heat and cold stress. Advances in mass spectrometry and nuclear magnetic resonance (NMR) spectroscopy facilitate large-scale metabolite profiling, allowing the discovery of biochemical pathways associated with climate adaptation. Additionally, phenomics, powered by high-throughput imaging and sensor technologies, enables precise measurement of plant responses to environmental stressors, bridging the genotype-to-phenotype gap. Systems biology approaches integrate multi-omics data to construct predictive models for stress tolerance, aiding in the development of breeding strategies for climate-resilient crops. Machine learning and artificial intelligence (AI) further enhance data analysis, enabling the identification of key biomarkers for targeted breeding and genetic engineering. The combination of omics technologies with CRISPR-Cas genome editing offers a precise and efficient tool for modifying stress-related genes, accelerating the development of improved crop varieties. Despite these advancements, challenges such as large-scale data integration, computational complexity and cost remain. However, continuous innovations in bioinformatics, cloud computing and high-throughput phenotyping platforms are making integrated omics approaches more accessible for crop improvement programs worldwide. By leveraging these advanced technologies, researchers can develop climate-smart crops with enhanced yield, nutritional quality and stress tolerance, ensuring sustainable agriculture in the face of climate change.

Keywords: Omics, Climate resilience, Genomics, Transcriptomics, Proteomics, Crop improvement.

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Organic Farming

Abhishek sharma

*M.Sc. Scholar, Department of Agronomy
Vivekananda Global University, Jaipur, Rajasthan
Email: sharmaabhishek1466@gmail.com*

Organic farming is an ecologically sustainable agricultural approach that emphasizes the use of natural processes and materials to enhance soil fertility, biodiversity, and environmental health. By avoiding synthetic fertilizers, pesticides, and genetically modified organisms (GMOs), organic farming promotes a balanced ecosystem and reduces pollution. This farming method focuses on crop rotation, composting, green manure, and biological pest control to maintain productivity and resilience. As global concerns about climate change, food security, and environmental degradation rise, organic farming offers a viable solution by supporting long-term sustainability, improving soil health, and reducing the carbon footprint of agriculture. This paper explores the principles, practices, and benefits of organic farming, highlighting its potential role in achieving sustainable agricultural development.

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Challenges in the Inland fish Retail Market: Socio-Economic Insights and Infrastructure Analysis in the Northern Region of Tamil Nadu

Pugazhenthir P¹., Aatepogu Revathi² , Chandran Sudhan 3*.

¹ Research Scholar, Fisheries College and Research Institute, Thothukudi – 628001.,

² Research Scholar, Andhra Pradesh Fisheries University, Muthukur, Nellore – 524001.,

^{3*} Assistant Professor, Department of Fisheries Resource Management, TNJFU – Dr. M.G.R. Fisheries College and Research Institute, Ponneri, Tiruvallur Dt. Tamil Nadu – 601204.

Corresponding Author : sudhancphd@gmail.com

The socio-economic profile of fish retailers, market functions, and operational constraints play a crucial role in meeting consumer demand for fish. This research aimed to evaluate the socioeconomic traits of rural inland fish traders in Tamil Nadu's northern region, examine the channels that currently connect them to the market, and pinpoint the main obstacles they must overcome. A purposive sample approach was employed to choose 36 neighbourhood fish stores. A standardized, pre-tested interview schedule was used to interview the 252 respondents who made up the sample size, which was obtained by randomly selecting seven fish retailers from each market. The findings revealed that 71% of the fish retailers were male, with 68% belonging to the middle-aged group. About 65% of the respondents had an educational qualification between primary and secondary levels, and 76% had over 10 years of experience in fish retailing. Most respondents belonged to nuclear families, and all were members of fisheries cooperatives. Fish retailing was a permanent occupation for 61% of the respondents, who reported an average monthly income of ₹16,500, higher than the national average rural household income (₹12,698) as per NAFIS 2021-22. Secondary occupations included fishing, agriculture, and labour work. The study identified six rural fish retail market channels, with Indian Major Carp (IMC), Tilapia, and Common Carp being the most in-demand fish varieties. Due to its taste and affordability, consumer preferences indicated that Rohu (*Labeo rohita*) was the most preferred species. Major infrastructural challenges included lack of shade, inadequate water supply, poor sanitation, and insufficient drainage facilities for waste disposal. Constraints were analysed using the Garrett ranking method, which revealed that unnecessary intermediaries and high fish transportation costs were the most significant challenges. According to the report, cooperative societies should invest in the infrastructure of fish markets, train fish retailers in fish handling and preservation techniques, provide hygienic facilities and access to icing or cold storage to extend the shelf life of fish, and promote direct purchases from fishermen to increase the profit margins of retailers.

Keywords: Socio-economic profile, fish retailers, market channels, operational constraints, rural inland fisheries, Garrett ranking.

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Artificial Intelligence in Cold Chain Management: Challenges for Small and Marginal Farmers

Dr. Pradipta Chandra

Chandigarh Group of Colleges (CGC), Jhanjeri, Mohali, Punjab – 140307.

Department of Management, Chandigarh School of Business

ORCID ID: 0000-0003-4186-8706

Scopus Author ID: 57202374305

Mobile: 8927163283 E-mail: pradipta.j3657@cgc.ac.in; drchandraiitkgp@gmail.com

A cold chain or cool chain is a temperature-controlled supply chain that involves the storage, transportation and distribution of perishable goods such as vaccine, chemical, sea-food, meats and dairy products. Multiple challenges are there in the business activities where products are agriculture, food and pharmaceutical based. This review paper highlights on the possible challenges associated with the intervention of artificial intelligence in various applications for cold chain in agriculture, horticulture and food processing. Maintaining a stable temperature throughout the supply chain is crucial to handle such products, specially by small and marginal farmers, as there are certain guidelines associated with nutrition quality, safety and freshness of the fruits and vegetables. To achieve these, alongwith temperature, other parameters like time, duration, humidity, handling, storage, transportation and logistics, monitoring, packaging, training are equally important. By monitoring and controlling the variables for a suitable parameter, the goal of cold chain can be achieved where artificial intelligence can play an instrumental role.

Keywords: Cold Chain, AI, Small and Marginal Farmers, Supply Chain and Logistics, India.

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Screens and Scenes: Changing Behavior in the Digital Age

Monika¹ and Prof. ShubhaDube²

Research Scholar¹, Professor²

Department of Home-Science

University of Rajasthan, Jaipur (302016)

Email: Monikhola4@gmail.com

Contact information: +919306546801₁, +919414349412₂

The study examined the correlation between screen time exposure and behavioral alterations among adolescents. A cross-sectional survey was employed, revealing that extended screen time significantly affects participant behavior. Respondents reported losing their temper in challenging situations, increased curiosity when engaging in digital activities, and experiencing nightmares as a consequence of excessive screen time. The influence of social media personalities and their lifestyles was found to adversely affect the mental well-being of participants. Additionally, delayed daily activities and declining study habits due to problematic screen usage were reported, potentially resulting in lower academic performance. However, positive influences were also noted, with respondents indicating altered perceptions and broadened perspectives due to digital activities. Chi-square tests of independence demonstrated significant associations between behavioral changes and all domains of screen time exposure, including access to digital devices, time spent on digital devices, parental regulations, screen time and learning, and screen time management. Gender differences were observed, with girls having greater access to digital devices, screen time and learning, and parental regulation, while boys spent more time on digital devices and achieved higher scores in screen time management. The study concludes that excessive screen time significantly impacts adolescents' behavior, leading to addiction and hindrances in the proper functioning of their lives.

Keywords: Screen time, Exposure, Behavior, Problematic, Addiction, Digital Activities

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Conservation of Indigenous Breeds, Breeding Policy and Enhancement of Animal Productivity

Anjali Arya^{1*} and Prasanna Godbole²

¹*Department of Livestock Production Management, M. B. Veterinary College, (RAJUVAS) -314001 (Rajasthan), India*

²*Department of Veterinary Pharmacology and Toxicology, M. B. Veterinary College, (RAJUVAS) - 314001 (Rajasthan), India*

**corresponding author: anjaliarya2609@gmail.com*

India is home to 53 registered cattle and 21 buffalo breeds, uniquely adapted to diverse agro-climatic conditions. Breeds like Gir, Sahiwal, Tharparkar, and Malnad Gidda are known for resilience, disease resistance, and efficiency under low-input systems. However, focus on exotic breeds and indiscriminate crossbreeding has led to a decline in indigenous populations and genetic purity. The National Livestock Policy (2019) advocates for region-specific breeding strategies that integrate traditional knowledge with modern genomic tools. Indigenous breeds are vital to sustainable livestock systems due to their adaptability, multipurpose roles, and cultural importance. Yet, they face challenges such as genetic erosion, economic undervaluation, and weak institutional support. A strong breeding policy, including breed zonation, selective breeding, and assisted reproductive technologies like Artificial Insemination (AI) and Embryo Transfer (ET), is crucial. Institutions like NBAGR and ICAR lead efforts in conservation and genetic improvement, aligned with global frameworks like the FAO's Global Plan of Action. Biotechnological tools such as marker-assisted selection, genomic selection, and cryopreservation enhance productivity while preserving native traits. Government initiatives like the Rashtriya Gokul Mission support this integration. Complementary strategies—nutrition, health management, and farmer empowerment through ICT platforms—ensure productivity enhancement alongside conservation of India's rich genetic heritage.

Key words: Conservation, Livestock, breeds, policy and productivity.

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**Performance of Intercropping Millets with Pigeon Pea (*Cajanus cajan* L.)
followed by Different Levels of Fertilizer on Chickpea (*Cicer arietum* L.) in
Sequence: A Review**

Dnyaneshwar Pandav¹, Dr. R. M. Gethe², Tulshidas Kadam³, Pratiksha Karpe⁴

¹Ph.D. Research Scholar, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri Ahilyanagar-413722, Maharashtra, India.

Email- dmpandav2017@gmail.com

²Professor, Department of Agronomy, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri Ahilyanagar-413722, Maharashtra, India.

³Ph.D. Research Scholar, Department of Agronomy, Post Graduate Institute, Rahuri Ahilyanagar-413722, Maharashtra, India.

⁴Ph.D. Research Scholar, Department of Agronomy, Post Graduate Institute, Rahuri Ahilyanagar-413722, Maharashtra, India.

Intercropping and crop sequencing are important strategies for improving crop productivity and soil fertility in smallholder farming systems. This review synthesizes the existing literature on the performance of intercropping millets with pigeon pea followed by different levels of fertilizer on chickpea in sequence. Studies have shown that pigeon pea, as a nitrogen-fixing legume, benefits soil fertility, leading to enhanced growth and productivity in subsequent crops like chickpea. Furthermore, the synergistic effects of intercropping millets with pigeon pea are investigated in terms of soil health, pest management, and moisture conservation. The subsequent application of different levels of fertilizer on chickpea further enhanced crop yields, improved nutrient uptake, and reduced soil nutrient depletion. The optimal fertilizer level for chickpea was found to be 75-100% of the recommended dose. However, the optimal fertilizer dose and the specific benefits of this intercropping sequence are site-specific and depend on soil type, climatic conditions, and crop variety. The review highlights the importance of intercropping and crop sequencing in improving crop productivity, soil fertility, and reducing environmental degradation.

Keywords: Intercropping, millets, pigeon pea, chickpea, fertilizer, crop sequencing, soil fertility, crop productivity.

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Designing Lamp Primer for Diagnosis of Downy Mildew in Cucurbitaceae

Abhilasha Thakur, Dr. Suruchi Jindal

*School of Bioengineering and Biosciences
Corresponding Author –suruchi.28640@lpu.co.in*

Agricultural crops have been vital to human civilization, providing food and resources for survival. However, the rise in crop diseases caused by pathogenic microorganisms, particularly soil-borne pathogens, poses a significant threat to crop yield and quality. These pathogens affect various plant parts, including roots, leading to symptoms like root cracking, black lesions, bark shredding, and vascular tissue discoloration. Favorable conditions such as poor drainage, high moisture, and low oxygen content contribute to the growth of these pathogens. To manage these diseases, several diagnostic approaches have been developed, including microscopic, morphological, serological, and molecular methods. Among them, molecular techniques like PCR, RT-PCR, multiplex PCR, and LAMP have shown promising results, with LAMP standing out due to its simplicity, rapidity, and suitability for field diagnostics.

Keywords: Downy Mildew Diagnosis, Cucurbitaceae Pathogen Detection, Molecular Primer Design, Rapid and Specific DNA Amplification.

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Development and Optimization of Enzymatic Process for Starch Separation from Corn and Its Characterization

Dr.G.M.Solanke,Prof. (Dr.) Ajay Kumar Singh

Assistant Professor, Department of Technology, Shivaji University Kolhapur

*Professor, **Department of Processing and food Engineering**, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India.
gopalsolanke456@gmail.com ,ajayk.singh@shuats.edu.in*

The study was carried out enzymatic corn wet milling process optimized that replaces or reduces the use of chemical by microbial protease enzymes. During the present investigation study was focus on develop and optimize enzymatic wet milling procedure. The treatment T₀ were use chemical, T₁ to T₄ were used 2g to 11g protease enzyme and T₅ were used chemical and protease enzyme in this process. Different functional properties of extracted corn starch such as Amylose and amylopectin, Water absorption capacity, Oil absorption capacity, Gelatinization, Starch purity, Protein, Ash, Fiber, Fat, Starch yield were studied. The physical properties of different corn varieties such as 1000 kernel weight was 283.49 to 301.02g, 1000 kernel volume varied from 292 to 308 mm³, true density 1197.04 to 1380.25 kg/m³, bulk density 766.062 to 726.949 kg/m³, porosity 36.00 to 47.32 %, sphericity 0.55 to 0.61 %, angle of repose 23.38 to 29.75°C respectively. Enzymatic wet milling procedure compared to a chemical treatment. Enzymatic wet microbial protease enzyme was evaluated in this process, and its dose was optimized for starch yield using a laboratory enzymatic wet milling procedure. Starch yields increased from 59.24% to 67.52% with increase in enzyme dose from 2 to 11 g. The functional properties of extracted corn starch the average value amylose was 23.02 to 25.31%, amylopectin 74.69 to 76.98%, water absorption capacity 92.03 to 93.90%, oil absorption capacity 93.49 to 94.87%, gelatinization 69.55 to 70.50 °C respectively. From the above study, new process might be commercially viable, the lost associated with enzyme uses were offset by the saving generated through decrease processing time and energy consumption.

Keywords: Physicochemical, Starch, Fibre, Germ, Protease enzyme, Functional properties, Purity.

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Development of Graphomotor Skills in Preschool Children: Factors and Strategies

***Rajani Karnwal ** Dr. Khwairakpam Sharmila**

**Research Scholar ** Assistant Professor*

*Department of Human Development and Family Studies, School of Home Science Babasaheb
Bhimrao Ambedkar University, Lucknow-226025(Uttar Pradesh)*

Email ID: khwairakpamsharmila@gmail.com; karnwalrajani7962@gmail.com

Graphomotor skills refer to the coordination of cognitive, perceptual, and motor abilities that enable children to perform tasks such as writing, drawing, and coloring. These skills are crucial during the preschool years, as they lay the foundation for academic readiness and future learning. The development of graphomotor skills in preschool children is influenced by a range of factors, including neurological maturity, fine motor coordination, visual-motor integration, and environmental stimulation. This paper explores the key developmental aspects of graphomotor skills in children aged 3 to 6 years and identifies the major factors that support or hinder their progression. The study highlights the role of parents, educators, and structured preschool environments in fostering fine motor and pre-writing skills through developmentally appropriate activities. Challenges such as delayed motor development, lack of exposure to fine motor tasks, and limited practice opportunities can negatively impact graphomotor development. The paper also discusses effective strategies to support these skills, including play-based learning, fine motor exercises, and early intervention approaches. Understanding the factors influencing graphomotor development and implementing targeted strategies can enhance children's readiness for formal schooling, promote academic success, and support overall developmental growth during early childhood. Collaboration among caregivers and educators is key to ensuring positive outcomes.

Keywords: Graphomotor skills, Preschool development, Fine motor coordination, Visual-motor integration, Early intervention strategies

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Effect of Feeding Spirulina (*Spirulina Platensis*) on Average Nutrient Digestibility in Konkan Kanyal Kids

Mr. R. R. Kore¹, Dr. D. K. Deokar² and Dr. N. N. Prasade³

¹Ph.D. Research Scholar, Dept of Animal Husbandry and Dairy Science
Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth, Rahuri Ahilyanagar-413722,
E-mail: korerushikesh37@gmail.com

²Associate Professor, Dept of Animal Husbandry and Dairy Science
Maharashtra, India.
E-mail: deokardk68@gmail.com

³Associate Professor, Dept of Animal Husbandry and Dairy Science
College of Agriculture, Dr Balasaheb Sawant Konkan Krishi Vidyapeeth,
Dapoli Ratnagiri-415712, Maharashtra, India.
E-mail: narendraprasade1974@gmail.com

Feed quality plays a crucial role in livestock farming, significantly impacting animal performance and productivity. Identifying and utilizing novel feed sources is essential for sustainable and efficient animal production. Spirulina (*Spirulina platensis*), a promising alternative feed source, is gaining attention due to its exceptional nutritional composition, including high protein content, essential amino acids, vitamins, minerals, carotenoids, and fatty acids, particularly gamma-linolenic acid (GLA), which offers various health benefits. The high protein and antibacterial properties of Spirulina contribute to improved digestion and overall animal performance. Commercial *Spirulina platensis* powder (SPP) contains approximately 60% protein, 20% carbohydrates, 5% fats, and 7% minerals, making it a highly nutritious, low-fat, and cholesterol-free protein source. A study was conducted to evaluate the effect of feeding Spirulina on average nutrient digestibility (%DM basis) in Konkan Kanyal kids. Sixteen kids were selected and divided into four treatment groups using a Completely Randomized Design (CRD). The control group (T1) received no Spirulina, while treatments T2, T3, and T4 were supplemented with 1 g, 1.5 g, and 2 g of Spirulina dissolved in 10 ml, 15 ml, and 20 ml of water, respectively. The Spirulina solution was administered daily via oral drenching through syringe before feeding.

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Navigating Global Trade Challenges in Vegetable Markets

Sadhana Kongala

*Department of Vegetable science, Sri Konda Laxman Telangana Horticulture University, Mulugu,
Siddipet, Telangana*

Global trade in vegetable crops is facing an evolving landscape marked by economic challenges and shifting market dynamics. The interplay between supply chain disruptions, climate change, labor shortages, and geopolitical tensions has significantly impacted vegetable crop production and distribution. Recent trade policies, such as tariffs and trade agreements, continue to reshape global markets, influencing both producers and consumers. The COVID-19 pandemic exacerbated existing vulnerabilities in the agricultural sector, leading to delays in transportation, market closures, and fluctuating demand. These disruptions have highlighted the need for more resilient and flexible supply chains. Moreover, the economic viability of vegetable farming in developing nations is often threatened by volatile market prices, limited access to advanced technology, and insufficient infrastructure.

The growing demand for organic and sustainably produced vegetables, particularly in developed markets, presents both opportunities and challenges for producers worldwide. However, the transition to more sustainable agricultural practices requires investments in soil health, water management, and eco-friendly pest control, which can be cost-prohibitive for small-scale farmers. Additionally, climate change continues to affect crop yields and quality, making it harder for producers to predict and meet market demands.

To address these challenges, recent studies suggest that digital technologies, such as blockchain for traceability, and precision agriculture tools can enhance supply chain efficiency and reduce costs (Liu et al., 2023). Furthermore, regional trade agreements and collaborative policies focusing on food security and agricultural sustainability are essential to building a more robust global vegetable crop market.

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Hairy Root Induction in *Catharanthus roseus* using *Agrobacterium rhizogene* Strain MTCC 2364

Neeta Upadhyay

MSC Biotechnology, NIMS University, Jaipur, Rajasthan

The medicinal plant *Catharanthus roseus* is renowned for its production of valuable alkaloids such as vincristine and vinblastine, which are extensively used in cancer chemotherapy. The establishment of hairy root cultures provides an efficient alternative platform for the stable and enhanced production of these secondary metabolites. This study focuses on the induction of hairy roots in *C. roseus* through genetic transformation using *Agrobacterium rhizogenes* strain MTCC 2364. Various explants including leaf, stem, and hypocotyl segments were inoculated with the bacterial strain under controlled conditions to optimize transformation efficiency. Key parameters such as infection time, co-cultivation duration, and the presence of acetosyringone were systematically evaluated to improve root induction frequency. The transformed roots were characterized morphologically and confirmed through polymerase chain reaction (PCR) using *rol* gene-specific primers. Successful integration of *A. rhizogenes* T-DNA into the plant genome was indicative of stable transformation. The induced hairy roots exhibited fast growth, high branching, and hormone-independent development compared to non-transformed roots. The cultures were maintained on hormone-free media and evaluated for biomass accumulation and preliminary alkaloid content. This work demonstrates the potential of *A. rhizogenes*-mediated transformation as a tool for metabolic engineering and enhanced production of pharmacologically important compounds in *C. roseus*. The optimized protocol developed through this study can serve as a foundation for further investigations into pathway modulation and large-scale production of therapeutic alkaloids using bioreactor-based hairy root systems. Results indicated that dry matter (DM) digestibility increased from 82.7% in T1 to 85.08% in T4. Similarly, crude protein (CP) digestibility improved from 48.88% (T1) to 56.44% (T4), ether extract (EE) from 60.62% (T1) to 66.2% (T4), crude fiber (CF) from 53.84% (T1) to 59.78% (T4), nitrogen-free extract (NFE) from 58.47% (T1) to 64.6% (T4), and ash from 49.38% (T1) to 57.66% (T4). Treatment T4 exhibited the highest digestibility values across all parameters, followed by T3, T2, and T1. These findings suggest that supplementing Konkan Kanyal kids with 2 g of Spirulina per day significantly enhances nutrient digestibility. Therefore, Spirulina can be considered a beneficial dietary supplement to improve digestion and overall animal performance in sustainable livestock farming.

Keywords: Konkan Kanyal kids and Spirulina

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Integrating Streptococcus Pathogen Management into Organic Farming Systems: Challenges, Policies, and Innovations

Harsha Sharma¹, Diksha¹

*Assistant Professor, Research Scholar
Department of Microbiology, Faculty of Science
Motherhood University, Roorkee, Uttarakhand*

Organic farming, while promoting sustainability, biodiversity, and eco-friendly practices, faces significant challenges in managing animal health without the use of synthetic chemicals. One such challenge is Streptococcus pathogens, which can severely impact livestock health, particularly in dairy and swine systems. This article explores the intersection of Streptococcus pathogen management within the framework of organic farming, addressing its implications across agroecological conservation, climate adaptation, technological capacity building, policy development, and international certification standards. Emphasis is placed on alternative treatments, early detection technologies, and the role of extension services in disease prevention. The need for integrated policies, stakeholder collaboration, and alignment of export regulations is highlighted, underscoring the importance of holistic and innovative approaches to ensure biosecurity while maintaining organic integrity.

Keywords: Climate adaptation, livestock biosecurity, organic farming, streptococcus pathogens, disease management.

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Utilization of Water Melon Rind for Valorization of Food Products

***Anamika Das**

Associate Professor, Dept. of Dairy Chemistry, SGIDT, Bihar Animal Sciences University, Patna-14
Email: anamikandri06@gmail.com

Fruits and vegetables when consumed by people results in generation of by products like peels, flesh, seeds etc. which are usually thrown away because they are not palatable in nature but if they are processed, then they can be used for value addition of food products as most of the time, they are nutritionally rich. Also these may help in reducing waste disposal problem and help in alleviating issues arising out of food waste management. Water melon is one of the fruit which is widely consumed in summer and it is well known that the creamish white thick flesh is usually thrown out while we consume the red portion of the fruit. This creamish white thick flesh of watermelon is called rind. The rind of water melon is a great source of dietary fibre, phenolic compounds, minerals, and fatty acids. Carotenoids, alkaloids, saponin, phytates, and soluble carbohydrates (average~55%) are also present. Lysine, leucine, valine, and other aromatic amino acids (phenylalanine and tyrosine) are much more abundant in watermelon rind powder. Watermelon rind contains citrulline, a non-essential amino acid that is a precursor of arginine. It is also rich in magnesium (average~208.25 mg/100 g), calcium (average~362.5 mg/100 g), phosphorus (average~322.81 mg/100 g), and potassium (average~3031.5 mg/100 g). Additionally, watermelon rind have anti-diabetic, antioxidant, antihypertensive, anti-inflammatory, antiulcer, antitumor, hypocholesterolemic, hepatoprotective, neuro-protective, and antibacterial effects which have been reported by many clinical studies. Therefore, it is crucial for sustainability throughout the food chain to design and develop novel functional food products with value added with these wastes. For the production of foods like jams, pickles, smoothies, mayonnaise, dips, and bread industry, watermelon rind can serve as an inexpensive raw material, rich in many nutrients.

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Alterations in Physico-chemical Attributes of Ber (*Zizyphus Mauritiana* Lamk.) Cultivars during Fruit Development Stages in *Tarai* region

Ankit Kumar^{a*} and Karishma Kohli^b

^a*Department of Horticulture, College of Hill Agriculture, Chirbatiya
VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand*

^b*Department of Horticulture and Food Processing, Government of Uttarakhand*

**Email: aktamta1993@gmail.com*

A study was conducted in Horticulture Research Centre, GBPUAT, Pantnagar, Uttarakhand during the season of 2017–18 and 2018–19 on variations in the physico-chemical characteristics of fruit on eight different ber cultivars: Chhuhara, Chinese, Kalagola, Nazuk, Sanaur-2, Sanaur-4, Umran, and ZG-2. Three replications and a two-factor Randomized Block Design (RBD) were used to set up the experiment. Sampling dates and cultivars were considered as the treatments. Observations were made every two weeks over 11 sampling periods, which ranged from 28 to 168 days after full bloom (DAFB). In pooled data at 168 DAFB, Kalagola recorded the lowest pH (6.62), while Sanaur-2 recorded the highest (6.89). Sanaur-4 had the lowest amount of ascorbic acid (66.50), whereas Umran had the highest amount (83.55). Chhuhara had the highest total sugar level (9.31), while Umran had the lowest (7.55). Kalagola had the lowest lowering sugars (3.19), while Chhuhara recorded the highest (4.45). Non-reducing sugars were lowest in Umran (4.06) and the highest was in China (5.08). Chhuhara observed the lowest TSS: acid ratio (75.78) in Kalagola and the highest (138.38) in Kalagola. Therefore, the results suggest that the advanced ripening stage is the ideal time to harvest fruit for commercial processing or fresh consumption, and that matured ber could be used for naturally occurring antioxidants. These kinds of studies will assist breeders in developing new breeding programs, identifying promising cultivars for breeding, and determining the optimal harvest time for both home and foreign markets.

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Nutritive Value of Fenugreek (*Trigonella foenum-graecum* L.) Seed and Industrial Fenugreek Residue

R Yasothai

Veterinary University Training & Research Centre (TANUVAS), Erode-638004, India

E-mail: yasothairamalingam@gmail.com

A study was undertaken to evaluate the nutritive value of fenugreek seed and Industrial Fenugreek Residue. The evaluation was based on series of chemical analyses. A total of six fenugreek seed samples collected from different parts of Tamilnadu and six Industrial Fenugreek Residue (Fenumax[®]) samples received from E.I.D. Parry (India) limited, Cuddalore, Tamilnadu were analysed for chemical composition. The proximate composition and mineral composition were analysed as per the methods of AOAC. Total phenolics content in the samples were analysed by the Folin-Ciocalteu method. The composition (%) of fenugreek seed and Industrial Fenugreek Residue samples were crude protein (26.65 and 33.79), crude fibre (7.54 and 6.82), nitrogen free extract (57.10 and 46.48), neutral detergent fibre (38.52 and 18.47), acid detergent fibre (13.13 and 10.07), hemicellulose (25.38 and 8.40), calcium (0.33 and 0.37%), phosphorus (0.40 and 0.49%), zinc (39.94 and 49.36 mg/kg) and iron (30.96 and 43.52 mg/kg). The total phenolic content of fenugreek seed was 10.3 and Industrial Fenugreek Residue was 9.86 mg/g.

Keywords: Fenugreek, Industrial Fenugreek Residue, Nutritive Value, Minerals, Phenolics

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Dragon Fruit (*Hylocereus* spp.) as a Potential Crop for Nutraceutical properties, Livelihood Enhancement and Climate Change Mitigation

Utpal Das* and Mangalambika Balaji

Department of Horticulture and Food Science, VIT School of Agricultural Innovations and Advanced Learning, Vellore Institute of Technology, 632014, Tamil Nadu, India.

** Correspondence utpal.das@vit.ac.in*

Dragon fruit, scientifically known as *Hylocereus* spp. has emerged as a promising crop with the potential to address key challenges related to climate change and rural poverty. Its ability to withstand extreme environmental conditions, including drought and high temperatures, makes it particularly suitable for production in arid and semi-arid regions. Furthermore, its low water and limited resource requirements enhance its sustainability, rendering it an optimal choice for resource-constrained agricultural systems. Hence, this study highlights the economic significance and commercial viability of dragon fruit, emphasizing its role in the development of functional foods, nutraceuticals, and climate-resilient agricultural practices. Moreover, its integration into traditional farming systems presents opportunities for value addition, thereby contributing to both economic and environmental sustainability. Beyond its agronomic advantages, dragon fruit cultivation offers substantial benefits for smallholder farmers by ensuring profitability despite minimal resource inputs. Its high market value, coupled with its rich composition of bioactive compounds-including vitamins, minerals, and nutraceuticals-positions as a valuable crop with significant health benefits. These attributes show that dragon fruit holds considerable promise for future agricultural systems, aligning with global efforts toward sustainable food production and enhanced rural livelihoods.

Keywords Dragon fruit, Nutraceutical property, Livelihood, Climate resilience, Utilization

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Empowering Farmers Digitally: The Role of Social Media in Extension Services

Alka yadav¹ and Himanshi²

*1,2 Research Scholar, Department of Extension Education and Communication Management
I.C. College of Community Science, CCS HAU, Hisar 125004
alkay5797@gmail.com*

In today's digital world, social media is revolutionizing agriculture by bridging communication gaps and empowering farmers with instant, accessible information. With the increasing penetration of smartphones and internet connectivity, platforms such as WhatsApp, YouTube, Facebook and Twitter are playing a pivotal role in disseminating agricultural information, fostering innovation and connecting farmers directly with experts, extension personnel and markets. The study explores the growing influence of social media in promoting timely and need-based agricultural knowledge among farmers. Extension workers use online platform to answer questions, share tips and connect with more people at once and the farmers are learning more about crop practices, pest and disease control, weather updates, government schemes and market prices with the help of engaging content such as videos, infographics, live demonstration and online discussion. Therefore, social media allows two-way communication, making extension services more interactive and farmer-friendly. Along with the benefits, there are some challenges of using social media including digital illiteracy, misinformation, language barriers and unequal access to technology. Despite these limitations, social media complements traditional farming advisory services by enhancing their reach, speed and interactivity. The integration of social media into formal extension system makes it more effective and supportive. By harnessing the power of social media, we can build digitally empowered farming community i.e. informed, connected and resilient in the face of modern agricultural challenges.

Keywords: Social media, Digital agriculture, Communication, Innovation, empowerment.

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Spray Drying for the Encapsulation of Garden Cress Seed Oil and Production of Powder

Nile Shubhangi Gorakhnath

PhD Scholar, ICAR-Indian Agricultural Research Institute, New Delhi, 110012.

Nile Hemlata Gorakhnath

M.Tech scholar, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra.

Dhawale Shubham Namdev

PhD scholar, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra.

Lepidium sativum, commonly known as garden cress, is an annual herbaceous plant belonging to the Brassicaceae family. Garden cress seeds represent a significant source of both macro- and micronutrients. In the food industry, spray drying has emerged as a highly favored dehydration technique for the production of a broad spectrum of functional food ingredients, surpassing conventional drying methodologies. Spray drying is particularly advantageous for encapsulation due to its relative economic efficiency compared to alternative encapsulation techniques. Encapsulation of oils via spray drying is routinely employed to enhance oxidative stability, protect bioactive compounds, extend shelf-life, and mask undesirable organoleptic attributes. Moisture content is an important quality parameter in the evaluation of powder quality and shelf life of such product. Moisture content value ranged between 1.42 to 4.08 % (w.b.). The conditions of 166 °C inlet air temperature, 25 °B wall material concentration, and 87.5 mL.h⁻¹ feed rate resulted in the lowest moisture content (1.42% w.b.), while 140 °C inlet air temperature, 20 °B wall material concentration, and 112.5 mL.h⁻¹ feed rate resulted in the highest moisture content (4.08 % w.b.). The range of solubility for encapsulated garden cress seed oil powder was 72.35 to 91.65 %. The wettability of encapsulated garden cress seed oil powder ranged from 612 to 877 second. From the study, it was revealed that spray drying is the best way to encapsulate garden seed oil and produce powder.

Keywords: Spray drying, Encapsulation, Oils, Wall materials, Optimization.

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E-Portal for Real-Time Vegetable Price Tracking

***Rahul**

Department of Agricultural, Jagannath University, Jaipur-303901, Rajasthan, India

**Corresponding author e-mail: rahulduhan003inld@gmail.com*

The rapid digitization of agricultural markets presents an opportunity to enhance transparency and efficiency in the vegetable supply chain. This paper presents the design and implementation of an E-Portal dedicated to providing real-time information on vegetable prices. The portal serves as a centralized platform for farmers, wholesalers, retailers, and consumers to access up-to-date pricing data, facilitating informed decision-making and fostering fair market competition.

The E-Portal features a user-friendly interface with intuitive navigation and robust search functionalities, allowing users to browse vegetable prices by type, region, and date. Through seamless integration with diverse data sources including public APIs, agricultural databases, and direct supplier feeds, the portal aggregates comprehensive price information spanning a wide range of vegetables and geographical areas.

1. **Customizable Alerts:** Users can set up personalized alerts to receive notifications when prices for specific vegetables reach predefined thresholds, empowering them to capitalize on market opportunities and mitigate risks.
2. **Geographic Mapping:** Utilizing geospatial data, the portal offers interactive maps displaying price variations across different regions, thereby facilitating strategic sourcing and distribution planning.
3. **Historical Price Analysis:** The E-Portal archives historical price data, allowing users to analyze pricing trends over time and make data-driven forecasts for future market behavior.
4. **Real-time Price Updates:** The portal ensures timely dissemination of price updates, enabling stakeholders to monitor market trends and make informed pricing decisions.
5. **Secure User Authentication:** To safeguard data integrity and user privacy, the portal employs robust authentication mechanisms and encryption protocols, ensuring secure access to sensitive information.

The development of this E-Portal represents a significant advancement in agricultural technology, bridging information gaps and promoting transparency within the vegetable market ecosystem. By empowering stakeholders with actionable insights and fostering greater market efficiency, the E-Portal contributes to the overall sustainability and resilience of the agricultural sector.

Key words: E-Portal, Vegetable Prices, Market Transparency, Real-Time Data, Agricultural Technology, Decision Support System

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Fibrolitic Enzyme for better Utilization of Poor Quality Crop Residues as Livestock Feed

Suresh F. Nipane^{*1}, Sudhir B. Kawitkar², Atul P. Dhok³, Nitin V. Kurkure⁴, Sachin A. Mandavgane⁵ and Divyajyoti Biswal⁶

¹Livestock Development Officer, ²Professor & Head, Department of Animal Nutrition, ³Assistant Professor, Department of Animal Nutrition, Nagpur Veterinary College, Nagpur, ⁴Director of Research, Maharashtra Animal and Fishery Sciences University, Nagpur, ⁵Professor & Head, Department of Chemical Engineering, VNIT, Nagpur and ⁶PhD Scholar, Department of Chemical Engineering, VNIT, Nagpur

** Corresponding Author: dr_sureshvet12@rediffmail.com*

Enzymes are proteins that act as biocatalyst that accelerate the metabolism or chemical reaction in living body. Due to the complex linkages of fibre fractions of roughages are incompletely digested in the rumen. Usage of enzymes may aid in optimising the utilization of roughages in ruminant production systems. Fibrolitic enzymes are fungal or bacterial enzymes that improve the availability of nutrients through the cell wall. Fiber degrading enzymes added to animal diets have the potential to improve feed utilisation and animal performance. Xylanases and cellulases are ruminant feed enzyme additions that are extracted from bacterial or fungal fermentation and have specialised enzymatic activity. Improvements in animal performance by enzyme additions can be attributed mostly to improved ruminal fibre digestion, which results in more digestible energy availability. Animal responses are spursy when fiber digestion is compromised and when energy is the first-limiting nutrient in the diet. The response to feed enzymes has been variable in different species of animals due to anatomical variation in G.I. tract activities, characteristics of the enzymes and inappropriate method of providing the enzyme product to the animal. A limited number of ruminant enzyme products are now commercially available, although much progress has been made in advancing enzyme technology for ruminants. In the future, enzymes are expected to play important role in utilization of poor quality roughages in the ruminant diet.

Keyword: Cellulases, Fibrolitic enzymes, ruminant, xylanase

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Transcriptomics: A time Efficient Tool for Crop Improvement Against Drought Stress

Neetu ^{1*}and Preeti Yadav²

¹Assistant Professor and ²PhD scholar, College of Horticulture,
Banda University of Agriculture and Technology
*nitubhu2009@gmail.com

The common bean (*Phaseolus vulgaris* L.) is grown extensively in various regions, from low land tropical to semi-arid environment. As a legume, it is an abundant source of total protein, micro-nutrients, and energy. But due to climate change drought, being the most important environmental stress, severely impairs plant growth and development, limits plant production and the performance of crop plants, more than any other environmental factor. In the event of terminal or intermittent drought, common bean yield can be negatively affected by up to 60%, a loss that is only further worsened when soil moisture is reduced to 60 – 70% during grain filling. Studying drought responses in field condition at vegetative and reproductive stage is likely to contribute to a better understanding of the molecular mechanisms underlying drought responses and facilitate the development of effective drought mitigation strategies. Transcriptomics (RNA-Seq) has been extensively studied in a variety and provides critical insights into gene structure, expression, and regulation. Transcriptome can be defined as the total number of RNA molecules transcribed from a particular tissue or cell at a given functional or developmental stage, which includes mRNA (messenger RNA) and nc-RNA (non-coding RNA). They are referred to as “bridges” because they accurately manage the transport of genetic information from DNA to protein. Understanding transcriptomics thus enhances research with reference to the functions of cells, & tissues.

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Winter Rice Cultivation under Organic and In-organic System at South Kamrup area in Assam

Mukul Chandra Kalita

*Principal Scientist, Zonal Livestock Research Station
Assam Agricultural University, Mondira, Kamrup-781127, Assam*

Organic farming is also called as non-chemical natural farming; which rely largely on natural nutrients cycles, biological recycling, biological rejuvenation of natural nutrients cycles and promote usages on farm plant and Livestock based inputs. Whereas In-organic farming mostly uses chemical fertilizers, with the use of advanced machinery to achieve higher yields and minimizes labour cost. A field trial was conducted at ZLRS, Mandira during 2023 to know the effect of Organic, in-Organic relations on winter rice(cv-Ranjit). There were four treatments viz-T₁-Control, T₂-Organic under substances(Crop residues+8t/ha of F.Y.M.), T₃-(60-40-40Kg/ha of N,P₂O₅, & K₂O +5t/ha, F.Y.M.) and T₄-(50% In-Organic fertilizer dose i.e. 30+20+20kg/ha of N,P₂O₅ & K₂O +8t/ha, FYM.). Soil physico-chemical properties of the experimental sites were medium type of available N, High content of Potassium, Low to Medium content of Phosphorus with P^H-4.9. Soil texture was recorded as sand-24.30%, Silt-34.10% and Clay-29.02%. Plot size was 200m² replicated each trial thrice in the experimental site. Mean values were considered for analysis. Highest grain yield was recorded under the treatment T₄(58.65q/ha) followed by T₃(56.75q/ha), T₂(53.65q/ha) and T₁(45.86Q/ha). Similarly, highest straw yields were also recorded under the treatment T₄(65.15q/ha) followed by T₃(61.16q/ha), T₂(58.45q/ha) and T₁(52.18q/ha). A combination of Organic and In-organic fertilizer sources recorded highest grain and straw yield of Winter rice(cv-Ranjit) at ZLRS, Mandira(T₄-treatment). This is because of higher availability and uptake of NPK nutrients by the rice plant as compared to rest of the treatments. Presently, the cost of fertilizers has been increased and their availability may also be limited in some places. In such condition, use of Organic sources of fertilizers viz-FYM, Compost, Crop residues, Vermicompost together with 50% synthetic fertilizers in rice cultivation will definitely solve some problems of farmers.

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Role of Women in Ensuring Food and Nutrition Security

Patel Ritu A.¹, Patel Tejasvini ², Dr.R.V Thakkar ³,

¹Student, Department of Agricultural Extension and Communication, Navsari Agricultural University,
Navsari, Gujarat 396450

²Student, Department of soil Science , Navsari Agricultural University, Navsari, Gujarat 396450

³ Assistant Research Scientist, S.D Agricultural university, Sardarkrushinagar Gujarat 385506

Corresponding author's Email: patelrituben5@gmail.com

Globally, addressing food and nutrition security (FNS) has been a longstanding priority due to widespread hunger and malnutrition. Recently, there has been increased recognition of the crucial role women play in ensuring family FNS through discreet, family-centered activities. However, in many countries, women still lack the necessary legislative authority to control land and financial resources. Women, across all landholding categories, predominantly use "Bhagona" and pressure cookers to preserve food's nutritive value. Pressure cookers have become popular due to their time-saving, fuel-efficient, and nutrient-preserving attributes; contributing to increased awareness in rural areas. Achieving FNS involves providing adequate diet, clean water, sanitation, and healthcare. Despite global efforts, hunger persists, particularly in Africa, South Asia, and parts of Latin America. Empowering women is crucial for eradicating under nutrition in the developing world. Poverty and malnutrition, while often linked, do not always coexist simultaneously, highlighting the influence of women and their control over resources within households. Studies show that undernourished children may be found in non-poor households, emphasizing the need for women's empowerment in addressing malnutrition. Effective economic development, raising the income of the poor, can significantly reduce malnutrition rates by empowering women and addressing the complex interplay between poverty and nutrition. In the quest for FNS, recognizing and addressing the unique role of women is paramount to achieving meaningful and sustainable progress.

Keywords: Food security, Cooking methods, land holding, Economic development, Malnutrition

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Fruit Begging - A Modern Method for Fruit Quality Improvement

Rupa Ujjwal, Anju Yadav and Dr. Prerak Bhatnagar

Department of Fruit Science, College of Horticulture and Forestry, Jhalawar (raj.)

(Agriculture University, Kota)

Email – rupaujjwal9530@gmail.com

Several good agricultural practices (GAP) are becoming popular throughout the World to produce high-quality fruit with less dependence on man-made chemicals. Among such practices, pre-and post-harvest fruit bagging has emerged as an effective method. Bagging is a physical protection method which not only improves the visual quality of fruit by promoting skin colouration and reducing blemishes but can also change the micro-environment for fruit development, which can have several beneficial effects on internal fruit quality

Fruit bagging is a widely adopted technology in modern fruit production, offering numerous benefits such as reduced pest and disease damage, improved fruit quality and appearance, and increased marketability. By protecting fruits from environmental stressors and pests, bagging enhances yield and profitability while reducing chemical usage. This technology has revolutionized fruit production, enabling growers to produce high-quality fruits that meet consumer demands. Fruit bagging affects colour, size and weight, maturity, appearance and other physio-chemical attributes. Pre-harvest bagging can be one of the possible approaches to produce quality fruits. There is a lot of scopes to exploit the pre-harvest bagging technology in quality fruit production as it improves postharvest quality attributes without having any adverse influence on the physical, biochemical and nutritional attributes of fruit.

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Animal / Veterinary Sciences and Climate Change & its Approaches for Climate Change Mitigation

Gaurav Singh and Dr. Deepak Chaturvedi

*Krishi Vigyan Kendra Jaisalmer, S.K. Rajasthan agriculture University
Corresponding author email- Singhgaurav660@gmail.com*

Livestock keeping in India has a long history, spanning thousands of years, and plays a crucial role in the relationship between local ecosystems, livestock breeds, and human communities. Around 21% of India's land is made up of common property resources (CPRs) like gochars and orans, which are essential for feeding livestock in rain-fed, arid, and semi-arid areas. These regions mainly depend on CPRs for fodder, as only one crop can usually be grown each year due to limited rainfall during the monsoon. Traditional livestock systems are vital for food and nutritional security, especially for women and children. They provide important resources like meat, milk, manure, and draught power in places where growing crops is difficult, such as the Himalayan pastures and the Thar Desert. Local livestock breeds have adapted well to their environments. Breeds from nomadic communities, like the Gaddi and Raika, can travel thousands of kilometers each year to find good grazing land. Research shows that these indigenous breeds have lower metabolic rates, helping them survive better in drought conditions compared to high-performance exotic breeds, which tend to struggle during times of feed shortage. In India, there is a significant shortage of dry fodder, green fodder, and for concentrates. Indigenous breeds, such as *Bos indicus*, are known for their heat tolerance and disease resistance. For example, Sahiwal cattle can handle ticks and blood parasites better than many exotic breeds, and native Nari cattle in Rajasthan show low susceptibility to diseases. However, these traditional livestock systems face growing threats from development pressures and changing land use policies. Many grazing lands are now labeled as 'wastelands' and are being converted for bio-fuel production or industrial use. This shift, along with the weakening of traditional management practices, puts the livelihoods of pastoralists at risk. It is essential to protect the genetic diversity of local livestock breeds and their ecosystems to ensure sustainable agriculture and food security in India. Recognizing and safeguarding CPRs is vital for maintaining traditional livestock systems, which support the livelihoods of millions of pastoralists throughout the country.

Keywords: CPRs; Gaddi; Raika; Wastelands, Land use policies.

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The Role of Gene Editing in Enhancing Agricultural Productivity and Sustainability

Mukesh Bhakal

Plant Breeding & Genetics, mukeshbhakal02@gmail.com

SKN College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Jaipur 303329

Gene editing has emerged as a revolutionary tool in modern agriculture, offering solutions to some of the most pressing challenges, including food security, climate change, and sustainable farming practices. By making precise modifications to an organism's DNA, gene editing technologies such as CRISPR-Cas9 enable scientists to develop crops that are more resilient, nutritious, and high-yielding.

Enhancing Crop Productivity: One of the primary benefits of gene editing is its ability to improve crop yields. Traditional breeding methods take years to develop desirable traits, whereas gene editing accelerates the process by directly modifying specific genes responsible for growth, disease resistance, or drought tolerance. For example, scientists have successfully used gene editing to enhance wheat's resistance to fungal infections and improve rice's tolerance to flooding, ensuring stable food production even in challenging environmental conditions.

Improving Resistance to Pests and Diseases: Farmers worldwide struggle with crop losses due to pests and diseases, leading to heavy reliance on chemical pesticides, which can harm ecosystems. Gene editing allows the development of pest-resistant crops, reducing the need for chemical interventions. For instance, scientists have modified tomatoes to resist bacterial infections and engineered bananas to withstand Panama disease, a devastating fungal infection. These advancements contribute to a reduction in pesticide use, benefiting both the environment and human health.

Boosting Nutritional Value: Another significant advantage of gene editing is its potential to enhance the nutritional profile of crops. Scientists have developed bio fortified crops such as tomatoes enriched with vitamin D and rice with increased levels of vitamin A to combat malnutrition. These innovations provide healthier food options, particularly in regions where deficiencies in essential nutrients are prevalent.

Promoting Environmental Sustainability: Gene editing supports sustainable agriculture by reducing the need for chemical fertilizers and pesticides while improving water-use efficiency. Crops engineered for drought tolerance can thrive in arid conditions, reducing the strain on water resources.

Conclusion: Gene editing holds immense promise for transforming agriculture by enhancing productivity, increasing resilience to environmental challenges, and promoting sustainability. As research progresses and regulatory frameworks evolve, gene-edited crops could play a crucial role in ensuring global food security while minimizing the ecological footprint of agriculture.

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Enhancing Plant Resilience through Grafting: A Sustainable Solution to Abiotic Stress Tolerance

Sadhana Kongala

Department of vegetable science, research Scholar

Sri Konda Laxman Telangana Horticulture University, Mulugu, Siddipet, Telangana

Grafting has emerged as a promising strategy for enhancing plant resilience to various abiotic stressors, such as salinity, drought, heavy metals, nutrient deficiencies, and extreme temperatures. These stressors can cause ion toxicity, osmotic imbalance, metabolic dysfunction, and damage to plant membranes. Grafting, using rootstocks or scions with superior genotypes, mitigates these stress-induced damages, ultimately boosting plant stress tolerance, growth, and development. Studies have shown that grafting improves salt tolerance in plants by regulating osmotic substances like proline, soluble carbohydrates, and inorganic ions (K^+ , Na^+ , Cl^-), reducing ion uptake, and counteracting salt's harmful effects. For example, grafted cucumber plants, when paired with salt-tolerant pumpkin rootstocks, exhibited improved root systems, higher nutrient uptake, and better access to phosphorus, despite similar root areas compared to non-grafted seedlings. The rootstocks also promoted the accumulation of osmoregulatory compounds, such as proline, and boosted antioxidant enzyme activities, reducing oxidative damage from salt stress. In environments with high salinity, grafted cucumber and tomato plants showed enhanced antioxidant enzyme activity, helping them cope with salt-induced damage. Moreover, pumpkin rootstocks enhanced the sensitivity of grafted plants to abscisic acid (ABA), promoting rapid stomatal closure and reducing water loss during salt stress, further enhancing salt and drought tolerance. Grafting has also been found effective in improving plant resilience to waterlogging and poor light conditions, as demonstrated by watermelon and eggplant grafted onto various rootstocks. These grafted plants exhibited better nutrient uptake, water-use efficiency, and tolerance to extreme temperatures. Overall, grafting has proven to be a valuable tool in mitigating the impacts of abiotic stresses on plants, with potential applications in sustainable agriculture, particularly under challenging environmental conditions. Further research is needed to fully understand the mechanisms underlying grafting-induced stress tolerance (Wenjing and Dan 2023).

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Antibacterial and Phytochemical Study of Medicinal Plant *Datura Stramonium*

Himani Sharma^{a,*}, Dr.J.Anuradha^b

Nims University, Jaipur, Rajasthan

Department of Biotechnology , Nims Institute of Allied Medical Sciences and Technology

**Corresponding author's email address: j.anuradha@nimsuniversity.org*

Datura stramonium, commonly known as Jimsonweed and thornapple , is a well-known medicinal plant belonging to the Solanaceae family. The family possesses 85 genera and over 2,800 species. It has been traditionally used for its medicinal properties in various cultures to treat diseases. The whole plant is antiseptic, narcotic, sedative and is useful for asthma. The plant contains bioactive compounds like alkaloids, flavonoids, terpenoids and phenolic compounds, which have shown antimicrobial and therapeutic effects. However, the full potential of *Datura stramonium* in terms of antibacterial activity and phytochemical composition has not been thoroughly explored. This research aims to investigate the antibacterial and phytochemical properties of *Datura stramonium* to provide scientific evidence of its traditional medicinal uses.

Objective: To evaluate the antibacterial activity of *Datura stramonium* leaf against common pathogenic bacteria and to analyze the phytochemical components present in the plant, including alkaloids, flavonoids, phenolics, and other secondary metabolites.

Method used: The study was conducted by preparing aqueous and solvent-based extracts from the leaves of *Datura stramonium* which is collected from jaipur rajasthan area. The antibacterial activity was done by using the agar well diffusion method against Gram-positive bacteria (e.g., *Staphylococcus aureus*) and Gram-negative bacteria (e.g., *Escherichia coli*). Phytochemical screening was performed using standard qualitative tests to identify the presence of alkaloids, flavonoids, tannins, saponins, and phenolic compounds. The results were compared with standard antibiotics to evaluate the effectiveness of the plant extracts.

Results: The results demonstrate that the extracts of *Datura stramonium* exhibited significant antibacterial activity, with the highest inhibition observed against Gram-positive bacteria. Phytochemical analysis revealed the presence of alkaloids, flavonoids, tannins, glycoside and phenolic compounds, which are likely responsible for the observed antibacterial effects.

Conclusion: *Datura stramonium* shows considerable potential as an antibacterial agent, supported by its diverse phytochemical profile. This study provides scientific validation for its traditional medicinal use, particularly in treating microbial infections. Further research is required to isolate and identify the specific compounds responsible for these effects and to explore their clinical applications.

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Climate Change Impact on Indian Food Security

Piyush Choudhary^{*1}, Hargilas², D. P. Singh³ and Vikas Kumar⁴

¹Research Associate, Agricultural Research Station, Directorate of Research, MPUAT, Udaipur

²Professor & ZDR, Agricultural Research Station, Directorate of Research, MPUAT, Udaipur

³Assistant Professor, Department of Soil Science and Agricultural Chemistry, RCA, MPUAT, Udaipur

⁴Agromet Observer, Agricultural Research Station, Directorate of Research, MPUAT, Udaipur

**Correspondence author's email: piyushdudi@gmail.com*

Climate change is a serious threat to global food security, sustainable development and poverty eradication. India is among the countries which are at the greatest risk of food insecurity due to weather extreme caused by climate change. To feed the growing global population, and to provide the basis for economic growth and poverty reduction, agriculture must undergo a considerable transformation. Climate change has added to the enormity of India's food security challenges. While the relationship between climate change and food security is complex, most studies focus on one dimension of food security, i.e., food availability. This paper provides an overview of the impact of climate change on India's food security. This task will be made more difficult by climate change. More extreme weather events and an increased unpredictability of weather patterns have already made an impact on agriculture and food security, leading to production reductions and lower incomes in vulnerable areas. In spite of the considerable progress made during the last several decades in reducing hunger, as of 2015 almost 800 million people are chronically undernourished. An estimated 161 million children under five years are stunted. At the same time, 500 million people are obese. Two billion people lack the essential micronutrients they need to lead healthy lives. FAO estimates that, to satisfy the growing demand driven by population growth and dietary changes, food production will have to increase by 60 percent by 2050. To tackle food loss and waste and manage flood and drought risks. The farmers have distribution of improved, drought-tolerant seeds, more efficient irrigation, and expanded use of forestry for farming and conservation agriculture techniques. The farmers more sustainably manage their land and brought more sustainable farming practices.

Keywords: climate change and food security

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Integrated pest management strategies of *Bt* cotton: A Review

Satappa Kharbade, S. G. Biradar, S. T. Aghav, U. K. Kadam

Bt cotton, genetically engineered to express *Bacillus thuringiensis* (*Bt*) toxins, has revolutionized pest management by providing resistance against major lepidopteran pests, particularly bollworms. However, the sustainability of this technology is threatened by the emergence of resistance in target pests and secondary pest outbreaks. Integrated Pest Management (IPM) approaches are crucial to prolong the efficacy of *Bt* cotton and ensure sustainable cotton production. This review highlights key IPM strategies, including refuge management, biological control, cultural practices, and judicious chemical pesticide use. The role of host plant resistance, agronomic practices, and advances in biotechnology, such as RNA interference (RNAi) and gene pyramiding, are also discussed. A multi-faceted approach incorporating these strategies is essential for effective pest suppression, resistance management, and environmental conservation. The integration of digital tools and precision agriculture further enhances IPM effectiveness, ensuring long-term sustainability and economic viability of *Bt* cotton cultivation.

Keywords: *Bt* Cotton, Integrated Pest Management, Biological control, Cultural Practices, Sustainability

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Integrated pest management strategies of Soybean : A Review

Shruti Biradar, S. B. Kharbade, S. T. Aghav, U. K. Kadam

*Department of Entomology, Post Graduate Institute, Mahatma Phule Krishi Vidyapeeth,
Rahuri-413722, Dist-Ahilyanagar, Maharashtra, India.*

Soybean (*Glycine max* L.) is a globally significant crop, contributing to food, feed, and industrial applications. However, its production is threatened by various insect pests, pathogens, and weeds, leading to significant yield losses. Integrated Pest Management (IPM) is a sustainable approach that combines biological, cultural, mechanical, and chemical control methods to minimize pest damage while reducing environmental and economic costs. This review explores various IPM strategies for soybean, including resistant cultivars, crop rotation, intercropping, biological control using beneficial organisms, and the judicious application of pesticides. Emphasis is placed on the role of precision agriculture and biotechnological advancements, such as genetically modified (GM) soybean varieties, in enhancing pest resistance. Additionally, the review discusses challenges in implementing IPM, including resistance development and policy constraints, while proposing future research directions. Adoption of holistic IPM strategies is crucial for sustainable soybean production, ensuring long-term agricultural productivity and environmental conservation.

Keywords: Soybean, Integrated Pest Management, Biological Control, Crop Rotation, Pest Resistance, Sustainable Agriculture

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Climate-Smart Breeding: Developing Crops for Carbon Capture and Environmental Sustainability

Akshaya Murali^{1*} and Muhilan Mahendhiran²

¹ *Department of Genetics and Plant Breeding, Annamalai University, Chidambaram-608002, Tamil Nadu, India.*

² *Faculty of Agriculture, Vivekananda Global University (VGU), Sector 36, NRI Colony Rd, V I T Campus, Jagatpura, Jaipur -303012, Rajasthan, India.*

Corresponding author : akshayamurali2008@gmail.com*

The dual challenge of ensuring global food security and mitigating climate change requires innovative strategies in agricultural science. Excessive emission of greenhouse gases and impacts of climate change necessitates various innovative strategies to ease the raising level of atmospheric carbon dioxide. Climate-smart breeding emerges as an evolutionary approach that integrates genetic improvement with environmental sustainability. This strategy focuses on developing crop varieties that not only adapt to changing climatic conditions but also actively contribute to carbon sequestration, thereby playing a pivotal role in climate change mitigation. Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide with a goal of reducing global climate change, plays a pivotal role in minimizing the levels of greenhouse gases. Important breeding goals include traits that boost biomass production, enhance root structure, improve photosynthetic efficiency, and increase soil organic carbon levels. Crops with deep roots and high root-to-shoot ratios, better interactions with beneficial soil microorganisms, and perennial growth patterns are considered some of the most promising options for enhancing belowground carbon storage. By integrating these traits into breeding programs, long-term carbon sequestering capacity of agricultural systems can be enhanced without sacrificing the crop yield. Recent advancements in the field of genomics, high-throughput phenotyping, and data-driven selection tools have accelerated the identification and manipulation of carbon-relevant traits. Along with the system-level understanding of plant-soil-microbe interactions, climate-smart breeding enables the development of ideotypes tailored for both productivity and ecological impact. Adopting these crops in traditional farming systems paves way for a considerable reduction in agriculture's carbon footprint. By integrating such approaches into existing crop improvement programs supports the transition to climate-resilient and low-emission agriculture.

Keywords: Climate-smart breeding, carbon sequestration, carbon footprint, greenhouse gases, high-throughput phenotyping, genomics.

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Building Climate-resilient Agriculture: Integrating Organic Practices for Drought-tolerant Cropping Systems

¹Kulveer Kaur, ²Tayshi Tolma ³Harpreet Kaur

*¹²³Department of Agronomy, Punjab Agricultural University Ludhiana, Punjab, 141004, India
Email- kulveer-2105015@pau.edu*

The global food security is seriously threatened by the rising frequency and severity of droughts. Agriculture that is climate-resilient is essential for overcoming these obstacles. This review investigates how cropping systems can become more drought-resistant by using organic agriculture methods. Composting, cover crops, mulching and intercropping are examples of organic agricultural practices that support biodiversity, soil health and water retention. These strategies provide a strong defense against climate variability when paired with crop varieties that can withstand drought and effective water management. In order to promote sustainable agriculture in the face of climate change, this study examines important mechanisms, case studies and policy implications.

Keywords: Climate resilient, drought, Organic

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Formulation and Quality Evaluation of Multi-millet Buns

Devadarshini C.^{1*}, Sahoo B.¹, Sahoo S. S.², Chhotaray S.³ Jena D.⁴ and Swain S. S.⁵

¹Dept. of Food and Nutrition, College of Community Science, Odisha University of Agriculture and Technology, Bhubaneswar, India

²Ph.D. Research Scholar, Dept. of Food Science and Nutrition, ASPEE College of Nutrition and Community Science, SDAU, Sardarkrushinagar, Gujarat, India

³Dept. of Food and Nutrition, College of Community Science, Odisha University of Agriculture and Technology, Bhubaneswar, India

⁴Dept. of Food and Nutrition, College of Community Science, Odisha University of Agriculture and Technology, Bhubaneswar, India

⁵ Dept. of Planning, Odisha University of Technology and Research, Bhubaneswar

*Corresponding author email: chitrotpalad.fn@ouat.ac.in Contact: 8280079986

Millets are one of the cheapest and most nutritious choices for bakery products due to their low glycaemic index and higher nutritive value in terms of micronutrients, fibre and phytochemicals. Finger millet, barnyard millet and little millet were taken in different proportions separately with wheat flour like T₀ (00:100), T₁ (10:90), T₂ (20:80), T₃ (30:70), T₄ (40:60) and a mixture of all three millets and wheat flour were prepared in the ratio like B₁ (5:5:5:85), B₂ (10:10:10:70), B₃ (15:15:15:55), B₄ (20:20:20:40). Organoleptic evaluation was done in all the products by using nine-point hedonic rating scale. The most accepted multi-millet buns and control (T₀) were kept in poly propylene packaging and sugar cane pulp plate-wrap separately for shelf-life study. Standard AOAC methods were followed to analyze the proximate and mineral composition of the treatments. T₂, T₃ varieties of finger millet buns and barnyard millet buns; T₁, T₂ varieties of little millet buns and mixed millet buns were found to have higher nutritional composition in terms of total total ash, crude fibre, crude fat, calcium, iron and phosphorous as compared to control. The most accepted multi-millet buns and control (T₀) varieties had a shelf life of three days within an acceptable range in both poly propylene packaging and sugar cane pulp plate-wrap with a better organoleptic value in poly propylene packaging. Incorporation of millets and carrot in bun enhanced its overall nutritional value.

Key words: Bun, Millet, Nutritional composition, Organoleptic evaluation, Shelf-life

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Reviving Soil and Sustaining Livelihoods: The Role of Organic Farming in Achieving Agricultural Sustainability

Niharika mandala^{1*}, Uttej Dubany², Sruthi Rangali

^{1*} *Ph.D Scholar, Department of Soil Science and Agricultural Chemistry, PJTAU, Hyderabad*

² *Senior Research Fellow, ICAR-ATARI, Hyderabad*

³ *Young Professional – II, ICAR-ATARI, Hyderabad*

Corresponding author - niharikamandala654@gmail.com

The pressing challenges of environmental degradation, soil fertility loss, and unsustainable input use in conventional agriculture have underscored the need for more ecologically balanced farming systems. Organic farming emerges as a promising approach that aligns closely with the principles of sustainable agriculture, emphasizing soil health, biodiversity, resource efficiency, and socio-economic equity. This paper explores the potential of organic farming as a transformative pathway toward long-term agricultural sustainability.

Drawing upon field-level observations, empirical data, and case studies from diverse agro-ecological zones, the presentation evaluates how organic farming enhances soil structure and fertility through natural amendments, green manuring, crop rotation, and reduced chemical dependency. It further investigates the role of organic practices in improving farm resilience to climate variability and reducing greenhouse gas emissions. The integration of traditional knowledge with modern scientific insights has resulted in context-specific innovations that not only preserve ecological integrity but also offer viable economic returns to smallholder farmers.

Additionally, the paper analyzes market trends, certification challenges, and policy gaps that affect the scalability of organic agriculture. It highlights successful models of farmer cooperatives, participatory guarantee systems (PGS), and government-supported schemes that have contributed to organic adoption at the grassroots level.

The study concludes that while organic farming is not a one-size-fits-all solution, it represents a vital component in the broader strategy for sustainable agriculture. With appropriate support systems, knowledge dissemination, and institutional frameworks, organic agriculture can significantly contribute to food security, climate resilience, and rural livelihoods.

This presentation aims to initiate a critical dialogue on integrating organic principles within mainstream agricultural development strategies and calls for a multi-stakeholder approach to promote organic farming as a cornerstone of sustainable agriculture.

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Characterising Histological Subtypes and Prognostic Markers in Diagnosing Canine Mammary Tumours

Vikas Galav, Alka Galav, Manish Agrawal and Rohitash Dadhich

**Presenter, Department of Veterinary Pathology, PGIVER, Jamdoli, Jaipur-302031 (Raj.)*

E-mail: vikasgalav@gmail.com

Canine mammary tumours (CMTs) are of great interest to cancer researchers and represent a significant clinical problem in intact female dogs. Interestingly, CMTs have also been used as model of comparative oncology to study human breast cancer for its marked biological and clinical similarities. Prognosis is a key challenge in clinical intervention of CMTs and to understanding their pattern in any geographical area, data on incidence, histological classification and molecular typing serves as baseline in providing future prognostic advisories. Looking to the severity and frequency of the CMTs and emergent need to validate prognostic indicators and improve upon therapeutic approach, this study was carried out in dogs of Jaipur to histopathologically evaluate and classify various CMTs, investigating sex steroid receptor and molecular grading using Er, PR and HeR2 expression. Total of 114 CMT cases were recorded and mean age of dogs with CMTs were 9.5 ± 3.8 years, however mean age for benign and malignant CMTs was 7.7 ± 1.7 years and 11 ± 2.3 years, respectively. All CMTs were in females (100%) of which 6 were neutered and 108 were intact. Highest CMTs were from inguinal (33.3%) followed by caudal abdominal (29.8%) and cranial abdominal (21.9%) glands. Histologically, highest incidence was of malignant CMTs (59.6%) followed by benign (34.2%) and hyperplastic /dysplastic lesions (6.1%). Duct ectasia and lobular hyperplasia were prominent hyperplasia/dysplasia changes, while fibroadenoma (23.1%), ductal adenoma and lipoma were most common benign CMTs. Among malignant subtypes, ER+/PR+ expressing were (51.5%) highest in numbers, while among those with difficult prognostic potential like ER+/PR- (11.8%), ER-/PR+ (10%) and ER-/PR- (22%) also were increased substantially, indicating higher risk. All malignant CMTs were also molecular subtyped and outcome was graded as luminal A (ER+/PR+/HeR2-) (54.5%), luminal B (ER+/PR+/HeR2+) (18.3%), HeR2 expressing (ER-/PR-/HeR2+) (12.7%) and triple negative (ER-/PR-/HeR2-) (14.5%).groups. In lumina-A subtypes, 13.3% were E-cadherin negatives, while E-cadherin negative cases in Luminal-B, HeR2 expressing, triple-negative subtypes were, 20%, 57.1% and 62.5% respectively associating E-cadherin negative cases to higher invasiveness and poor prognosis. Ki67, a proliferation marker was also studied and 20.5% of benign, 95.6% of malignant tumours were Ki67 positive. Among PR- subtypes, 50% of benign and 95.6% of malignant CMTs were Ki67 positive. This study provides first step towards better visualization and understanding of occurrence of canine mammary tumours in Jaipur. Using both classification into histotypes and molecular phenotypic grading, presents a fascinating scenario that brings along strong rationale for discovering, developing or establishing therapeutic approaches that could either be patient-specific or even tumour-specific, in future veterinary oncology practice.

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Regulation of AQP's in Buffalo Mammary Glands: An Immunolocalization and Gene Expression Comparison with Subclinical and Clinical Mastitis

Fathima Jasmin A.T¹ and Sunita Meena²

¹*Ph.D. Research Scholar, Laboratory of Biofunctional Peptidomics & Metabolic Syndrome (BPMS-150), Animal Biochemistry Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India*

e-mail id: fathimajasmuni@gmail.com

²*Senior Scientist, Animal Biochemistry Division, ICAR- National Dairy Research Institute, Karnal, Haryana, India*

e-mail id : sunitameena1188@gmail.com

Aquaporins (AQP) are a family of channel proteins that promote the transport of water and small molecules across the cell membrane. Aquaporins are extensively expressed in the body, especially in tissues engaged in fluid transport. Certain research indicate that many aquaporin proteins are found in mammary glands. The expression of AQPs in the mammary gland is proposed to facilitate milk dilution in order to sustain an isotonic solution. AQP 1, 3, 4, 5, 7, and 9 have been documented at the mRNA level in the lactating mammary glands of rats and mice. Mastitis imposes a significant economic strain on milk supply, leading to large losses in the livestock industry. This study utilized somatic cells obtained from buffalo milk samples classified as healthy, subclinical, and clinical mastitis. The principal objective of this work was to examine the control of aquaglyceroporins within the cell under these conditions. The findings highlight the significance of aquaporins (AQPs) in water homeostasis within the mammary glands and demonstrate how mastitis disrupts this equilibrium by down-regulating certain AQPs. The outcomes demonstrate a desire to utilize AQPs, as diagnostic indicators of mastitis and effective targets for disease management and improving milk production in affected animals.

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Effect of the Unmanned Aerial Vehicle Spray Volume and Height on Droplet Distribution, Spray Drift and Weed Control Efficiency in Groundnut Crop

Chandana Mudigiri^{a*}, RamPrakash T. ^b, Jayasree G ^a, Padmaja B. ^b, and Latha P.C. ^c

^aDepartment of Soil Science and Agricultural Chemistry, College of Agriculture, PJTAU, Rajendranagar, Hyderabad, Telangana - 500 030, India.

^bAICRP on Weed Management, PJTAU, Rajendranagar, Hyderabad, Telangana - 500 030, India.

^cICAR - Indian Institute of Rice Research, Rajendranagar, Hyderabad, Telangana - 500 030, India.

Unmanned aerial vehicles (UAVs), as emerging plant protection machinery, have the advantages of high operational efficiency, high speed, and low drift. The current study aimed to elucidate the characteristics of droplet distribution and drift, weed control efficiency in groundnut during UAV spraying. This study is expected to pave the way for the use of UAV sprayers for accurate herbicide application on groundnut crops. A two year field experiment in 2022-23 and 2023-24 was designed at RARS Palem, Telangana, using a factorial randomized block design with application of the imazethapyr 3.75% + propaquizafop 2.5% ME (Ready mix) as a herbicide with UAV at two spray volume (25 and 40 L ha⁻¹) and spray height (2.0 and 2.5 m) to know the influence of the dose, spray height and volume on the droplet distribution were discussed in this study. UAV with XR11002VP nozzle was used as a spray tool and water sensitive paper was used as the droplet test card. This two year investigation revealed that droplet size VMD (0.5) was affected by the dose of the herbicide, spray volume, and height of the spray. A significantly lower droplet size was observed under the low dose of the herbicide (161µm, 176µm), lower spray volume (171 µm, 175 µm), and higher height of herbicide application (174 µm, 184 µm) in 2022-23 and 2023-24. % Coverage varied between 5.62 to 7.16 % and 6.22 to 7.23% and droplet density (10.09 to 20.52 and 10.73 to 20.57 no. cm⁻²) in 2022-23 and 2023-24. Highest drift % was observed at 0.75X of the herbicide dose (16.23%, 16.35%), 25 L ha⁻¹ spray volume (13.52 %, 13.53%) and 2.5 m height of the spray (13.50%, 13.50 %, 13.35 %) in 2022-23 and 2023-24.

Keywords: Droplet size, density, % coverage and % drift.

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Pollen Characterization of Common Weeds of Amaranthaceae in the Agricultural Fields of Nizamabad district of Telangana State

Chaya Pallati*

Palynology and Paleobotany Research Laboratory, Dept. of Botany, University College of Science, Saifabad, Osmania University, Hyderabad-500004, Telangana State, India.

**Email: pallati.chaya@gmail.com*

The present work is aimed to study the pollen morphology of weed plants of Amaranthaceae by light microscopy (LM). Polleniferous material of eight weed plants viz., *Achyranthus aspera*, *Oureta lanata*, *Amaranthus spinosus*, *Amaranthus blitum*, *Amaranthus viridis*, *Chaenopodium album*, *Amaranthus graecizans*, *Digera arvensis*, *Celosia argentea*, *Gomphrena serrata* and *Alternanthera sessilis* was collected from agricultural tracts of Nizamabad district of Telangana state, India during 2022-2023.. The pollen slides were prepared by using Erdtman's acetolysis technique (1960). The characteristics of pollen shape, symmetry, apertural pattern, and the exine surface ornamentation was studied. Apertural pattern of these eleven genera is **pantoporate**. Pollen surface ornamentation is indicated by **scabrate** ornamentation in *Achyranthus aspera*, *Oureta lanata*, *Amaranthus spinosus*. **psilate** ornamentation is observed in *Alternanthera sessilis*, *Digera arvensis*. **Granular to coarsely granular** is observed in *Amaranthus blitum*, *Amaranthus graecizans*. *Amaranthus viridis*, *Celosia argentea*, *Chaenopodium album*, **lophoreticulate** observed in *Gomphrena serrata*. **The highlighted pollen characteristics are useful for distinguishing between species of Amaranthaceae weeds found in agricultural areas.**

Keywords: Weed flora, Amaranthaceae, Light microscope, Pollen morphology, Nizamabad district, Telangana.

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Indigenous Knowledge Systems and Community Resilience in Organic Farming

Marwan Reddy Chinnam

*M.Sc. Scholar, Department of Agriculture, Vivekananda Global University, Jaipur, Rajasthan, India.
Email: marwanreddy@gmail.com | Phone: +91-9448360512*

Long before the invention of synthetic fertilizers or the rise of monocultures, agriculture flourished in the hands of those who listened to the land, observed the skies, and trusted the wisdom of nature. Indigenous knowledge systems, rooted in spiritual symbiosis and ecological awareness, were the original architects of sustainable farming. This paper explores how these timeless traditions continue to empower communities, foster organic resilience, and offer answers to the environmental and food security challenges of our time. In the past, seeds were sacred, seasons were teachers, and every farming act was a dialogue with the earth. These knowledge systems—holistic, context-specific, and community-driven—enabled people to farm in rhythm with their ecosystems. Today, amidst climate change, soil degradation, and the erosion of rural identities, these ancient practices are re-emerging with renewed relevance. Farmers across India—from the seed keepers of Odisha to the organic warriors of Sikkim—are reviving ancestral wisdom to restore soil health, crop diversity, and community solidarity. This paper presents a "Living Heritage and Resilience Framework," which integrates indigenous practices with participatory innovations, local governance, and knowledge digitization. It envisions a future where traditional farmers are not seen as backward but as visionaries of a regenerative era, capable of leading the transition toward food sovereignty, ecological harmony, and cultural renewal. As we shape the future of agriculture, we must look backward with gratitude and forward with responsibility—drawing strength from the stories, songs, and soil-bound wisdom of our elders.

"When the wisdom of the old meets the vision of the new, every seed saved by tradition becomes a spark for a resilient revolution—and the soil remembers, and begins to heal."

Keywords: Indigenous Knowledge, Organic Farming, Community Resilience, Traditional Wisdom, Agroecology, Living Heritage, Seed Sovereignty, Ecological Harmony, Rural Empowerment, Climate Resilience, Regenerative Future, Bio-cultural Rights, Food Sovereignty, Sustainable Agriculture

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Agriculture, Horticulture and Forestry: Pathways, Extension Strategies and Approaches

Manisha Sharma

*Ph.D. Research Scholar, Department of Extension Education and Communication Management,
College of Community Science, SKRAU, Bikaner, Rajasthan
Email: mannni14.sharma@gmail.com*

Agriculture, horticulture, and forestry remain the cornerstone of rural livelihoods, food security, and ecological balance, especially in developing nations. The integration of these sectors with home sciences, community sciences, and life sciences has become critical in addressing multifaceted challenges such as climate change, nutritional insecurity, sustainable resource management, and socio-economic upliftment of rural populations.

Home Science, often regarded as the science of a home and family, encompasses key areas such as nutrition, textiles, family resource management, child development, and extension education. It contributes significantly to building healthier societies through improved dietary practices, effective child care, and better household management. In rural and semi-urban areas, home science interventions like kitchen gardening, food preservation, and income-generating activities have proven to be highly effective in empowering women and enhancing nutritional security.

Community Science, with its people-centric approach, emphasizes participatory development, social empowerment, and capacity building at the grassroots level. It supports the creation of inclusive communities by addressing issues such as public health, gender inequality, livelihood generation, and sustainable resource use. Community-based programs that involve Self-Help Groups, Anganwadi workers, and local NGOs are vital channels through which knowledge is disseminated and behavioral change is promoted.

Life Sciences, which include biology, microbiology, physiology, and environmental science, provide the foundational understanding of living organisms and the ecosystems they inhabit. The convergence of life sciences with home and community sciences has opened new frontiers in nutrition science, health care, sanitation, and environmental sustainability.

In conclusion, Home Science, Community Science, and Life Sciences are not just academic disciplines but are powerful tools for social transformation. Their holistic and practical approach contributes significantly to national development goals and global sustainable development targets. This conference provides an important platform to discuss forward-looking strategies, interdisciplinary collaborations, and community-based innovations for a healthier, more equitable, and sustainable future.

Keywords: Home Science, Community Science

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IPM in fruit production: A Holistic Approach to Sustainable and Resilient Agriculture

Anjali Pandey¹, R.N. Yadav², Somdutt Tripathi³

*Research Scholar¹, Professor², Department of Agricultural Extension Education,
SVPUAT, Meerut, U.P.*

*Research Scholar³, Department of Agricultural Extension, BUAT, Banda, U.P.
Corresponding Mail ID – anjoopandey2612@gmail.com*

Integrated Pest Management (IPM) in fruit production represents a holistic and ecologically sound strategy aimed at achieving sustainable and resilient agricultural systems. IPM integrates a range of practices - biological control, cultural methods, mechanical tools, and the selective use of chemical pesticides to manage pest populations in an economically viable and environmentally friendly manner. One of the key benefits of IPM is the significant reduction in pesticide residue levels on fruits, which enhances food safety and meets both domestic and international quality standards. By prioritizing preventive and non-chemical control methods, IPM reduces the frequency and volume of pesticide applications, making pest control more cost-effective over the long term. This strategic reduction in input costs contributes to higher profit margins for fruit growers without compromising crop health or yield. IPM contributes to reducing chemical-induced stress on plants, and preserving beneficial organisms. The emphasis on environmentally responsible practices under IPM also leads to reduced soil and water contamination and the preservation of biodiversity. Government interventions have played a critical role in promoting IPM through policy frameworks, farmer training programs, subsidies for biocontrol agents, and support for research and extension services. These initiatives have accelerated the adoption of IPM practices, especially among small and medium-scale fruit growers, enhancing both environmental sustainability and rural livelihoods. In the context of climate change and increasing pest pressures, IPM provides a resilient and adaptive framework for pest management, ensuring food security and environmental health. Thus, IPM in fruit production is not only a cost-effective solution but also a cornerstone for achieving sustainable and resilient agriculture.

Keywords: Integrated Pest Management (IPM), fruit production, pesticide residue, cost-effective management, fruit quality, government interventions, sustainable agriculture.

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Association Mapping and Population Structure Studies for Yield Attributing Traits in field pea (*Pisum sativum* L.)

Amit¹, Ravika²

¹Ph.D. Student, ²Assistant Professor, Department of Genetics and Plant Breeding, CCS Haryana
Agricultural University, Hisar- 125004, Haryana, India

*Corresponding author e-mail: ravika.sheoran@hau.ac.in; Contact no.: +919991301420

The inadequacy in the genomic studies and presence of narrow genetic base in Indian field pea genotypes provides a mean for stagnancy in the yield as well as a bottleneck in the quest for breeding improved cultivars. In this research study, 150 diverse field pea genotypes were screened using 174 SSR markers to assess genetic diversity among genotypes, population structure and detecting genomic regions associated with different yield contributing traits. The PIC values of SSRs studied ranged from 0.25 (CEDG 037) to 0.87 (CEDG 030) with an average of 0.56. The most discriminative and informative SSRs were CEDG 030 (0.87), CEDG 014 (0.87), CEDG 149 (0.86), VrCS SSR 3 (0.81) and CEDG 147 (0.81). Population structure revealed three subpopulations at a maximum likelihood value of $\Delta K=3$ with low genetic differentiation as evident by high admixture. Overall, low genetic variation was observed. Reasons for such results suggested that the studied genotypes may have common ancestral history at some level exhibiting limited gene flow and diversity. Linkage disequilibrium patterns and distributions are of fundamental importance for genome-wide mapping association. The R^2 value above 0.3 between marker pairs was considered to be in LD and there were 101 marker pairs having the R^2 value of above 0.3. Association analysis was performed with two different approaches, the general linear model (GLM) incorporating the Q-matrix only and the mixed linear model (MLM) including also the kinship-matrix. Association analysis revealed that twenty-four marker-trait associations were present significantly for seven traits viz., anthocyanin at grain filling, normalized difference vegetation index at grain filling, number of pods/plant, plant height, relative water content at flowering, hundred seed weight and seed yield/plant by GLM (Q) method and seven marker-trait associations were found significant for two seed yield related traits viz., number of pods/plant and seed yield/plant by MLM (Q+K) method. Through MLM association analysis, SSR marker 620 was found to be associated with number of pods per plant. Therefore, after QTL validation this SSR marker 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

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Nutritional Studies in *Populus deltoids* with Aromatic Crops in Uttar Pradesh, India

Afreen Mohsin

Ph.D scholar, Forest Research Institute, Dehradun, India
e-mail: mohsinafreen54@gmail.com

Quantity of litterfall, its chemical composition (NPK), nutrient addition, changes in soil chemical constituents of soil along with standing state and nutritional storage in standing vegetation and magnitude of re-translocation (%) and uptake of nutrients after re-translocation were studied under agroforestry systems involving *Populus deltoids* intercropped with *Mentha arvensis* and poplar as pure plantation (without intercrops) at farmers field in District Rampur, UP, India, under juvenile age group (2 and 3 years) and old age group (5 and 6 years) plantations of *Populus deltoides*.

Poplar trees intercropped with *Mentha arvensis* produced higher quantity of litter (t/ha/yr) than pure poplar (without intercrops). Total addition of nutrients (kg/ha/yr) was also found highest in Poplar intercropped with *Mentha arvensis* than pure poplar. As the age increases, nutrients addition through litterfall also increases. Similar pattern of NPK was recorded in standing state of nutrients (Kg/ha) in Poplar at all the age groups of plantation intercropped with *Mentha arvensis* and also in pure poplar plantation. While going through the studies of NPK storage (kg/ha) in standing vegetation, it was found that poplar intercropped with *Mentha arvensis* recorded higher than pure poplar plantation. NPK storage in standing vegetation was found much higher in old age plantation than juvenile age plantation group. But, In available NPK (kg/ha) content of soil was found maximum in pure poplar plantation.

Magnitude of re-translocation (%) of NPK in pure poplar as well as in intercropped with aromatic crops (*Mentha arvensis*), increased with increasing ages of the stands. Uptake of nutrients (kg/ha/yr) was found maximum in intercropped with *Mentha arvensis* and minimum was in sole poplar plantation at all the age groups of poplar plantation. Similar pattern of uptake of NPK (kg/ha/yr) after re-translocation was found in poplar plantation.

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Menthol Mint (*Mentha arvensis* L.)- A Suitable Intercrop under Agroforestry System in North Indian States

Afreen Mohsin and Faiz Mohsin*

Forest Research Institute, Dehradun, U.K
SVBPUA&T, Meerut, U.P
mohsinafreen54@gmail.com

Menthol mint (*Mentha arvensis* L) can be taken as an intercrop under agroforestry system. It is a suitable combination for the states like U.P. Punjab, Tarai of Uttarakhand and Haryana. It is being grown as a profitable crop under poplar plantations. Based on the field observations and interaction with the farmers, It has been observed that at a distance of 5 X 4 m or 4 X 3 m block plantation the mint varieties like shiwalik or Koshi gives an additional return of Rs 1,50,000 to 2,30,000/ ha/ year during the initial years. During the Later years too a reasonable income can be generated provided the poplar plants are pruned to the desired extent. The most important factors for better growth and yield is the irrigation and nutrient management. Both the crops as a common factor requires plenty of irrigation during hot summer month. The system besides giving good returns also improves soil fertility as a lot of root bio-mass of mentha and more litter fall of poplar trees increases the total quantity of residue added in to the soil. The poplar trees intercropped with menthe have more diameter and height in comparison to trees planted as sole plantation.

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Plant-Based Functional Foods: Current Trends, Key Ingredients, and Future Perspectives

Mangalambika Balaji, Utpal Das

Email Id – Mangalambika.b2023@vitstudent.ac.in

Plant-based functional foods have received significant attention in recent years due to their health benefits and roles in sustainable food systems. This review closely examines the current trends shaping consumer preferences, the main bioactive compounds present in plant based ingredients, and the technological innovations driving their development. Additionally, it critically analyses challenges related to sensory qualities, bioavailability, and regulatory issues. Case studies of commercially available successful products are presented, followed by an exploration of emerging trends such as innovative ingredients and the integration of artificial intelligence in the creation of functional foods. The review concludes by emphasizing the need for ongoing research and innovation in this field to meet the growing demand for sustainable and health-promoting food.

Keywords: Functional foods, bioactive compounds, encapsulation, fermentation

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Sustainable and Nutritious Food

Vikash Kumar Meena

*M.Sc. Scholar, Department of Agronomy, Vivekananda Global University, Jaipur, Rajasthan
Email: vikasshmeena02@gmail.com*

The global demand for sustainable and nutritious food sources has intensified the focus on functional foods and bioactive compounds in food science and nutrition. This study explores the nutritional potential and health benefits of underutilized plant-based ingredients with an emphasis on their antioxidant activity, dietary fiber content, and bioavailability of micronutrients. The objective was to evaluate the physicochemical properties and nutritional composition of selected indigenous grains and legumes and assess their potential as functional food ingredients. Samples of amaranth, finger millet, and cowpeas were analyzed for macronutrient content, mineral profile, and phytochemical properties using standard laboratory methods. Results indicated that these crops are rich in dietary fiber, iron, calcium, and polyphenols, which are known to contribute to improved metabolic health and reduced risk of chronic diseases. Furthermore, *in vitro* digestion models demonstrated moderate to high bioavailability of iron and calcium, suggesting their potential contribution to addressing micronutrient deficiencies in vulnerable populations. Sensory evaluation of value-added food prototypes incorporating these ingredients—such as gluten-free snacks and fortified porridges—revealed high consumer acceptability, particularly when enhanced with natural flavoring agents. The study concludes that the inclusion of these underutilized crops in food systems can significantly enhance nutritional quality and support dietary diversification. Promoting their consumption and integration into food product development can contribute to food security and public health, especially in regions facing nutritional challenges. Further research on large-scale processing methods and long-term health outcomes is recommended to maximize their impact in nutrition-sensitive interventions.

Keywords: Functional foods, Indigenous grains, Bioactive compounds, Dietary fiber, Micronutrient bioavailability, Nutritional composition

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Navigating Global Trade Challenges in Vegetable Markets

Sadhana kongala

*Department of Vegetable science, Sri Konda Laxman Telangana Horticulture University
Mulugu, Siddipet, Telangana*

Global trade in vegetable crops is facing an evolving landscape marked by economic challenges and shifting market dynamics. The interplay between supply chain disruptions, climate change, labor shortages, and geopolitical tensions has significantly impacted vegetable crop production and distribution. Recent trade policies, such as tariffs and trade agreements, continue to reshape global markets, influencing both producers and consumers. The COVID-19 pandemic exacerbated existing vulnerabilities in the agricultural sector, leading to delays in transportation, market closures, and fluctuating demand. These disruptions have highlighted the need for more resilient and flexible supply chains. Moreover, the economic viability of vegetable farming in developing nations is often threatened by volatile market prices, limited access to advanced technology, and insufficient infrastructure.

The growing demand for organic and sustainably produced vegetables, particularly in developed markets, presents both opportunities and challenges for producers worldwide. However, the transition to more sustainable agricultural practices requires investments in soil health, water management, and eco-friendly pest control, which can be cost-prohibitive for small-scale farmers. Additionally, climate change continues to affect crop yields and quality, making it harder for producers to predict and meet market demands.

To address these challenges, recent studies suggest that digital technologies, such as blockchain for traceability, and precision agriculture tools can enhance supply chain efficiency and reduce costs (Liu et al., 2023). Furthermore, regional trade agreements and collaborative policies focusing on food security and agricultural sustainability are essential to building a more robust global vegetable crop market.

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Pathways and Extension Strategies for Mathematical Approaches to Sustainable Agriculture, Horticulture and Forestry

Dr. Neeru Bala

Department of Mathematics, Dayanand College, Hisar-125001
Affiliated to Guru Jambheshwar University of Science and Technology, Hisar
neerubala@dnc.ac.in

Mathematical resources act as vital components in designing sustainable agricultural practices across all farming sectors along with forestry operations and horticulture domains. Resource optimization and decision-making quality together with productivity enhancement happen when multiple sectors use unified mathematical models with optimization methods and statistical approaches. Advance forecasts connecting crop development plus pest behaviour and soil well-being and forest systems originate from mathematical models which help organizations set decisions and allocate resources. Scientific researchers create solution methods for managing water scarcity together with land degradation and environmental changes which result from these processes. Mathematical models lead to highest production yields through simulations that support eco-friendly business operations. Extensive implementation approaches create the essential pathway for scientific discoveries to reach field operations through field-to-lab bridging methods. Practitioner and farmer education about data-based methods allows innovative dual-purpose practices to spread across farms through combined economic and environmental advantages. Through mathematical solutions these major industrial areas can maintain sustainability and operational resilience while increasing efficiency at the agriculture horticulture and forestry production levels.

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Speed Breeding: An Innovative Strategy for Accelerated Crop Improvement in Vegetable

Dhaneshvari Arya¹, Balraj Singh¹, Bajrang Kumar² Raju Yadav¹

¹ *Department of Horticulture, Sri Karan Narendra Agriculture University,
Jobner-303329, Rajasthan, India*

² *Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University,
Varanasi, 225001*

Email. Id: - arya081998@gmail.com

The growing human population and changing environment have raised significant concern for global food security, with the current improvement rate of several important crops inadequate to meet future demand. This slow improvement rate is attributed partly to the long generation times of crop plants. Speed breeding, which greatly shortens generation time and accelerates breeding and research programmes. Speed breeding can be used to achieve up to 6 generations per year for spring wheat (*Triticum aestivum*), barley (*Hordeum vulgare*), chickpea (*Cicer arietinum*) and pea (*Pisum sativum*) and 4 generations for canola (*Brassica napus*), instead of 2–3 under normal glasshouse conditions. I demonstrate that speed breeding in fully enclosed, controlled-environment growth chambers can accelerate plant development for research purposes, including phenotyping of adult plant traits, mutant studies and transformation. The use of supplemental lighting in a glasshouse environment allows rapid generation cycling through conventional breeding and potential for adaptation to larger-scale crop improvement programs. Cost saving through light-emitting diode (LED) supplemental lighting is also outlined. We predict great potential for integrating speed breeding with other modern crop breeding technologies, including high-throughput genotyping, genome editing and genomic selection, accelerating the rate of crop improvement. In future the use of speed breeding can accelerate the development of high performing cultivars with market-preferred traits by reducing the amount of time, space and resources invested in the selection and genetic advancement of superior crop varieties. The technique will allow plant breeders to deliver improved crop varieties more rapidly.

Key words- Speed breeding, breeding cycle, photoperiod and growth accelerating.

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One Health in Action: Tackling Livestock and Poultry Health Challenges

Prasanna Godbole^{1*} and Anjali Arya ²

¹*Department of Veterinary Pharmacology and Toxicology, M. B. Veterinary College,
(RAJUVAS) -314001 (Rajasthan), India*

²*Department of Livestock Production Management, M. B. Veterinary College,
(RAJUVAS) -314001 (Rajasthan), India*

**corresponding author: drprasannagodbole@gmail.com*

The One Health approach recognizes the interdependence of human, animal, and environmental health, offering a collaborative strategy to tackle zoonotic diseases, particularly in livestock and poultry sectors. In India, where these sectors are central to food security and livelihoods, intensive farming and weak biosecurity heighten disease risks. One Health supports integrated surveillance, outbreak response, and antimicrobial resistance (AMR) mitigation through initiatives like the National One Health Program and collaborations among ICAR, ICMR, and MOHFW. This review highlights the approach's role in controlling diseases such as brucellosis and avian influenza, while addressing AMR linked to antibiotic misuse in animal agriculture. Despite its promise, challenges remain—including sectoral silos, limited funding, weak surveillance, and workforce gaps. Strengthening inter-sectoral coordination, policy support, and community engagement is essential for success. Embracing One Health ensures sustainable animal health management, protects public health, and fosters ecological resilience against emerging health threats.

Keywords: One health, zoonotic, AMR, program and public health.

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Organic Farming with Residue-Free Production

Manda Sai Krishna, Babu Lal Choudhary

*M.Sc. Research Scholar, Department of Agriculture, Vivekananda Global University-VGU,
Jaipur, Rajasthan*

*Assistant Professor, Department of Agriculture, Vivekananda Global University-
VGU, Jaipur, Rajasthan
mandasaikrishna123@gmail.com*

Organic farming is a method of growing crops using a natural method without the use of synthetic chemicals and giving importance to safety and sustainability. Residue-free organic farming is a new method that helps to maintain food safety without compromising environmental sustainability. Overall, it focuses on getting the final agricultural product free from harmful chemical Residues. In traditional organic farming, there are a bit chances of having residues from natural inputs like animal manure, Natural pesticides. But in residue-free organic farming, it completely removes all chemical residues. This technique helps to control weeds through integrated weed management and also maintains organic insect control with resulting in better soil fertility and good productivity without contamination. Major practices in residue-free organic farming are using bio-pesticides, Microbial yoga, Green manure, and precision agriculture techniques. It helps to restore soil health and also promotes biodiversity and residue reliance on artificial inputs. The new technology, like AI and LOT is also supports monitoring systems with better use of resources and regulations for residual-free standards. Performing residue management is also one of the techniques for residue-free organic farming, like instead of burning crop residues or letting them to go to waste, organic farmers are compost them. These practices are called composting and recycling. These help to avoid harmful residues and create a safe environment for crops and a balanced farm ecosystem. With the help of residue-free organic farming, marketing advantages there to be resulting in high demand for chemical-free organic products. The combination of new advanced technology in agriculture and continued improvement of organic farming can change the traditional method to be better in the supply of healthy and safer food for consumers and less environmental damage. The future of organic farming rests on the ability to achieve purity, Productivity, and residue.

Key Words: Organic farming, Residue-free, Natural methods, Chemical residues, Bio-pesticides, Biodiversity, Composting, Recycling, Monitoring systems.

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Evaluation of Anti-inflammatory, Antimicrobial and Antioxidant Properties of Isolated Phenolic Compounds from Papaya peel of Red lady Variety

Roshni A.S¹ and Lubaina A.S*

P G & Research Department of Botany, Christian College Kattakada, Thiruvananthapuram, Kerala, India.

Email- roshnimisha95@gmail.com.

In recent decades, polyphenols have gained popularity owing to their potential benefits to human health resulting from their significant bioactivities. Papaya peels promises natural bioactive compounds. Four (04) phenolic compounds named syringic acid (compound 1) , epicatechin (compound 2) , vanillic acid (compound 3) and cinnamic acid (compound 4) were isolated from papaya peel of red lady variety through repeated column chromatography and thin layer chromatography (TLC). In order to study the potentialities of isolated phenolic compounds the antimicrobial assesment such as antibacterial and antifungal analysis were carried out. Antifungal activity by well diffusion method against selected fungal strains *Candida albicans*, *Aspergillus niger*, *Rhizopus stolonifer* and *Fusarium oxysporum* and the antibacterial activity by Minimum inhibitory concentration (MIC) macro broth dilution method against selected bacterial strains *Klebsiella pneumoniae*, *Echerichia coli*, *Staphylococcus aureus* and *Bacillus subtilis*. The isolated phenolic compound 4 named cinnamic acid showed highest antimicrobial activities against all the tested fungal and bacterial strains followed by epicatechin, vanillic acid and syringic acid.

In view of the pharmacological interest in phenolic compounds, the antioxidant potentialities such as FRAP, DPPH, hydrogen peroxide (H₂O₂) radical scavenging activity and superoxide radical scavenging activity were performed. Among the four (04) phenolic compounds , epicatechin showed highest antioxidant activity in FRAP and DPPH assay followed by syringic acid, vanillic acid and cinnamic acid. In H₂O₂ radical scavenging activity cinnamic acid exhibited significant radical scavenging activity followed by syringic acid, epicatechin and vanillic acid and in superoxide radical scavenging assay cinnamic acid showed highest radical scavenging activity followed by vanillic acid, epicatechin and syringic acid. The levels of pro-inflammatory enzymes such as cyclooxygenase (COX), lipooxygenase (LOX), myeloperoxidase (MPO) and inducible nitric oxide synthase (iNOS) were evaluated. The isolated flavonol named epicatechin showed increased anti-inflammatory activity followed by syringic acid , vanillic acid and cinnamic acid. The present study highlights the useful benefits of isolated phenolic compounds from papaya peel as a natural source of anti-inflammatory, antimicrobial and antioxidant agents. Hence the thrown away papaya peel waste displays great potential for the formulation of new functional value added products.

Keywords : Papaya peel ; phenolic compounds; syringic acid, epicatechin, vanillic acid, cinnamic acid, anti- inflammatory activity, antimicrobial activity, antioxidant activity.

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Ploughing Device for Problematic Soil

Suryansh Shishodia and Ramesh Abhishek

Faculty of Agricultural Sciences, SGT University, Gurugram

Corresponding author's email: ranasuryansh55@gmail.com

ramesh_fasc@sgtuniversity.org

Problematic soils are soils having such physical, chemical & biological conditions which make them unsuitable for plant growth. Such soils are characterized by high salinity, increased acidity or alkalinity and poor drainage. Problematic soils can significantly hinder crop growth and yields by reducing nutrient availability uptake and increasing salt mobility. For this reason, the invention of a plough for problematic soil with enhanced functioning is designed to construct residue-filled shallow sub-surface drainage using surface crop residue. This instrument will diagnose the soil condition, like the concentration of different salts in the soil and crops that can be easily cultivated on such land. The structure of the device comprises a cuboidal unit equipped with a pair of vertical rods (tractor-mounted machine) that can conveniently move on the farmers' field. Multiple horizontal sliders are attached at the bottom periphery of the cuboidal unit facing the ground. Farmers can benefit from this instrument as it will optimize salt load, increase soil strength and efficiency and improve cultivation practices. A GPR sensor is attached to the device to determine the salinity in the soil. It is a technology-driven plough that can increase crop yield, enhance crop productivity, and help improve soil health by providing knowledge about different beneficial operations. The calibration and validation part for this equipment will be performed, and the outcomes will be taken into account consecutively.

Keywords: Problematic soil, Ploughing device, Drainage, Salinity

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Pollination Management in Fruit Orchard: Understanding the Role of in Productivity

Chandrashekhar Ogare, Vinay Sahu, Nikhil Gupta

Research Scholar, Department of Fruit Science

Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg (C.G.)

Email –Shekharogare02@gmail.com

Importance of pollination management in fruit orchards, emphasizing its critical role in improving fruit production. Pollination, often misunderstood, plays a vital part in ensuring fruit set and development, especially in crops that require cross-pollination. The presentation examines different mechanisms of pollination, including self and cross-pollination and discusses the various factors that affect successful pollination, such as climatic conditions, the role of pollinators and the spatial arrangement of pollinizers within orchards. Case studies on crops like mango, citrus and apples highlight specific pollination challenges and solutions, such as introducing honeybee colonies or optimizing planting plans for better pollination efficiency. The conclusion underscores the necessity of integrating pollinizers in orchards and the importance of conserving pollinators for sustainable fruit production. Pollination means transfer of viable pollen from mature anther to receptive stigma. Flowers are fully dependent on vector to move pollen. These vectors may be wind, water, birds, butterflies, bats and other animals that visit flowers. An abundance of pollinators sets a greater proportion of early flowers, results in an earlier and more uniform crop with higher quantity as well as quality of fruit. Insects contribute between 15% and 30% of global food production. honey bees are primary pollinators for the majority of the worlds.

Keywords: Cross pollination, Fruit orchard, Pollination management,

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ICT-enabled Market Linkages and Value Chain Development for Organic and Natural Farming Products

Priya.V¹, Vanathi D², Dr. Shijaatt Hussain Bhat³

^{1&2}MSc Research Scholar, Division of Agriculture Extension and Communication, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, J&K – 193 201, India.

³Assistant Professor, Division of Agriculture Extension and Communication, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, J&K – 193 201, India

Presenting Author Email: Karthiickvembadiyan@gmail.com

This study examines how information and communication technology (ICT) might improve value chain development and market connections for natural and organic farming goods. ICT enables farmers to make well-informed decisions about planting, harvesting, and selling their crops by giving them real-time access to market data, including pricing, demand, and weather trends. The study emphasizes how ICT, through e-commerce platforms and mobile applications, enables direct contacts between farmers and buyers, cutting out middlemen and boosting market transparency. Additionally, it talks about how ICT can increase supply chain traceability and efficiency by using tools like block chain and Internet of Things devices to keep an eye on manufacturing conditions. It is stressed that building a strong value chain for natural and organic goods is a means of boosting farmer income, enhancing food security, and creating a sustainable agriculture industry. The report highlights important prospects for ICT applications like e-Choupal and Farmer Friend, which can propel the expansion of organic farming, notwithstanding obstacles like digital literacy, infrastructure and want for legislative assistance. This study emphasizes how important it is to integrate ICT into agriculture in order to promote a more lucrative and sustainable food system. This study examines how information and communication technology (ICT) might improve value chain development and market connections for natural and organic farming goods.

Keywords: Value chain development, market connections, e-commerce platforms, mobile applications, supply chain traceability.

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Propagation Structures used in propagation and nursery management of Fruit Crops

Chandrashekhar Ogare, Vinay Sahu, Nikhil Gupta

Research Scholar, Department of fruit Science

Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg (C.G.)

Email – Shekharogare01@gmail.com

Propagation structures play a vital role in fruit crop production by providing controlled environments that enhance plant establishment, growth, and yield. Various structures, including greenhouses, cold frames, hotbeds, mist propagation units, tissue culture labs, shade houses, and propagation trays and domes, are used to optimize conditions for rooting, budding, and early growth. Efficient propagation and nursery management are critical components of fruit crop production. Fruit crop production faces significant challenges due to environmental variability, disease susceptibility, and increasingly complex market demands. Specialized propagation structures offer a viable solution, enabling growers to control environmental factors, enhance plant establishment, and improve yield quality.

Keywords: Climate resilience, Controlled environment, Fruit production, Propagation structures.

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Reference Evapotranspiration Assessment for Sangli District: A Comparative Study of Empirical Methods and CROPWAT 8.0 Model

Komal G. Rokade¹, Ravindra D. Bansod²

¹Ph.D Research Scholar, Department of Soil & Water Conservation Engineering, Dr. ASCAET, Mahatma Phule Krishi Vidyapeeth, Rahuri, District – Ahmednagar, Maharashtra, India (413722)
²Associate Dean, Dr. ASCAET, Mahatma Phule Krishi Vidyapeeth, Rahuri, District – Ahmednagar, Maharashtra, India (413722).

Optimizing agricultural output requires effective management of water resources, particularly in areas with limited water supplies. One important metric for determining crop water needs and enhancing irrigation scheduling is reference evapotranspiration (ET₀). This study uses the CROPWAT 8.0 model, which uses the FAO-recommended Penman-Monteith equation, and fourteen empirical approaches to estimate ET₀ for Sangli district, Maharashtra. We gathered and examined historical meteorological data, such as air temperature, relative humidity, wind speed, sun radiation, and precipitation. Stephens-Stewart, Hargreaves-Samani, Jensen-Haise, Schendel, Abtew, and others are among the empirical techniques that have been assessed. Regression coefficients (R²), slope, and intercept values were compared to the Penman-Monteith estimations in order to evaluate their effectiveness.

The study's findings show that, albeit with notable differences, all fourteen empirical approaches produced ET₀ estimations that were credible. The Schendel approach had the best accuracy among all, closely matching the Penman-Monteith estimates with a slope of 1.5388 and an intercept of -0.5799. The Hargreaves-Samani approach produced a slope of 0.8663 and an intercept of -0.214, indicating good performance. The Jensen-Haise method's predictive dependability was confirmed by the fact that it had the highest regression coefficient. The accuracy of other techniques, including McGuinness and Bordne (slope = 0.2616), Temperature Radiation (slope = 0.2970), and Global Radiation (slope = 0.1149), varied. The regression study also shown that in situations where comprehensive meteorological data is not available, empirical methods can be effective substitutes.

The results highlight how crucial it is to choose suitable ET₀ estimation techniques depending on local climate variables in order to guarantee precise irrigation planning. Additionally, the study highlights how well the CROPWAT 8.0 model estimates crop water requirements. In order to increase the accuracy of ET₀ predictions and water resource management plans in arid and semi-arid areas, future studies should investigate the integration of remote sensing data and machine learning approaches.

Keywords: Reference evapotranspiration, CROPWAT 8.0, empirical methods, Penman-Monteith, irrigation planning, water resource management.

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Fruit Crop Monitoring Using Remote Sensing: Enhancing Production Efficiency and Sustainability

Chandrashekhar Ogare, Vinay Sahu, Nikhil Gupta

Research Scholar, Department of Fruit Science

Mahatma Gandhi Udyanikee Evam Vanikee Vishwavidyalaya, Durg (C.G.)

Email – Ogaredocs01@gmail.com

The use of remote sensing technology in fruit production has significantly advanced agricultural practices by enabling precise monitoring and management of orchards. The application of remote sensing across various stages of fruit crop management, including assessment of crop health, yield estimation, pest detection, and land suitability analysis. platforms such as satellite, airborne, and ground-based systems, coupled with advanced sensors like multispectral and hyperspectral cameras, have proven effective in optimizing inputs such as irrigation and fertilizers, as well as detecting disease and environmental stress. The integration of GIS and GPS further enhances the spatial analysis and mapping capabilities necessary for precision horticulture. Government initiatives like CHAMAN and FASAL also demonstrate the growing importance of remote sensing in supporting large-scale fruit crop development and sustainable agricultural practices.

Keywords: Fruit production, GIS, GPS, Multispectral sensors, precision horticulture, Remote sensing.

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A Novel System for Crop Management – Using Drones

Sanjitha S¹, Rajeev Kumar²

¹M.Tech Scholar, ²Scientist.

Division of Agricultural Engineering, ICAR – IARI, New Delhi

Corresponding Author Mail Id : sanjithasenthilvel@gmail.com

Agriculture is a crucial sector, contributing to nearly one-third of India's Gross Domestic Product and serving as a primary livelihood source for a significant portion of the population. Farmer's annual income largely depends on crop yields, which have been steadily declining due to various factors. One such factor is crop damage caused by birds. Studies have identified 63 species of birds from 19 different families that affect various crop types in India. Specifically, 52 bird species have been linked to cereal crop damage, 14 to pulses, 15 to oilseeds, and 23 to fruits, often causing significant losses. (Chavda et al., 2023). In case of fruits, for instance, birds are estimated to damage about 30% of the total annual production (Cheol et al., 2016). A study in New York quantified bird-related crop damage in apple orchards, vineyards, blueberry fields and sweet cherry farms as 2.3%, 3.6%, 22%, and 26.8% respectively amounting to an annual financial loss of \$6.65 million (Henrich et al., 2013). A novel Unmanned Aerial Vehicle (UAV, more commonly referred to as drone) system incorporating bird psychology was introduced for efficient bird damage control. The UAV is equipped with a loud speaker broadcasting distress calls, as well as a crow taxidermy installed on the undercarriage that appears as captured prey. This special UAV configuration is designed to engage birds' well-established abilities to learn to recognise and avoid novel predators, thus providing the benefit that a long-term fear response towards the UAV can be expected. Results indicated the UAV can deter large pest birds such as ravens and cockatoos in a 50-metre radius centred on the UAV for an extended period of time. The UAV can also effectively deter small pest birds such as silvereyes for brief time periods. It is also evident from the results that while one UAV is sufficient to protect vineyards smaller than 25 hectares, multiple UAVs are needed to protect a large vineyard effectively.

Key words: Birds, Crop damage, Distress call, Psychology, UAV.

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Emerging Technologies for Protecting the crops from birds - A Review

Sanjitha S¹, Rajeev Kumar²

¹M.Tech Scholar, ²Scientist.

Division of Agricultural Engineering, ICAR- IARI, New Delhi – 110012

Corresponding Author Mail Id :sanjithasenthilvel@gmail.com

In India, agriculture serves as the primary source of income for approximately 70% of rural households and contributing 18.2% to GDP of the country. (Economic survey, 2023-2024). Despite its critical economic and social role, agricultural productivity remains challenged by several factors, one of which is crop damage caused by birds (Riya et al., 2020). Changes in land use patterns leading to the loss of natural habitats. So many birds are well adapted to living on crops, have significantly increased in number and have become pests (Baral et al., 2019). The economic losses caused by birds were unquantifiable. Farmers have traditionally used various methods to deter birds, yet these approaches typically offer only limited relief from crop damage. To tackle this problem, advanced bird management technologies have been created to detect birds, alert the farmer, and trigger a reflex action to divert the birds. The systems are designed to regularly monitor the field for birds intrusion. They utilize various sensors, such as infrared and ultrasonic sensors, to detect bird movement and send a signal to the system's controller. Then the controller takes reactive measures, such as emitting loud sounds or laser lights, to draw the bird's attention away from the crops. This helps to prevent birds from damaging the fields. The major challenge in existing bird scaring systems is the rapid behavioural adaptation of birds. A study in Gwalior reported that a single automated laser system effectively reduce damage to farmer's sweet corn crop by 80 to 85%. (Shakshi et al.2021). Drone based device "Helikite" reduces crows damage from 19.1% to 4.2% in sprouting corn fields. (Santilli et al.2014). The review infers that interventions are still needed to reduce the crop damage without harming the birds.

Key words: Birds, Crop Damage, Economic loss, Repelling, Sensors.

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Role of Organic Farming for the Sustainable Agriculture in the Cold Desert Ladakh

Jigmet Yangchan

School of Agriculture Science and Technology University of Ladakh
jigmetchan@gmail.com

Land degradation, poor soil quality are major threats to our food and environmental security and the extent of degradation is more pronounced in rainfed regions, with larger soil erosion, loss of fertile soil, organic matter, nutrients and beneficial microbes. Falling yield trends in various crop production systems in India is a serious concern. Environmental degradation is a major threat confronting the world, and the rampant use of chemical fertilizers contributes largely to the deterioration of the environment through depletion of fossil fuels, generation of carbon dioxide (CO₂) and contamination of water resources. Keeping under consideration organic techniques in cogent and easily understandable manner which provide a win win solution to tackle the problems discuss above. In this chapter discussed through study of different organic techniques used under Ladakh condition, to improve soil health, soil fertility and enhance the crop productivity for sustainable agriculture in the Cold Desert Ladakh.

Key words: Degradation, Organic matter, Nutrients, Chemical fertilizer, Water Resources

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Vegetables: A New Age of Nutraceutical Power

Shaily Purohit¹, M.K. Sharma², Dhaneshvari Arya¹

¹Department of Horticulture, Sri Karan Narendra Agriculture University, Jobner-303329,
Rajasthan, India

²College of Agriculture, Kumher, Bharatpur, Rajasthan, India, 321201
Email Id:-purohitshaily15@gmail.com

Due to nutritional imbalances, billions of people around the world suffer from undernourishment and poor health. A diet rich in vegetables offers numerous benefits, including higher levels of phytonutrients and nutraceuticals. These secondary metabolites are believed to play a preventative role in health and medicine.

Nutraceuticals are dietary components or supplements that not only enhance overall well-being but also play a crucial role in preventing various diseases. Vegetables are a rich and natural source of these compounds, as they contain a wide range of bioactive elements that support health and protect against numerous chronic conditions. Among the most beneficial phytochemicals present in vegetables are phenolic substances—including phytoestrogens, phenolic acids, flavonoids, phytosterols and phytosterols—along with carotenoids, prebiotics, dietary fibre and glucosinolates. These bioactive compounds modulate metabolic pathways, enhance immune response, reduce oxidative stress, and support cardiovascular and gastrointestinal health. These compounds work synergistically to boost immunity, reduce inflammation and promote long-term health. These therapeutic compounds help strengthen the immune system, improve general health and aid in both the prevention and treatment of disease particularly cancer, diabetes, and neurodegenerative and cardiovascular disorders. Therefore, incorporating phytonutrient-rich vegetables into your diet is essential for achieving significant health benefits.

Modern research is now focused on developing personalized nutrition strategies—foods and vegetables specifically designed to meet individual health needs. Innovations such as biofortification, various breeding techniques (foliar spray, traditional, molecular and mutation-based) and recombinant DNA technologies are driving the development of these targeted dietary solutions.

Key words: Nutritional imbalance, nutraceuticals, phenolic substances and biofortification.

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Comparative Analysis of Genetic Diversity in *Vigna* and *Phaseolus* species using SSR and STMS Markers

Priyanka Bhareti* R. K. Panwar, Anju Arora and S. K. Verma

¹Department of Genetics and Plant Breeding, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand 263 145, India

Corresponding author - Priyanka Bhareti*, Department of Genetics and Plant Breeding, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar, Uttarakhand 263 145, India, E mail: bhareti.priyanka9@gmail.com

Twenty simple sequence repeats (SSR) and eight chickpea STMS markers were compared to evaluate the genetic efficiency using thirty one genotypes of *Vigna* and *Phaseolus* species. The combined dendrogram based on the genomic SSR and STMS marker data showed differences in grouping of genotypes. A total of 31 genotypes were grouped into 3 clusters using genomic SSR and STMS, respectively. The similarity coefficient ranged from 0.59 to 1.00 (i.e., 59 to 100 per cent similarity). clusters I and II showed approximately 63.7 per cent similarity with each other and comprised 11 and 3 genotypes, respectively, whereas cluster III showed approximately 59 per cent similarity with clusters I and II, comprised 17 genotypes. SSR vs STMS gave $r = -0.008$, whereas correlation between combine vs SSR and combine vs STMS are 0.739 and 0.251. Among all the different markers studied combine vs SSR have cophenetic correlation values of 0.739, which indicated very good fit of the cluster analysis. However, rest of the markers viz., combined vs STMS and SSR vs STMS, have the cophenetic correlation values of 0.251 and -0.008, respectively indicating good fit of the cluster analysis. The highest genetic similarity value (100%) was observed between Pant moong 5 and Pant moong 4. The lowest genetic similarity value (39.3%) was observed between Pant moong 2 and Pant lobia 1. The similarity coefficient between most of the genotypes lies between 50.8 to 78.6 per cent.

Keywords: Dendrogram, SSR, STMS, Cophenetic correlation.

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Global Rise of Chia (*Salvia hispanica* L.): Nutritional Superiority, Consumer Demand, and Economic Potential

Anuj Kumar^{1*}, J. P. Tetarwal², and Hitesh Genan³

^{1&3}Research scholar, Department of Agronomy, Agriculture University, Kota

²Associate Professor, Department of Agronomy, Agricultural Research Station, Ummedganj – Kota

Corresponding Email: anujjakhar561@gmail.com

Chia (*Salvia hispanica* L.), an ancient superfood, is gaining global recognition for its exceptional nutritional value, health benefits, and market potential. Rich in omega-3 fatty acids, protein, fiber, and antioxidants, it supports heart health, digestion, and metabolism. The rising demand for plant-based and functional foods has positioned chia as a key ingredient in the health and wellness industry. This study explores its agronomic potential, value-added products (chia oil, flour, nutraceuticals), and market dynamics, while addressing challenges in production, processing, and regulatory frameworks. Strengthening scientific research, policy support, and agribusiness collaborations can enhance chia's global commercialization and role in food security.

Keywords: Chia, superfood, antioxidants, market potential and food security.

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Nutrient Management Practice Reducing the Dependency on Chemical Fertilizer and their Impact on Soil Properties and Crop Yield

Tanu^{1*} and Dipti²

*¹Department of Soil Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar
Email :tanusagwal9@gmail.com*

The augmented use of synthetic agrochemicals alongwith the adoption of nutrient-responsive high yielding varieties during green revolution era had led to a great boom for agriculture sector by escalating the production and productivity of the major crops of the country. This boost in agriculture production has slowed down or even declined over the years due to heavy removal of native nutrients, which led to deteriorating soil health. Sustaining soil health by soil organic matter accumulation has become a prime importance in terms of recycling plant nutrients and improving the soil physico- chemical and biological properties along with the sustainable yield. Application of biofertilizers and enriched compost have positive impact on plant accessible nitrogen, phosphorus and potassium in soil as compared to inorganic fertilizers. To sustain the soil quality, environment pollution, and crop productivity it is imperative to adopt an organic production system i.e., integration of organic manure with crop residues and biofertilizers. Conversely, exclusive organic farming would not be feasible under high-productive rainfed agriculture. It is, therefore, important to strike a balance between organic, biological and chemical sources of fertilizers to optimize a nutrient management regime that favors SOM and soil quality build up under rainfed region. Therefore, long-term effect of continuous integrated nutrient management regarded as best management practices for better carbon sequestration in soils of rainfed areas thereby enhancing soil quality and can help in partially mitigating the current effects of rise in atmospheric carbon dioxide. The rice–wheat-mungbean system reduced the bulk density and water-filled porespace over the rice–wheat after 16 years of cropping. Pulse inclusion in rotation and the addition of crop residues/farmyard manure (INM) can minimize the negative impact of soil mechanical disintegration, compaction, and nutrient losses in the degraded rice ecologies and increase the SOC stock in soil. The integrated combinations of chemical fertilizers, organic manures like enriched compost, FYM, vermicompost and biofertilizers like Azotobacter and Arbuscular mycorrhiza gave the best results significantly as compared to control and sole application of chemical fertilizers in terms of bulk density, porosity, water holding capacity, infiltration rate, soil aggregates, electrical conductivity, cation exchange capacity, soil organic carbon, total organic carbon, available N, P and K in soil and their uptake by maize. Therefore, integration of different sources of nutrients organic and inorganic along with biofertilizers, crop residue incorporation and crop rotation help in maintaining physico-chemical and biological properties of soil and also help in achieving yield sustainability.

Keywords: Integrated nutrient management, Sustainability

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Immune Response Studies in *Spodoptera litura* (Fabricius) to the Potential Entomopathogens

Adama Thanuja¹ and Dr.S. J. Rahman²

¹M.Sc Scholar (Entomology), Jayashankar Telangana State Agricultural University

²Professor (Entomology), Jayashankar Telangana State Agricultural University

In nature, insects frequently interact with a diverse group of microorganisms. Among the microbes, wide to diverse group of insect pathogens include viruses, bacteria, fungi, nematodes and protozoa which are collectively referred to as ‘Entomopathogens’. To protect themselves from the pathogenic microorganisms, insect engages in various defense responses. The effective employment of entomopathogens for biological control of insects requires an understanding of the mechanisms of pathogenesis by entomopathogens and the mechanisms of defense by insects.

Insects have a powerful innate immune system for fighting against the entomopathogens. The innate immunity involves cellular and humoral immunity. Haemocytes are the primary immune cells in insects which are responsible for various cellular defence mechanisms including phagocytosis, nodulation and encapsulation. The humoral immunity involves activation of host enzymes such as phenol oxidase (PO) and lysozyme. Upon infection of the haemocoel, cellular immune reactions are engaged almost immediately and later the humoral immune reactions takes place many hours later. It is believed that invading microorganisms are first eliminated by haemocytes and later the humoral responses destroy the few microorganisms which are not eliminated by the haemocytes.

Studies were conducted on tobacco caterpillar, *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae) larvae which are a very destructive polyphagous pest that infests a variety of crops, including potato, cotton, capsicum, tomato, soybean, okra, clover, onion, etc. To further understand the mechanisms of disease development and insect defence system, third instar larvae of *S. litura* were exposed to various entomopathogens viz., *Beauveria bassiana*, *Metarhizium anisoplae*, *Bacillus thuringiensis* var. *kurstaki* and *S. litura* Nuclear Polyhedrosis virus (SLNPV) independently: by sampling at 1, 3, 6, 12, 24, 48 and 72 HAI the immune responses were monitored.

The combined effect of the entomopathogenic fungus *M. anisoplae* with different insecticides such as Emamectin benzoate, Spinosad and Spinetoram on the immune response of *S. litura* larvae was also studied. The results showed a strong suppression of immune response of the larvae under combined treatment of *M. anisoplae* with the Emamectin benzoate and mild response was shown when *M. anisoplae* was combined with Spinosad and Spinetoram. However, the response started decreasing after 24 hours after treatment. The changes in the response of immune system under combined treatment suggest the effect of synergism.

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Integrating Dietary Innovation, Diet Informatics, and Assistive Technology for Personalized Dietary Interventions and Counselling in Health and Disease Management

Towera Tengtenga Sisya

Affiliation - Chandigarh University

e-mail - Sisya3towera@gmail.com

Biotechnology, data science, and digital health are rapidly converging to enable personalized nutrition. This review integrates contemporary advancements in functional foods, nutraceuticals, nutrigenomics, and microbiome-targeting strategies and presents emerging functionalities in diet informatics with assistive technologies. These three domains are redefining the personalization, delivery, and dynamic adjustment of dietary interventions to the individual's physiology and behaviours. We now have the luxury of artificial intelligence, mobile platforms, and even the integration of health records that can facilitate real time analytics and predictive decision making and assistive tool like wearables, voice guided interfaces, and tele nutrition system do so much for older adults, people with disabilities, and communities that are far from help. It also reviews important systemic and ethical concerns, such as data privacy and algorithmic bias, as well as digital literacy and health equity. This article shows the need for developing closed-loop, user-centered models that unite input, analysis, and personalized feedback for the design of scalable, inclusive nutrition systems that have ethical grounding. To advance the field of personalized nutrition, countless scientific innovations will also be needed, as well as a commitment to equity, transparency, and social responsibility.

Keywords: Personalized nutrition, Diet informatics, Nutrigenomics, Assistive technologies, Ethical AI in healthcare

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Genetic Divergence Analysis for Yield and Component Traits Among Wild and Cultivated Accessions of Rice (*Oryza sativa* L.)

Uma Bharti^{1*} and Poonam Sharma²

^{1*} Ph.D. Scholar, Department of Genetics and Plant Breeding

² Ph.D. Scholar, Department of Genetics and Plant Breeding

Choudhary Sarwan Kumar Himachal Pradesh Krishi Vishwavidyalaya, Palampur (H.P.)-176062

Email: ^{1*}umabharti198@gmail.com and ²poonam20061998@gmail.com

Genetic divergence is a crucial aspect of crop improvement and biodiversity conservation, offering insights into the genetic variability present within and among rice populations. Wild species of rice serves as a reservoir of genetic diversity, plays a crucial role in enhancing the resilience, yield and adaptability of cultivated rice varieties. The objective of this study was to identify desirable traits among different wild (*viz.*, *O. glaberrima*, *O. nivara*, *O. barthii* and *O. meridionalis*) and cultivated accessions of rice (*O. sativa*). Based on cluster analysis, the thirty accessions were grouped into seven clusters in which only one cluster found to be phylogenetic and rest all are monogenetic. Cluster I was the largest cluster among all comprised of 24 accessions including both wild and cultivated accessions. The highest inter-cluster distance was observed between Cluster VI and V and minimum inter-cluster distance was observed between Cluster III and II. The highest inter-cluster distance indicated that maximum genetic diversity was present among these accessions which could be used in the future for hybridization programme. Cluster VII recorded highest cluster mean value for total tillers/plant, grain yield/plant, Cluster VI recorded maximum value for days to 50% flowering, days to 75% maturity, biological yield/plant, Cluster V showed highest value for maximum traits such as plant height, number of spikelets/panicle, spikelet fertility(%), 1000-grain weight, harvest index, milling (%) and head rice recovery (%) while Cluster II showed maximum value for flag leaf length. The accessions fell under different clusters with highest mean values can be selected directly on the basis of these traits and could be used in future for improving grain yield and its component traits.

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Influence of Different Spacing and Organic Manure on the Growth and Yield of Groundnut (*Arachis hypogea* L.)

Vaishnavi G. Jaiswal*, Ambarish Thaokar¹

*Assistant Professor, Shramshakti College of Agriculture, Maldad Sangmner, Maharashtra

¹ Assistant Professor, School of Agricultural Sciences, G.H. Rasoni University,
Saikheda, Madhya Pradesh

*Corresponding authors email address vaishnavidjaiswal09@gmail.com

A field experiment was conducted during *Kharif* season 2021, at the Agronomy Farm, Department of Agronomy, School of Agricultural sciences, G.H. Rasoni University, Saikheda, Chhindwara (M.P.). The objective of the trail was to find out the performance of different spacing and organic manure. The experiment was laid out in a Factorial Randomized Block Design with nine treatments and three replications. The treatments were given on different levels of spacing and organic manure; treatment combination which are T₁: S₁O₁ (30 cm x 10 cm + Farm Yard Manure), T₂: S₁O₂ (30 cm x 10 cm + Vermicompost), T₃: S₁O₃ (30 cm x 10 cm + Poultry Manure), T₄: S₂O₁ (30 cm x 15 cm + Farm Yard Manure), T₅: S₂O₂ (30 cm x 15 cm + Vermicompost), T₆: S₂O₃ (30 cm x 15 cm + PM), T₇: S₃O₁ (45 cm x 10 cm + Farm Yard Manure), T₈: S₃O₂ (45 cm x 10 cm + Vermicompost) and T₉: S₃O₃ (45 cm x 10 cm + Poultry Manure) used. Among the organic sources tested application of 6 t/ha of PM in combination with spacing of 30cm x 10cm recorded significantly higher growth parameters, yield attributes, yield of groundnut and economics compared to other combination. Significantly recorded higher plant height (54.83 cm), nodules/plant (75.40), No. of Branches/plant (7.40), Plant dry weight (21.86 g/plant), pods/plant (30.67 q/ha), kernels/pod (2.07 q/ha) whereas this treatment combination also exhibited higher pod yield (63.01 q/ha).

However, higher kernel yield (23.45 q/ha) and haulm yield (39.56 q/ha) reason of to find significantly higher gross returns (Rs.172022.00/ha), net return (Rs.99367.00/ha) and benefit cost ratio (1.37: 1) were obtained with application of 30 cm x 10 cm + PM as compared to other treatments. This finding revealed that groundnut crop sown with spacing 30 cm x 10 cm in addition with poultry manure recorded the maximum and significantly higher yield and yield attributes resulting best economics return.

Keywords: Spacing, Organic manure (OM), Farm Yard Manure (FYM), Vermicompost (VC), Poultry Manure (PM), Growth, Yield, Economics

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Extension strategies for Scaling Up and Scaling Out Natural Farming

Vanathi.D¹, Dr. Syed Shafat Kubrevi²

¹MSc Research Scholar, Division of Agriculture Extension and Communication, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, J&K – 193 201, India.

²Assistant Professor, Division of Agriculture Extension and Communication, Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Wadura, J&K – 193 201, India.

Presenting Author Email: vanathibscagri@gmail.com

This study offers a thorough framework for expanding natural farming using efficient extension techniques that emphasize market access, farmer empowerment, and knowledge exchange. Important tactics include the creation of demonstration farms to promote hands-on learning and comprehensive training programs that improve farmers' abilities in managing soil health, controlling pests, and preparing organic inputs. Peer-to-peer interactions and farmer cooperatives are two examples of community-based learning methods that are highlighted as ways to promote cooperative knowledge sharing. To reach a wider audience, the publication promotes a multi-media strategy for knowledge transmission, utilizing platforms including social media, webinars, and Krishi Vigyan Kendras (KVKs). Emphasis is placed on the growth of value chain improvements and market connections, which promote direct marketing and the creation of specialized markets for natural agricultural goods. Furthermore, it is suggested that technology be included to encourage innovation in agricultural methods through the use of mobile applications and participatory research projects. It is emphasized that government assistance in the form of financial incentives, policy advocacy, and departmental coordination is crucial to the advancement of natural farming. The study emphasizes how policy, technology, market access, and training are all intertwined in supporting a sustainable shift to natural farming methods.

Keywords: Natural farming, Extension techniques, Market access, Farmer empowerment, Organic inputs, Value chain improvements.

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Vegetable Power: Nature's Defense Against Cancer

Sadhana Kongala

Department of vegetable science, Research scholar, sri konda laxman telangana horticulture university, mulugu, siddipet, Telangana

Cancer is a major global cause of death, and its incidence is expected to rise in the future. Although there's no surefire way to prevent cancer, research shows that a healthy diet, rich in certain foods, can lower the risk. This article explores the role of nutrition in natural cancer prevention, focusing on foods that support the body's defense against cancer. Antioxidants act as protectors for your cells by neutralizing harmful molecules called free radicals, which can damage cells and promote cancer development. By keeping cells healthy, antioxidants help reduce cancer risk. Additionally, phytochemicals natural plant compounds play a similar protective role, supporting both plant health and human well-being. Eating colorful fruits, vegetables, and whole grains is beneficial due to the variety of phytochemicals they contain, each with its own health-promoting effects. Key foods that may help prevent cancer include: **Leafy Greens:** Spinach, kale, and collard greens are packed with vitamins and minerals. **Tomatoes:** Rich in lycopene, they may reduce the risk of prostate cancer. **Garlic:** Contains compounds that can help prevent stomach and colorectal cancers. **Cruciferous Vegetables:** Broccoli, cauliflower, and Brussels sprouts contain sulforaphane and indole-3-carbinol, which have antioxidant and anti-inflammatory properties that combat carcinogens and inhibit tumor growth. **Pumpkin Seeds:** High in zinc, they may lower the risk of prostate cancer. Incorporating these foods into your diet can be a proactive step toward reducing cancer risk. While no diet can guarantee cancer prevention, a nutrient-rich diet can significantly support overall health and reduce the likelihood of cancer development.

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Versatile Role of Bamboo

Bhavna¹, Pranali Gawade², Ashwini Uikey³ and Mrinalini Uikey⁴

¹*Scholar, Department of Horticulture (Vegetable Science)
College of Horticulture, Mandsaur, RVSKVV, Gwalior 474011
E-Mail – bhavnasirsam2017@gmail.com*

²*Scholar, Department of Horticulture (Vegetable Science)
IEC (Infotech Education Society) Bhopal, MP*

³*Research Scholar, Department of Horticulture (Fruit Science)
College of Agriculture, Gwalior, RVSKVV, Gwalior 474011*

⁴*Scholar, Department of Agronomy, College of Agriculture, Akola
Dr. PDKV, Akola 444104*

Bamboo (*Bamboo spp.*) the giant grass of the sub family Bambusaideae of Poaceae, represent one of the most important Non Timber Forest Product. It is popularly known as poor man's timber and plays an important role in the socio-economic condition of tribal and rural people of India. The entire NEH region is characterized by extensive bamboo forests, which have considerable socio-economic value. Young shoots of some of the bamboo species have edible delicacy. Tribal folk use tender bamboo shoots as food. The major source of young edible shoots goes to food purpose and rest for making pickle and other fermented products. In rainy season young bamboo shoots are regularly harvested from forests and home gardens for selling or domestic consumption. Similar to fresh bamboo shoots, a significant amount of fermented bamboo shoots is also used round the year. The best time to establish a new plantation is just prior to the rainy season. Compared to the cost of growing other vegetables or fruit, bamboo growing is relatively inexpensive. Plant propagation techniques include the use of seeds, seedling per juvenile plant stock as well as mature clumps.

Key Words: Bamboo, Non Timber Forest, Tribal folk, Forest, NEH region.

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Exploring Microbial Potential: A Comparative Study of *Rhizobium trifolii* and *Bradyrhizobium* in PHB Bioplastic Production

Vindhesh Dixit, Monika Yadav, Monika Asthana, Pramod Kumar

Plastic pollution represents one of the most significant environmental challenges, leading to severe ecological degradation and increasing waste accumulation globally. As the demand for sustainable alternatives grows, biodegradable bioplastics have gained attention, particularly beta-polyhydroxybutyrate (PHB), a microbial biopolymer with great potential. This study investigates the comparative bioplastic production capabilities of two rhizobial species, *Rhizobium trifolii* and *Bradyrhizobium*, focusing on their PHB synthesis under different carbon sources. Experimental results demonstrate that both species are capable of significant PHB biosynthesis, but with distinct metabolic efficiencies. *Bradyrhizobium* showed a wider range of substrate utilization, indicating a more versatile metabolic pathway, while *Rhizobium trifolii* exhibited superior PHB accumulation when cultured in media supplemented with mannitol and sucrose. These differences in metabolic profiles suggest that the two species possess unique adaptations, potentially influencing their efficiency in bioplastic production. Understanding these metabolic variances and the factors affecting PHB biosynthesis is crucial for optimizing microbial systems for large-scale bioplastic production. Future research should prioritize genetic modifications and process optimization to further increase PHB yields and make production more industrially feasible. This study underscores the promising role of rhizobia in developing sustainable bioplastics, offering a significant opportunity to reduce plastic dependency and alleviate environmental pollution.

Keywords: Bioplastic, polyhydroxybutyrate, *Bradyrhizobium*, *Rhizobium trifolii*, sustainable materials

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Weed management Practices as Influenced on Weed Dynamics of Kharif Okra [*Abelmoschus esculentus* (L.) Moench]

Sadhana Kongala¹, Venkateswara Reddy², Veena Joshi³, Madhavi Molluru⁴
and Ram Prakash⁵

Corresponding E Mail: Kongalasadhana14@gmail.com

A field experiment was conducted to find out best weed management practices in okra at PG research block, College of Horticulture, SKLTSHU, Rajendranagar, Hyderabad during the year 2019-20. The experiment was laid out in randomized block design with twelve treatments and replicated thrice. The results of the experiment revealed that application of black polythene sheet mulch recorded the highest weed Control efficiency (WCE) with minimum weed density and weed dry matter which was statistically on par with mechanical weeding (inter row) followed by hand weeding (intra row) at 30 and 60 DAS (weed free check) and pendimethalin 675g ha⁻¹ (PE) + propaquizafop 62.5g ha⁻¹ (PoE) + intercultivation at 45 DAS. However the higher weed density weed dry matter and lower weed control efficiency was recorded with unweeded control plot. The lowest weed index values were recorded with black polythene mulch while the highest was recorded with unweeded control plot.

Keywords: Okra, Black polythene mulch, Oxyfluorfen, Pendimethalin, Propaquizafop, Weed management

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Response of Wheat Yield Attributes under Different Nutrients and Conservation Agriculture Based Management Practices in Rice–Wheat Cropping System

Yogesh^{1*}, Kailash Prajapat¹, Satyajeet², Madhu Choudhary¹, R.K. Fagodiya¹

¹*ICAR-Central Soil Salinity Research Institute, Karnal 132001, Haryana (India)*

²*Chaudhary Charan Singh Haryana Agriculture University*

*Email: yogeshdahiya71997@gmail.com

A field experiment was carried out during rabi season of 2023-24 at the research farm of ICAR-CSSRI, Karnal, Haryana under rice–wheat cropping system. The experiment was designed in Randomized Block Design with five different tillage, crop establishment, residue and nutrient management practices and replicated thrice. The management practices were Mp-1 (Farmer's practice)- conventional tilled transplanted rice (CTTPR)–CT wheat (CTW) with all residue removed and RDF, Mp-2 (Improved practice)-CTTPR-zero tillage wheat (ZTW) with full rice residue retention, dhaincha green manure in summer and RDF), Mp-3 (Organic)-CTTPR–ZTW along with full rice residue and fertilization with FYM+Vermicompost+Biofertilizers, Mp-4 (Integrated)- CTTPR–ZTW along with full rice residue, dhaincha green manure and 50% RDF + Organic {FYM +Vermicompost}), Mp-5 (Full Conservation agriculture, CA)-ZTR–ZTW along with full rice and dhaincha residue retention on soil surface and RDF. Result of rice showed that Mp-2 was significantly higher in terms of growth attributes and yield attributes. Grain Yield was maximum in MP-4 (29.2 q/ha), straw yield (78.6 q/ha), test weight (43.5 gm), and panicle length (10.1 cm) followed by Mp-2 (Integrated) in terms of grain yield in both the years. Overall performance Mp-4 (Improved practice)-CTTPR-zero tillage wheat (ZTW) was better than other practices, that might be due to incorporation of dhaincha before sowing and providing adequate amount of dose of fertilizers through inorganic compounds.

Keywords: Rabi, conservation, residue, tillage.

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Problems Faced by Sugarcane Growers in Gujarat State

CHAUDHARI V. P.*, RAJPUT Y.V. * AND TRIVEDI S. M.**

**Research Scholar, **Research Guide, Post Graduate Institute of Agri-Business Management,
Junagadh Agricultural University, Junagadh, 362 001, Gujarat, India*

**Corresponding Author: Email –viral6929@gmail.com*

The economic difficulties that Gujarat's sugarcane farmers experience is examined in this research, with a focus on the contribution that sugar co-operatives may make to solving these problems. 240 farmers connected to 12 active sugar co-operatives were given a structured questionnaire and Garrett's ranking system was used to order the issues according to their economic significance. With a mean score of 80.24, the results show that the low price of sugarcane is the biggest obstacle, having a substantial impact on farmers' earnings and profitability. Production costs are further inflated by high labour prices and shortages (71.34), while farmers' effective returns are decreased by dishonest weighbridge procedures (66.53). Other significant economic issues include excessive deductions, late payments from co-operatives and expensive transportation expenses, all of which exacerbate cash flow issues and financial instability. Furthermore, relying more on manual labour due to the lack of mechanical harvesting raises operating expenses. Infestations of pests and diseases reduce yield, which further reduces revenue. Overall economic growth is constrained by the absence of professional advice, Insufficient training facilities and restricted access to timely finance, which impede productivity gains and the adoption of economical agricultural practices.

The Study suggests changing government pricing regulations to guarantee stable and equitable prices, improving the financial stability of farmers. It is possible to lower production costs and increase efficiency by promoting mechanization and the use of contemporary agricultural techniques. It is essential to guarantee that sugar cooperatives pay farmers on time in order to preserve their liquidity and financial stability. Enhancing technical assistance, training programs and finance availability can also promote innovation and capacity growth. Building trust and ensuring fair resource allocation may be achieved by improving sugar co-operatives operational effectiveness and openness. Gujarat's sugarcane farmers' socioeconomic well-being and economic resilience are intended to be improved by these actions taken together.

Keywords: Sugarcane growers, Sugar Co-operatives, Problem analysis, Garratt's ranking

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