JUST AGRICULTURE

multidisciplinary e-Newsletter

VOL. 1 ISSUE-2

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From the Founder Editor's desk

Dear Readers,

The last six months in Indian Agriculture have witnessed paradoxical circumstances. Amid the COVID crisis, besides the uncertainty in health, economy and others sectors, Agriculture is the only bright spot with spike of 3% growth sector in India. The Inter-Ministerial Committee has the target of Doubling the Farmer's Income (DFI) by 2022 which uplift the agriculture sector and enormous e–commerce and agribusiness models have started during this pandemic period. The young professionals understand the potential of this sector.

So, during this COVID, education and publishing sector effected. It will be difficult for the academicians to publish and get innovative knowledge about agriculture specialisation. So being as ***Young Agriculture Professional****, I think about starting an e-newsletter which provides platform to bound all the agriculture students, scholars and research oriented people.*

We are glad to introduce the second issue of ***JUST AGRICULTURE e-Newsletter.*** *Carrying forward our vision of starting this agriculture e-magazine is to engage all the agriculture students, scholars and research oriented people and to increase the writing capacity of agriculture students.*

The word ***"Just Agriculture"*** *signifies the prominence given to the agriculture field and other allied sciences in today's era. Our magazine offers sufficient platform and broad coverage for agriculture researchers and scientists for deliberating connecting throughout India and globally. For the agriculture students endowed with inquisitive mind and driven by professional goals, this newsletter will be a voyage of discovery.*

Keep Reading……..

Mohit Bharadwaj
Editor in Chief,
JUST AGRICULTURE e-Newsletter

D.P.S. BADWAL
Founder Editor,
JUST AGRICULTURE e-Newsletter

Message from Editor's Desk

Just Agriculture has been in service to educate the farmers of the India since its inception and publication of Magazine and Newsletter, both are those means towards this informal way. This Multidisciplinary e-Newsletter is a monthly platform for researchers being published monthly. I am quite happy that uninterrupted journey of this farmer's friendly e-Newsletter has started. Through this Newsletter, we try to our level best to make aware very latest, valuable, season-driven and scientifically proven technologies to the farmers for improving their farm practices and inturn to enhance their farm income. The authors of these important articles have shown their keen interest and expertise. I thank to all our authors for their valuable contribution and making this issue a source of knowledge.

On behalf of Chief Managing Editor of Just Agriculture e-Newsletter, I would like to express sincere thanks to the Editorial team of e-Newsletter for compiling questions/queries raised. Without proper co-operation of the all Editorial Advisory Board members to bringing out this issue in very sophisticated way.

*The present issue of "**Just Agriculture e-Newsletter**" is intended to provide its readers, specially the farmer, a wider choice from the above list to help them understand and follow the practices, which can help improve their production, productivity and incomes.*

Abhishek Dehal
Executive Editor,
JUST AGRICULTURE e-Newsletter

Ankur Sharma,
Chief Managing Editor,
JUST AGRICULTURE e-Newsletter

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MESSAGE

The dissemination of updated information till the end users is the key of successful sustainable agriculture in the today's era, when huge information of diverse nature is being generated regularly. The idea behind bringing such information in the form of volume(s) like **Just Agriculture Magazine** is absolutely a brilliant.

I appreciate the efforts of Editorial team members of **Just Agriculture Magazine,** who are working relentlessly for bringing the scattered information into concise form to the intended users.

I wish a great success for this publication in future.

(R M Sharma) Date: 28.09.2020

NAAC Accredited A

Sam Higginbottom University of Agriculture, Technology And Sciences

सैम हिग्गिनबॉटम कृषि, प्रौद्योगिकी एवं विज्ञान विश्वविद्यालय

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Message

My best wishes to the team of Just Agriculture magazine for inviting & publishing popular and technical articles, success stories and short communications. This initiative will be helpful in increasing the thinking, writing and reading capacity of agriculture students and researchers.

It is well known fact that agriculture is the backbone of Indian Economy but increasing population is becoming a threat to the food and nutrition security of the nation. To achieve the goal of food & nutrition security it is important to implement the scientific techniques in modern Indian Agriculture. This magazine can guide the farmers for practicing agriculture activities in a scientific manner.

It's my firm belief that this magazine will definitely increase the awareness among agricultural students and will act as a medium for all of them to join and share their innovative ideas.

I congratulate the entire team of the just agriculture magazine for conceiving of this idea.

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Apps that Revolutionize Indian Agriculture

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ARTICLE ID: 001

INTRODUCTION

Information and Communication Technology (ICT) plays an important role not only in turning agriculture into socially, economically and environmentally sustainable, but also contributing to the delivery of nutritious and economical food for all. Increasing internet penetration in states of India has led to the rise and development of mobile apps which are helping farmers with existing government schemes and other agriculture-based information to reach them in rural India. This digital change is revolutionizing Indian agricultural conditions to a great extent.

KISAN SUVIDHA

Kisan Suvidha helps farmers by providing relevant information on weather conditions for the next five days, dealers, market prices. Agro advisories, IPM practices, plant protection. Some unique features include extreme weather alerts, and market prices of commodities in the nearest area also, the maximum price in the state as well as in India. This app has empowered farmers in its best possible manner.

PUSA KRISHI

This app was launched in 2016 by the Union Agriculture Minister to help farmers to get information about technologies developed by the Indian Agriculture Research Institute (IARI), which will help in increasing returns to farmers. The app also provides farmers with information related to new varieties of crops that were developed by the Indian Council of Agriculture Research (ICAR), resource-conserving cultivation practices, farm machinery, and its implementation will help in increasing returns to farmers.

IFFCO KISAN AGRICULTURE

IFFCO Kisan is a subsidiary of Indian Farmers' Fertilizer Cooperative Ltd and the application was launched in 2015. They help Indian farmers to make decisions through customized information related to their needs. The user can also access a variety of informative modules that includes agricultural advisory, weather, market prices, agriculture information library in the form of text, imagery, audio, and videos in the preferred language at the profiling stage. The app offers helpline numbers to get in touch with Kisan Call Centre Services.

CROP INSURANCE

This application is very useful for farmers in calculating insurance premium amounts for notified crops and provides information with cut-off dates and company contacts for their location and crops. It also works as a reminder and calculator for farmers about their insurance amount to be paid. This app can also be used to get details of the normal sum insured, extended sum insured, premium details, and subsidy information of any notified crop in any notified area. Information is linked to its web portal which caters to all stakeholders including farmers, states, insurance companies, and banks.

MKISAN APPLICATION

This application has been designed and developed by the in-house team of DAC with help of C-DAC Pune. It enables all the stakeholders to obtain advisories and information being sent by experts and government officials at different levels through MKISAN without registering in this portal.

SHETKARI MASIK

This is a popular monthly magazine in the agriculture sector, published by the Department of Agriculture, Maharashtra since 1965. It has a very simple interface with mobile connectivity to register and magazines can be downloaded and used offline.

FARM-O-PEDIA

This was developed by Centre for Development of Advance Computing, Mumbai and the application is a bilingual android application targeted for rural Gujarat. The important functionalities include getting suitable crops as per soil and season, getting crop-wise information, check the weather in that area, managing cattle.

AGRIMARKET

This application can be used to get the market price of crops within a distance of 50km. Thus helping farmers in better price realization.

DIGITAL MANDI INDIA

As the name suggests this app helps in knowing different Mandi prices from different states and districts. This application helps farmers, traders, and all others to know the prices by browsing through various commodities, simplified reach to the selected mandi, data synced with Agmarknet.nic.in.

PASHU POSHAN

National Dairy Development Board has developed an android based software that optimizes the cost considering animal profile, like cattle age, milk production, fat in milk, feeding regime, etc., and also feed advisory to farmers were also given.

SIKKIM HORTICULTURE AND CASH CROP ASSISTANCE

This application can be used for submitting an online application for obtaining departmental assistance for farmers in Sikkim.

APPLICATION FOR POULTRY

The animal husbandry department of Himachal Pradesh has introduced a backyard poultry scheme which is centrally sponsored, where low input technology birds of colored, disease-resistant strains are supplied to farmers, with this app, farmers can avail the opportunity.

KHETI-BADI

It is a social initiative app that aims to support organic farming with information regarding the same to farmers in India. This helps farmers to switch from chemical farming into organic farming.

MNCFC

National Remote Sensing Centre, ISRO has developed his applications for field collection for crop assessment using satellite data under FASAL project of the Ministry of Agriculture. This app can be used to collect field photographs, GPS coordinates, and field information like crop type, condition, sowing date, soil type, etc., this information is used in creating a national geospatial database of crops.

CROP INFO

Crop Info was developed by Nirantara Livelihood Resources Private Limited, Bangalore, and Karnataka an app that provides production technology of commercially important Horticultural and Agricultural crops, production aspects, post-harvest management, processing possibilities, and market information. Crop Info is specifically developed for students, faculty of Agricultural and Horticultural Universities, Subject Matter Specialists, Extension officials, private sector professionals, and farmers.

CONCLUSION

These agriculture apps provide farmers up to date information about the latest technologies used in agriculture and helps to fill the information gap between the rural people and Government schemes in reaching them. These are Android apps for Indian farmers used in farming which provides them latest market rates, weather forecasting, information on Government policies and schemes for farmers, latest technology videos, news related to agriculture etc. Using these applications, one can directly ask questions to the agriculture experts and queries can be solved instantly by availing the audios and videos related to new technology, successful farming methods that can shape Indian agriculture.

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Farmer suicide in India: reasons and statistics

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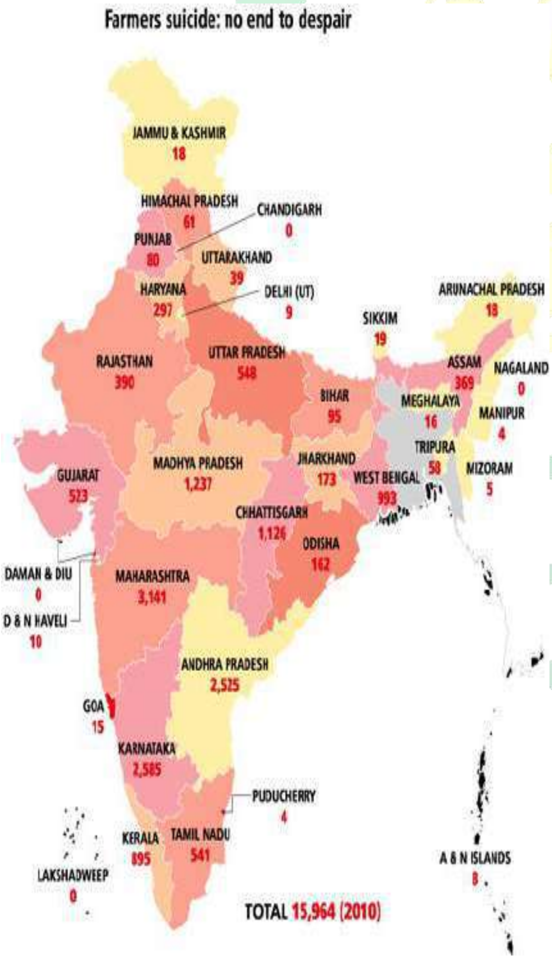
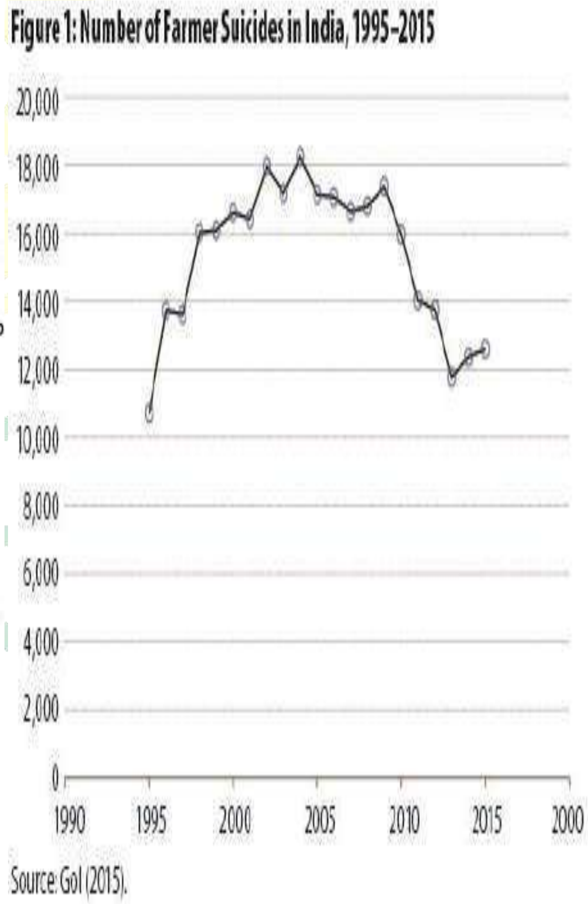
ARTICLE ID: 002

The Farmers of India are the hard worker Farmer from all over the world. They don't see the clock whether it is day or night. They don't see whether it is raining or sun is shining. They have not any interest in gold or silver or any other type of cosmetics but for them the real gold is their Golden crop. The used to take care of the crop like their children. After that when the crop is ready now they did the duty of a cop. Yes now they prevent them from thieves. Then they take the reap crop at home and sell over the market. This is the job of a farmer.





But today they are ending their life for many reasons. This situation is such a serious one. If they keep hanging themselves then what the world would eat. Financial conditions or debt: The farmer of India is poor and this poverty is famous all over the world. That means everyone is aware of this. The farmer of India can't afford the meal for two times of the day because of poverty. How surprising is this that one who's growing food for us is himself remains hungry. They are unable to give education to their children and they can't fulfil the need of their children. Their children can't dream. His wife is a woman who does lots of sacrifices for their families. The primer reason for suicide is inability to repay the loans that they have taken for cultivation needs. Panchagavya an economist at the world bank states "farm related reasons get cited only approximately 25 percent of the time as reason for suicide" and "studies do consistently show greater debt burden and greater reliance on informal sources of credit" amongst farmers who commit suicide. The BT cotton seeds cost twice as compare to the ordinary ones. The high cost forced farmers to take loans, often from private moneylenders charging exorbitant interest rates. The moneylenders force farmers to sell their cotton at lower price than market. According to studies this created a source of debt, economic stress and hence suicide. The other reasons for the suicide are interconnected with debt. According to a study of 2006, the percentage of farmers who were in debt in Andhra Pradesh, Punjab, Karnataka, Maharashtra was 70%, 65%, 61%, 60% respectively.

Failure of crops:

The fluctuation in the climate is the reason of failure of crops. High temperature and low rainfall during the growing season impact annual suicide rates. The harvest of saffron has been declining in recent years and has failed farmers in Kashmir because of severe drought in part by climate change. Everybody knows that how expensive saffron is and a small loss in this affects a lot. I think this reason is all up to God, if he wishes he can cause the rainfall, but if he is not happy with us, he will make us suffer.

Family disputes and problems:

Many families trade in partnerships and this is the reason for dispute in family members. If there is a loss happens then both the partners affects the same. After this one blames on another that he is wrong here and he is right. This cause conflictions on both sides. Another is Family farm inheritance dispute leads to such day court battles, bitter inheritance disputes centred around family farms and so on because of these dispute they have to pay lawyers also and hence their debt increases and to avoid this situation he ultimately suicides .

Chronic illness:

The chronic conditions such as asthma, diabetes and other respiratory diseases increase farmer's suicidal thoughts. Having a chronic illness may increase the risks of development of psychiatric disorder which in turn increase the risk of suicidal plans, thoughts and attempts. Everybody knows that farmer is the busiest person. They don't have much time to go to doctor. They don't take care of their own health and hence their body weakens. After this when their condition affects badly then they don't have enough money to pay the doctor's fee. This made them to suicide.

Marriage of daughters:

This reason seems small and not major but this is such a serious one. We all know that farmers are the middle class peoples. They took debt for cultivation then how will they marry their daughter without money. They are already under a loan. This make them to borrow more for marriage and other gatherings.

Unavailable of bore Wells:

This is the another reason for suicide of farmers. Not only bore Wells but unavailability of other equipment that is expensive became a reason for suicide. They are unable to buy huge expensive equipments and sometimes they borrow money to buy them. Sometimes they use alternative methods like Bullocks for farming and they hire some labors also. The other reason is bore well. This water quality is not same everywhere. The water availability is also not same everywhere. Somewhere it is too saline which is not perfect for some crops and somewhere the water level is too deep and without water there is no cultivation possible. This leads to suicidal thoughts in the mind of farmer.

I concluded that these are not only the reasons for suicide of farmers but there are many more others. Today government is supporting them wholeheartedly but because of the lack of knowledge they unable to take benefit of various schemes. The government needs to create various programs for awareness in farmer so that suicidal rate decreases.

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A review on "price support scheme 2020'' and its effects on farmer's income

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ARTICLE ID:003

Abstract:

The Department of Agriculture & Cooperation implements the PSS for procurement of oil seeds, pulses and cotton, through NAFED which is the Central nodal agency, at the MSP declared by the government. The price policy also seeks to evolve a balanced and integrated price structure in the perspective of the overall needs of the economy. The primary target of the value strategy in India was to secure the interests of purchasers. In this approach no consideration was followed through on to give impetus cost to farmers. It was uniquely in 1964, an obvious approach was acquainted for furnishing motivator cost with ranchers. Price policy plays a pioneer role in the economic development of a country. It is an important instrument for providing incentives to farmers for motivating them to go in for production oriented investment and technology. Farmers get benefit of the scheme by sell of their produce at support price in APMC centers opened by Nodal procurement agency.

Keywords: Effects of price support policy , Market intervention scheme(MIS),Planning of Madhya pradesh on PSS , Price support scheme (PSS)

Introduction:

Price Support Scheme (PSS) is being implemented by Government of India in the state. Main crops of the state like Bajra, Jowar, Maize, Paddy, Cotton, Tur, Moong, Urad, Groundnut, Sesamum Wheat, Gram, Mustard, and Sugarcane etc. are covered. The central government took a decision in favour of farmers to deal with the situation arising out of nationwide lockdown in view of corona virus COVID-19 pandemic. The government approved the enhancement, from 25 quintals to 40 quintals, of daily procurement limit per farmer per day under the Price Support Scheme (PSS).

At the point when costs of items fall underneath the MSP, State and central notified procurement nodal organizations buy products straight forwardly from the ranchers at MSP under indicated FAQ (reasonable Average Quality) through APMC centers arranged by them. The government agencies like Nafed, SPAC and other state-owned agencies procure pulses and oilseeds at minimum support price under the PSS. The procurement shall continue for 90 days from the date of commencement of procurement.

Market intervention scheme(MIS):

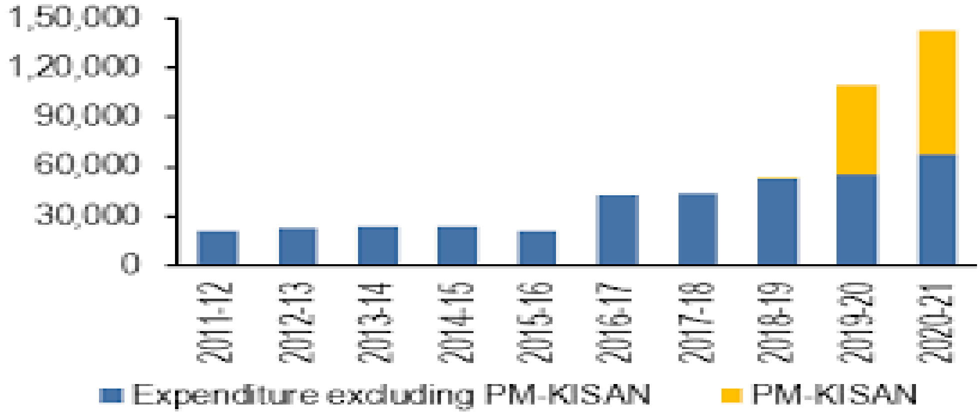
The Centre has reportedly invited proposals from the state governments and Union Territories for implementation of the Market Intervention Scheme for the procurement of perishable agriculture or horticulture crops, whose prices have gone down recently.

The Scheme is executed when there is in any event 10% expansion underway or 10% diminishing in the decision rates over the past ordinary year. Proposition of MIS is affirmed on the particular request of State/UT Government, if the State/UT Government is prepared to manage half misfortune (25% in the event of North-Eastern States), assuming any, acquired on its execution.

Need of PSS:

Development of cost is a typical element. In any case, quick and vicious development or vacillations in the costs of farming wares have genuine outcomes on the economy of the nation. As the unexpected steep fall in the cost of a specific yield, bring about tremendous misfortune to the ranchers creating that crop as their pay decreases.

The Ministry has been allocated Rs 1,42,762 crores in 2020-21. Allocation to the Ministry accounts for 5% of the central government's budget. This allocation is 30% higher than the revised estimate for 2019-20, primarily due to a higher allocation of Rs 75,000 crores to PM-KISAN (income support scheme for farmers) for 2020-21. For 2019-20 as well, the scheme was allocated Rs 75,000 crore at the budgeted stage, which has now been revised down to an estimate of Rs 54,370 crore.



Demand for Grants 2020-21 Analysis : Agriculture and Farmers' Welfare

- This will drive the ranchers not to develop the harvest one year from now prompting a genuine deficiency in the gracefully of that food thing and that may compel the administration to import that food crop from far off nations**.**
- Then again, an unexpected climb in the cost of a specific yield may make immense enduring the purchasers which may compel the customers to dispose of it or to shorten their other use.
- Significantly for meeting the utilization use on that crop. In the two different ways, the huge scope vacillation in the cost of agrarian produce will make a tragic impact on the economy of the nation.
- So as to protect the enthusiasm of the two makers and buyers an exhaustive rural value strategy must be reasonably figured. This ought to be upheld by keeping up cradle supplies of horticultural products along with the broad organization of open appropriation framework.
- These will offer a base help cost to the makers and orchestrate the flexibly of these horticultural produce to the customers at reasonable costs. Subsequently while fixing the base help costs and acquirement costs care must be taken to fix those costs at such level which will actuate the ranchers to create more. Consequently, the farming value strategy can be planned as an "instrument of development".

Objectives

- To secure or protect the producer through ensured minimum support price, which as an adjustment measure diminishes the variability in products and consequently price risk of the producers. The effect of the danger decrease is required to actuate ranchers to embrace enormous speculations and to receive improved creation innovation.
- To prompt the ideal yields of various harvests as indicated by development targets.
- To actuate an expansion in total agricultural yield through enormous information use and selection of high yielding seed, manure and water responsive innovation.
- To actuate ranchers to leave behind an enormous extent of food grains creation as a promoted excess.
- To secure the buyer against the unreasonable ascent in costs, particularly to ensure the low salary buyers in periods when supplies fall behind interest and market costs rise consistently".

Effects of price support policy

I. **Incentive to Increase Production**: Agricultural price policy has been giving important motivating force to the ranchers for raising their agricultural yield through modernisation of the division. The base help cost ought to be resolved viably by the administration which will protect the enthusiasm of the ranchers

II. **Increase in the Level of Income of Farmers**: The agricultural price policy has given vital advantage to the ranchers by giving vital consolation and motivating forces to raise their yield and furthermore by supporting its costs. All these have brought about an expansion in the degree of pay of ranchers just as their expectations for everyday comforts.

III. **Change in Cropping Pattern:** The agricultural price policy has brought about an extensive change in trimming example of Indian agribusiness. The creation of wheat and rice has expanded extensively through the reception of current procedures by getting important help from the Governments. However, the creation of heartbeats and oilseeds couldn't accomplish any extensive change without such value uphold.

IV. **Benefit to industries:** The agricultural price policy has likewise profited the agro businesses of the nation, similar to sugar, cotton material, vegetable oil and so on. By balancing out the costs of rural items, the arrangement has made arrangement for sufficient amount of crude materials for the agro businesses of the nation at sensible costs.

V. **Price stability:** The agricultural price policy has stabilised the prices of agricultural items to an enormous degree. It has gotten effective to contain the unjustifiable change of costs of agrarian items. This has made a positive effect on both the purchasers and makers of the nation.

Planning of MP on price policy:

Madhya Pradesh is planning to spend 11.6 billion rupees under the price support scheme to procure kharif pulses--tur, urad, and moong--harvested in 2020-21 (Jul-Jun), a state government official said. Malaysia's crude palm oil output rises 3.1% on month to 1.86 metric tonnes in August, data from Malaysian Palm Oil Board showed. Total palm oil stocks were a tad down at 1.69 mt tn. Malaysia's palm oil exports in August fell by 11.3% on month to 1.58 mt tn, and biodiesel exports were down 36.7% on month at 24,675 tn, data showed, India got 5.2 mm precipitation yesterday, 16% underneath typical, the India Meteorological Department said. Since Jun 1, the nation has gotten 828.6 mm precipitation, 7% better than average. The Association of Natural Rubber Producing Countries has brought down its estimate for worldwide elastic yield in 2020 to 13.15 mln tn, down 4.9% from the earlier year, from the 13.20 mln tn pegged in July, the affiliation said in its month to month report. Brazil has had the option to diminish contamination levels by half by mixing ethanol with petroleum, said Evandro Gussi, the leader of Brazil's sugarcane industry affiliation UNICA. Tamil Nadu has mentioned the Center to draft new rules for its lead Pradhan Mantri Kisan Samman Nidhi Yojana to stay away from any misrepresentation, a senior state government official said. The water level in 123 key repositories the nation over rose over 2% over the previous week to 142.234 become today, information from the Central Water Commission appeared. The level is 83% of the absolute live stockpiling limit of 171.090 bcm. It is 2% higher on year and 18% higher than the 10-year normal, as per the commission.

Conclusion:

India's agricultural price support programme has lost its pertinence without giving any noteworthy advantage to the cultivating sector, and just adding to the monetary burden as the

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expense of acquirement and capacity of yield produce stood near 1% of GDP for FY20 while covering select monetarily huge harvests in chosen geology. Regardless of the presence of floor-cost based support for more than forty years, ranch trouble has not declined yet has expanded, as an ever increasing number of ranchers are turning out to be obligation ridden and can't get gainful costs for their produce. Likewise, there have been expanding advance waivers by different state governments lately, adding to the financial weight without tending to the issue of lower livelihoods related with trouble offer of harvests. Along these lines, there is a requirement for finding a key answer for guarantee gainful costs for ranchers without twisting business sectors and upsetting India's financial math.

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RNA Interference in Crop Improvement

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RNA interference (RNAi) is a innovative step in the field of plant molecular genetics and is an incredible revolution in the field of functional genomics. RNA interference includes insertion of match part of the target gene sequence as such no proteins are synthesized and there by blocking the gene function. RNAi inducers, have the potential to effectively silence specific genes which in form of transgenic plants or applied as crop spray. This technology will generate potential for controlling the gene expression. Fire and colleagues, were first to discover RNA interference (RNAi) in the nematode worm *Caenorhabditis elegans*. who found that double-stranded RNA (dsRNA) induced a more potent sequence-specific silencing response than single-stranded antisense RNA alone, Which was customarily used for this purpose. In the recent past with the discovery of small non-coding RNAs which play a important role in RNA silencing RNA-mediated functions has been greatly increased. RNAi operates in plants using double stranded RNA (dsRNA) as a trigger that targets homologous mRNAs for inhibiting its transcription and translation. This RNA-mediated gene control technology has provided new pathways for developing molecular tools for crop improvement by suppressing the genes responsible for various stresses and improving novel traits in plants including disease resistance and will be a promising future therapeutic agent to combat plant invaders.

RNAi was first described in plants as an immune response to viral infection. As early as 1928, it was noticed that as tobacco plants infected with tobacco ringspot virus grew, the upper leaves showed resistance to the effects of the virus. It is now known that dsRNA intermediates produced during virus infection activate the RNAi machinery to silence expression of complementary genes, thus producing immunity to the virus. This defense against foreign genetic material is one of several physiologic pathways that are induced by naturally occurring dsRNAs in a wide variety of eukaryotic organisms including fungi, plants, and animals. With some variations, these responses are all mediated by a common RNAi pathway that involves processing of the dsRNA into short duplexes of about 22 base pairs with characteristic end structure.

Mechanism of RNAi:

RNA interference refers collectively to diverse RNA based processes that all result in sequence specific inhibition of gene expression at the transcription, mRNA stability or translational level. The unifying features of this phenomena are the production of small RNAs (21.26 nucleotides) that act as specific determinants for down-regulating gene expression and the requirement for one or more members of Argonaute family of protein. RNA i operates by triggering the function of dsRNA intermediates, which are processed into RNA duplexes of 21-24 nucleotides by ribonuclease III Like enzyme called Dicer (Mehrotra and Aggarwal 2003). Once produced, these small RNA molecules of short interfering RNAS (SiRNAs) are incorporated in a multi-subunit complex called RNA induced silencing complex (RISC). The RISC complexis formed by an endonuclease and siRNA among other component. The siRNAS within RISC acts as a guide to target the degradation of complementary messenger RNAS (mRNAS), When dsRNA molecules produced during viral replication trigger gene silencing the process is called Vinas-induced gene silencing (VGS). One interesting feature of RNA silencing in plants is that once it is triggered in a certain cell, a mobile signal is produced and spread through the whole plant causing the entire plant to be silenced. This silencing process is also enhanced by the enzymatic activity of the RISC complex, mediating multiple timer reaction. Furthermore, production of the more secondary siRNAs leads to enrichment of silencing via its spread from the first activated cell to neighboring cells, and systematically through system . The cell-to-cell spread can be mediated as passive spread of the small RNAS via plasmodesmata, since it does not spread into meristematic cells. The discovery of RNA binding protein (PSRPI) in the phloem and its ability to build 25 nts.

How RNA Works:

The entry of long double stranded RNA, such as an introduction of a rogue genetic element or a viral intruder, triggers the RNA pathway of cells. This results in the recruitment of the Dicer. The Dicer leaves the dNA into 20-25 basepairs long, fragments, called small

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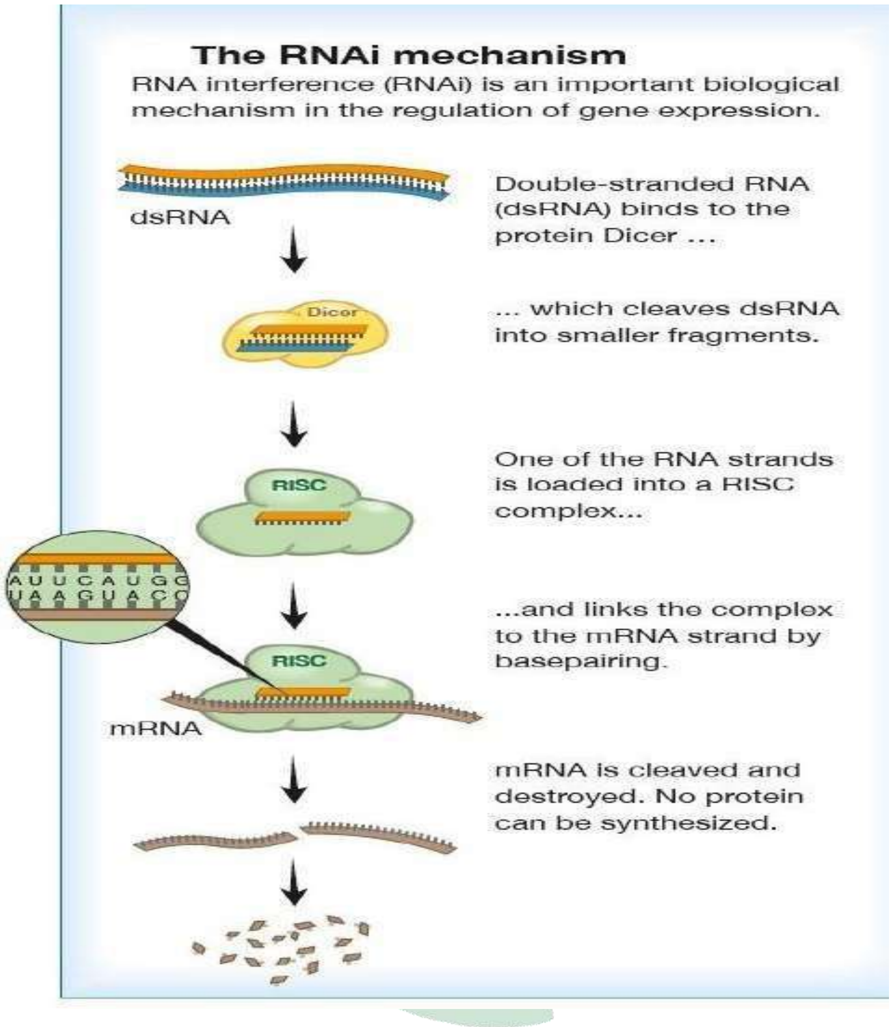
interfering RNA (siRNA). An RNA-induced silencing complex (RISC) then distinguishes as sense or antisense between the two siRNA strands. The sense strands which has exactly the same sequence as of the target gene are degraded. The antisense strand on the other hand are incorporated to the RISC also used as guide to target messenger RNA (mRNA) in a sequence-specific manner, Messenger RNAS (mRNA), which codes for amino acids, are cleaved by RISC. The activated RISC can repeatedly participate in mRNA degradation, inhibiting protein synthesis.



Disease Management by RNAi:

The RNA interference technology has emerged as one of the most potential strategies for enhancing the building of resistance in plants to combat various fungal, bacteria, viral and nematode diseases causing huge losses in important agricultural crops (Singh, 2005) The nature of this biological phenomenon has been evaluated in a number of host-pathogen systems and effectively used to silence the action or pathogen. Many of the examples listed below illustrate the possibilities for commercial exploitation of the inherent biological mechanism to generate disease resistant plants in the future by taking advantage of this approach eg: including: *Cladosporium fulvum, Magnaporthe oryzae, Venturia inequali, Neurospora crassa* and *Fusarium graminearum* whether it is suitable for large-scale mutagenesis in fungal pathogens remains to be tested. Such silencing mechanisms (RNAi) can also be exploited to manage and protect plants from viral infections. The effectiveness of this technology in generating virus-resistant plants was first reported to PVY in potato, harboring vectors for simultaneous expression of both sense and antisense transcripts of the helper-component *proteinase* (*HC-Pro*) gene

RNAi for Male Sterility

RNAi has also been used to generate male sterility, which is valuable in the hybrid seed industry. Genes that are expressed solely in tissues involved in pollen production can be targeted through RNAi. For instance, scientists have developed male sterile tobacco lines by inhibiting the expression of TA29, a gene necessary for pollen development. RNAi was also used to disrupt the expression of Msh1 in tobacco and tomato resulting to rearrangements in the mitochondrial DNA associated with naturally occurring cytoplasmic male sterility.

Disease Management by RNAi:

For RNAi application in agricultural pest control the target insect must take the dsRNA autonomously from the transgenic plants expressing dsRNA. the feeding by the insect should be continuous as the insects lack an amplification mechanism based on RdRP. Many of the agricultural pest species have already been targeted by RNAi technology using various genes and delivery methods. However three orders have been the major focus of the development of transgenic plants expressing target gene region they are lepidoptera coleoptera and hemiptera. The table describes provides the examples of the effect of the RNAi in these orders

Specie	**Order**	**Crop**	**Target Gene**	**Effect**
Diabrotica v. virgifera	Coleoptera	*Zea mays*	*vATPase*	Mortality
Leptinotarsa decemlineata	Coleoptera	*Solanum tuberosum*	*β-actin, Shrub*	Mortality
Helicoverpa armigera Spodoptera exigua	Lepidoptera	*Nicotiana tabacum*	Nuclear receptor complex of 20-hydroxyecdysone (*HaEcR*)	Molting defect and larval lethality

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Helicoverpa armigera	Lepidoptera	*Nicotiana tabacum*	Molt-regulating transcription factor gene (*HR3*)	Developmental deformities and larval lethality
Helicoverpa armigera	Lepidoptera	*Arabidopsis thaliana*	*HaAK*	Developmental Deformities and larval lethality
Myzus persicae	Hemiptera	*Arabidopsis thaliana and Nicotiana benthamiana*	*MpC001, Rack1*	Progeny reduced

Limitations of RNAi:

- The limitations mainly depend on the type of polymerase ultimately used to recognize and amplify the siRNA sequence.
- even following the recommended rules for siRNA design does not ensure effective silencing of the target gene.
- The efficacy of siRNA-mediated suppression of gene expression depends on a number of factors, including not only the chosen siRNA sequence but also the structure of the siRNA, and the receptiveness of the cell type to siRNA uptake.
- the half life of the target message and/or protein needs to be considered in order to achieve optimal silencing.
- Although siRNAs are relatively stable in cell culture conditions, they require enhanced nuclease and thermodynamic stability when in circulation in vivo.

Conclusion:

Because the benefit of RNAi applications to both basic and applied research is substantial, strategies must be developed to maintain a high level of siRNA efficiency while minimizing the potential for the misinterpretation of data due to the nonspecific or off-target effects that have been associated with siRNA expression. Finally, as our understanding of this fascinating mechanism of gene regulation improves, new ways to effectively harness RNAi for experimental and therapeutic approaches will be revealed.

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Crop Residues Management

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India is an agrarian economy. A vast majority of land is used for farming and a wide range of crops are cultivated in its different agro-ecological regions. It is but natural that a huge volume of crop residues are produced both on-farm and off-farm. It is estimated that approximately 500-550 Mt of crop residues are produced per year in the country. These crop residues are used for animal feeding, soil mulching, bio- manure making, thatching for rural homes and fuel for domestic and industrial use. Thus crop residues are of tremendous value to the farmers. However, a large portion of the residues is burnt on-farm primarily to clear the field for sowing of the succeeding crop. The problem of on-farm burning of crop residues is intensifying in recent years due to shortage of human labour, high cost of removing the crop residues by conventional methods and use of combines for harvesting of crops. It is a paradox that burning of crop residues and scarcity of fodder coexists in this country, leading to significant increase in prices of fodder in recent years. Industrial demand for crop residues is also increasing. To manage the residues in a productive and profitable manner, conservation agriculture (CA) offers a good promise. With the adoption of conservation agriculture-based technologies these residues can be used for improving soil health, increasing crop productivity, reducing pollution and enhancing sustainability and resilience of agriculture. The resource conserving technologies (RCTs) involving no or minimum tillage, direct seeding, bed planting and crop diversification with innovations in residues management are the possible alternatives to the conventional energy and input-intensive agriculture.

Adverse consequences of on-farm burning of crop residues Burning of crop residues leads to release of soot particles and smoke causing human and animal health problems. It also leads to emission of greenhouse gases namely carbon dioxide, methane and nitrous oxide, causing global warming and loss of plant nutrients like N, P, K and S. The burning of crop residues is

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wastage of valuable resources which could be a source of carbon, bio-active compounds, feed and energy for rural households and small industries. Heat generated from the burning of crop residues elevates soil temperature causing death of active beneficial microbial population, though the effect is temporary, as the microbes regenerate after a few days. Repeated burnings in a field, however, diminishes the microbial population permanently. The burning of crop residues immediately increases the exchangeable NH4+-N and bicarbonate-extractable P content, but there is no build up of nutrients in the profile. Long-term burning reduces total N and C, and potentially mineralizable N in the upper soil layer.

Reasons behind on-farm burning of crop residues Farmers and policy makers are well-aware of the adverse consequences of on-farm burning of crop residues. However, because of increased mechanization, particularly the use of combine harvesters, declining numbers of livestocks, long period required for composting and unavailability of alternative economically viable solutions, farmers are compelled to burn the residues.

Competing uses of crop residues

The crop residues can be gainfully utilized for livestock feed, composting, power generation, biofuel production and mushroom cultivation besides several other uses like thatching,mat-making and toy making.

Livestock feed

In India, the crop residues are traditionally utilized as animal feed as such or by supplementing with some additives. However, crop residues, being unpalatable and low in digestibility, cannot form a sole ration for livestock. Crop residues are low-density fibrous materials, low in nitrogen, soluble carbohydrates, minerals and vitamins with varying amounts of lignin which acts as a physical barrier and impedes the process of microbial breakdown. To meet the nutritional requirements of animals, the residues need processing and enriching with urea and molasses, and supplementing with green fodders (leguminous/non-leguminous) and legume (sunhemp, horse gram, cowpea, gram) straws

Compost making

The crop residues have been traditionally used for preparing compost. For this, crop residues are used as animal bedding and are then heaped in dung pits. In the animal shed each kilogram of straw absorbs about 2-3 kg of urine, which enriches it with N. The residues of rice crop from one hectare land, on composting, give about 3 tons of manure as rich in nutrients as farmyard manure (FYM). The decomposition process, which is hastened by a consortium of microorganisms, takes 75-90 days.

Energy source

Biomass can be efficiently utilized as a source of energy and is of interest worldwide because of its environmental advantages. In recent years, there has been an increase in the usage of crop residues for energy generation and as substitute for fossil fuels. In comparison with other renewable energy sources such as solar and wind, biomass source is storable, inexpensive, energy-efficient and environment-friendly. However, straw is characterized by low bulk-density and low energy yield per unit weight basis. The logistics for transporting large volumes of straw required for efficient energy generation represents a major cost factor irrespective of the bio-energy technology. Availability of residues, transportation cost and infrastructural settings (harvest machinery, modes of collection, etc.) are some of the limiting factors of using residues for energy generation.

Bio-fuel and bio-oil production

Conversion of ligno-cellulosic biomass into alcohol is of immense importance as ethanol can either be blended with gasoline as a fuel extender and octane-enhancing agent or used as a neat fuel in internal combustion engines. Theoretical estimates of ethanol production from different feedstock The technology of ethanol production from crop residues is, however, evolving in India. There are a few limiting steps in the process of conversion of crop residues into alcohol, which need to be improved. High energy requiring operating conditions, costly hydrolytic cellulase enzyme, and unavailability of natural robust commercial organism to ferment pentose and hexose sugars simultaneously either as single species or in combination of other species are some of the constraints, which require additional research efforts.

Biomethanation

The process of bio-methanation utilizes crop residues in a non-destructive way to extract high quality fuel gas and produce manure to be recycled in soil. Biomass such as rice straw can be converted into biogas, a mixture of carbon dioxide and methane, which can be used as fuel. Biogas of 300 $m^3$with 55-60% of methane can be obtained per ton of dry rice straw. The process also yields good quality spent slurry, which can be used as manure.

Gasification

Gasification is a thermo-chemical process in which gas is formed due to partial combustion of crop residues. The main problem in biomass gasification for power generation is the purification of gas for removal of impurities. The crop residues can be used in the gasifies for 'producer gas' generation The gasification technology can be successfully employed for utilization of crop residues in the form of pellets and briquettes. The generated 'producer gas' is cleaned using bio-filters and used in specially designed gas engines for electricity generation. The Central Institute of Agricultural Engineering (CIAE), Bhopal, has developed a power plant running on 'producer gas' generated from biomass.

Biochar production

Biochar is a high carbon material produced through slow pyrolysis (heating in the absence of oxygen) of biomass It is a fine-grained charcoal and can potentially play a major role in the long-term storage of carbon in soil, i.e., C sequestration and GHG mitigation. However, with the current level of technology, it is not economically viable and cannot be popularized among the farmers. However, once all the valuable products and co-products such as heat energy, gas like H2 and bio-oil are captured and used in the biochar generation process, it would become economically-viable. There is a need to develop low cost pyrolysis kiln for the generation of biochar to utilize surplus crop residues, which are otherwise burnt on-farm.

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Bio-Refined Nano Nutrients From Fish & Shellfish By-Product For Roof Top Gardening And Urban Horticulture

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In-discriminatory usage of chemical fertilizers, pesticides, antibiotics, agro-chemicals in agriculture and water bodies has created many environmental and health issues. Culture and capture fisheries resources utilizes nutrients from the coastal water bodies which creates pollution in Bay of Bengal through river systems. Post harvests fish processing waste constitute around 50% in a fish are not commonly used in human feeding and are disposed off. Fish waste recycling into organic fertilizers is well in tuned with current food production concern, waste disposal, environmental responsibility and supply chain efficiency.

“Fish waste bio-refineries” are defined as sustainable processing of fish waste biomass into a spectrum of marketable products and energy for crop, animal and fish farming. Fish processing waste are promising renewable biomass.

Fish bio extracts are liquid organic fertilizers for plants and crops are used as a foliar spray and drenching. Solid bio-extracts are powdered organic fertilizer use for soil and aquaculture pond recharge.

Shellfish bio-extracts are immune-modulators, plant and animal disease prevention, anti fungal and anti bacterial activities. All these products provide resistance to plant and animals against climate change issues such as drought, flood and cyclone.

Nutritional composition of liquid fish fertilizer (LFF)

Bio-available Primary nutrients	
Nitrogen	1.5%
Phosphorus	0.5%
Potash	0.4%
Carbon	33.7%

Bio-available Secondary nutrients	
Sulphur	1.52%
Magnesium	1.75%
Calcium	2.24%

Bio-available Micro nutrients	
Boron	10.4%
Zinc	17.9%
Haem iron	24.5%
Manganese	5.2%
Copper	3.5%
Choline and molybdenum	traces

Benefits of organic fish fertilizer :
Fish fertilizer is a liquefied organic fertilizer, excellent for fertigation and foliar spray.

Agri-Horti-Vegi-Flori-Lawn Foliar spray :
1 ml/litre liquid fish fertilizer (Planktofert) for foliar spraying once in every week.

Agri-Horti-Vegi-Flori-Lawn Fertigation :
2 litre /acre for fertigation/drip irrigation/green house farming

Liquid planktofert dose :
Drip irrigation – 1ml /ltr water
Soil less planting – 1ml /ltr water
Hydroponics – 1ml /ltr water
Vertical gardening – 1ml /ltr water
Aqua ponics – 1ml /ltr water

Agri-Horti-Vegi-Flori Use :
Lawn and Landscape – 6gm/sqft/every 15 days interval, 2 times
Floriculture flower beds – 6gm/sqft/every 15 days interval, 2 times
Rose plants/flower pots – 6gm/flower pot/every 30 days interval, 2 times
Vegetables/fruit plant beds – 6gm/sqft/every 30 days interval, 2 times

Powdered biofert dose :
Potting material preparation – 1kg /100kg /potting media

Pestolyse dose :
Liquid bio-organic immunostimulant, disease and pest control foliar spray 1ml/ltr water.

Planktofert and pestolyze are bio-organic and suitable for green house farming, spraying by drone and drip irrigation.

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Effect of soil organic matter on physical properties of soil

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Abstract

Organic matter is the lifeblood of fertile, productive soil, without it agriculture production is not sustainable. Soil organic matter plays a vital role in determining the physical properties of soils. We reviewed the information on the relationships of soil organic matter with soil structural stability, consistency, compaction, water holding capacity of soil and other physical properties of soil which are vital for agriculture production. Our review indicates that studies specifically assessing relationships between organic matter content and physical properties of soil. These studies indicates soil organic matter improves soil physical properties by providing organic binding agents , increasing water holding capacity of soils, provides better aeration , lowering soil bulk density, and improving the elasticity and resilience of the whole soil. The numerous benefits of soil organic matter on physical attributes suggest that crop residues should be returned to the soil to maintain or increase SOM concentration. Management practices including no –till with residue return, continuous cropping systems, cover crops, and grass –based rotations should be promoted to further increase SOM concentration and thus improve soil physical properties.

Keywords- Organic Matter, Organic matter decomposition, Physical properties, Soil organic carbon Soil.

Highlights

Soil Organic matter (SOM) and specifically soil organic carbon (SOC) are known to play important roles in the maintenance as well as as improvement of many soil properties. While agriculture is the area most concerned with key functions and critical levels of soil organic matter. The physical properties of the soils are very important for agricultural production and for the sustainable use of soil. Agricultural wastes can be used as a source of organic matter and nutrients for soils and can influence physical properties of soils.

Introduction

Soil organic matter is the fraction of the soil that consists of plant or animal tissue in various stages of decomposition. Most of our productive agriculture soils have between 3-6% organic matter. Soil organic matter contributes to soil productivity in many different ways. Soil organic matter is made up of different components that can be grouped into three major types :-

- Plant residues and living microbial biomass.
- Active soil organic matter also referred to as detritus.
- Stable soil organic matter, often referred to as humus.

The first two types of organic matter contribute to soil fertility because the breakdown of these fractions results in the release of plant nutrients such as nitrogen, phosphorus, potassium etc. The humus fraction has less influence on soil fertility because it is the final product of decomposition (Hence the term stable organic matter).

Physical Properties of soil :-

1. Soil texture
2. Soil structure
3. Soil density
4. Soil temperature
5. Soil aeration
6. Soil porosity
7. Soil colour
8. Soil compaction

Effect Of Soil Organic Matter On Soil Structure,Texture And Aggregate Stability

Soil structural stability refers to the resistance of soil to structural rearrangement of pores and particles when exposed to different stresses. Chaney and Swift (1984) investigated aggregate stability of 26 soils from agricultural area and found a linear correlation between aggregate stability and organic matter. Organic matter improves soil structure ,allowing the free passage of air and water , both equally necessary to the growth of plants, its like a sponge holding onto water and nutrients. Tisdall and Oades (1982) proposed that the fresh or active part of SOM was largely responsible for stabilization of aggregates. The addition of organic matter to the soil usually increases the water holding capacity of soil. This is because the addition of organic matter increases the number of microspores and macrospores in the soil either by gluing soil particles together or by creating favourable living conditions for soil organisms. Oades and Waters (1991) introduced the concept of aggregate hierarchy. The concept of aggregate hierarchy suggests that organic matter controls aggregate stability, and degradation of large aggregates creates smaller, more stable aggregates.

Effect of Soil Organic Matter on Soil colour and Soil Temperature

Soil colour is often used as the highest categorical level in many soil classification systems. A good linear correlation exists between soil colour and SOM content. Dark coloured soils with a higher amount of organic matter hold comparatively larger amounts of water, which require a greater amount of energy for heating. The thermal property of soil is largely influenced by a combination of water content, soil texture and soil colour. Generally good soil conditions are associated with dark brown colours near the soil surface, which is associated with relatively high organic matter levels, good soil aggregation and high nutrition levels (Peverill *et al*. 1999). The effect of usually dark brown or black SOM on soil colour is important not only for soil classification purposes, but also for ensuring good thermal properties , which in turn contribute to soil warming and promote biological processes (Baldock and Nelson, 1999), Konen et al (2003) and Schulze *et al* . (1993) confirm that a consistent relationship exists between SOM content and Soil colour. Thus the influence of organic matter on thermal properties of soils may not only be affected by its colour but by the other soil organic properties as well Organic matter increases the water holding capacity of the soil. It also contributes to the dark colour of the soil. These two soil properties increases its absorption of heat, thereby increasing the soil temperature

Effect of Soil Organic Matter On Bulk Density Of Soil

Any practice that improves soil structure decreases bulk density. A system that uses cover crops, crop residues and reduced tillage results in increased soil organic matter, less disturbance and reduced bulk density . Bulk density is dependent on soil organic matter, soil texture, density of soil mineral (sand ,silt ,and clay) and their packing arrangement. Bulk density decreased 0.07 grams per cubic centimeter with a one percentage unit increase in organic matter (Shaykewich and Zwarich , 1968) .

Effect of SOM On Soil Porosity And Soil Aeration

Soil porosity is the volume of soil not occupied by solids and can be filled with air or water. Soil porosity is strongly linked to soil organic matter concentration. Increased organic matter contributes indirectly to soil porosity (via increased soil faunal activity). Increased levels of organic matter and associated soil fauna; ead to greater pore space with the immediate result that water infiltrates more readily and can be held in the soil.

Humus is vitally important for soil it improves soil aeration. The organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms. It improves soil aeration, as it is fibrous and porous. This improves the soil environment for many microbes and plant roots, which require aeration.

Effect of SOM On Soil Compaction

Soil compaction is the process of increasing the density of soil by packing the soil particles closer together causing a reduction in the volume of air. Soil compaction can be a serious form of soil degradation. Compaction of soil is the compression of soil particles into a smaller volume, which reduces the size of pore space available for air and water . Increase in the soil organic matter may reduce compatibility by increasing resistance to deformation and by increasing elasticity (Rebound effects :Soane 1990). High organic carbon contents can even reduce the compactibility of soil at high moisture levels in clay and silty clay soils (Smith et al. 1997).

Effect of Organic matter On Water Holding Capacity of Soil

The addition of organic matter to the soil usually increases the water holding capacity of the soil. (Hudson ,1994) showed that for each 1- percent increase in soil organic matter, the

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available water holding capacity in the soil increased by 3.7 percent. When a soil is at field capacity ,organic matter has a higher water holding capacity than a smaller volume of mineral soil. While the water held by organic matter at the permanent wilting point is also higher overall, an increase in organic matter increases a soil's ability to store water available for plant use.

Management of Soil Organic Matter

Soil organic matter (SOM) is the foundation for productive soils. It promotes healthy crops, supplies resources for microbes and other soil organisms, and regulates the supply of water, air and nutrients to plants. Ways to increase soil organic matter :-

- Grow perennial pasture, a period under perennial grass dominant pasture is an effective way of increasing organic matter in farm soils .
- Growing green manure crops to enrich the nutrient status of soils.
- Spreading manure and use of organic fertilizers
- Use of concentrate organic matter, retain all organic additions, whether roots, stubble or manure, close to the surface.
- Management steps like tilling and using cover crops that boost soil health can increase the organic matter content of the soil.

Conclusion

Soil organic matter is the foundation for productive soils. Organic matter is the lifeblood of fertile, productive soil, without it agriculture production is not sustainable. It is evident that there is a perfect linear correlation between SOM and physical properties of soil. The physical properties of the soil are very important for agricultural production and the sustainable use of soil. The amount and rate of water, oxygen, and nutrient absorption by plants depends upon the physical properties of the soil. Considering the physical properties, organic matter amendments can increase water holding capacity, soil porosity, water infiltration, and percolation while decreasing soil crusting and bulk density. Agricultural wastes can be used as a source of organic matter and nutrients for soils and influence the physical properties of soils. This addition can be a good strategy to maintain or even increase the levels of organic matter in the soil to improve physical properties of soils. So we need to maintain optimum levels of organic matter content is soil for promoting better physical properties of soil, which is a key for agriculture production.

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Use of Crop Residue in Solar Insulated Mud House: An Alternative of Burning Crop Residue

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Introduction:

What will you do if you are stationed at 12000ft above sea level in a cold desert like Ladakh where you do not have access to 24x7 power? The usual solution is to burn diesel and kerosene to keep warm or if it's available, burn firewood. This is exactly what people in Ladakh have traditionally done and does the Indian army for scores of its men stationed out there in Ladakh. With the mercury dipping to -20˚C or lower during winter nights and about -5˚C at night during March & April, it becomes virtually impossible to live without proper heating. Above all, Ladakh is not connected to the national electricity grid. It has a few areas that get power from local hydro plant while de-centralized solar power helps in many other remote areas but is highly inadequate.

Solar passive structures are not new. However, the one we are talking about are movable, prefabricated and can be assembled on the spot and give solution to meet the army's shelter requirements. The cost of heating will be zero. Even if the temperature outside is -20˚C, it will be 20˚C inside the hut, without any heating. This is going to rid of all the pollution caused by the massive amounts of the army consume to keep the jawan's warm.

India's first solar insulated mud house

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Passive Solar Heating or Solar Insulated Mud House

Passive solar design takes advantages of building's location and climate with the use of materials such as soil and local resources that will lead to low or almost nil use of energy for heating all through the day and still provides sufficient natural light.

Procurement of Material:

We require clay soil, water, straw fibre and waste fibre. All the material is very economical as it is natural & mostly waste reused. The straw to be used in mud house can be sourced from states like Punjab & Haryana where it would otherwise be burnt & cause pollution. Moreover, the waste fibre can also be obtained from the food processing units & textile industries so as to reduce the amount of waste generated.

Procedure of the making:

Whole procedure is quite simple. First of all clay is mixed with water to form a paste like matter called clay slurry. In this clay slurry we add the straw, fibre & waste fibre's. Then we solidify this mixture in small brick like structures. On a large scale, instead of bricks, large wall can also be formed as per the comfort. The block formed is highly insulating & forms all the walls of our solar insulated mud house. The only fault in this was that the compressive strength was low but very efficient solution was found for that too. The solution is to make the straw clay block with hole. While assembling, we may add either gravel or mixture of cement & gravel to increase its compressive strength. If we use rods we can even replicate this technique in reinforced/multi-storeyed buildings too.

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How to Assemble This Mud House?

In a mud house, there are specific functions of the walls & the directioning is quite important. The math is simple, it adds up to massive successful result. The south face of the building needs to be all windows, so that it gets maximum exposure of sunlight from sunrise to sunset in winters. The building's south side has huge thick plastic sheet or highly absorbent fibre glass attached to these windows at an angle. This stops strong chilly winds but allows sunlight & heat in winters. The top of the building has glass openings to keep the inside of the building well illuminated during the day and also trap heat in winters. Essentially, it is the double-layered, south-facing windows (plastic sheet & glass sheet or both). The other sidewalls are made up of thick mud with insulation in between. The insulation is the clay straw block we created earlier. The idea of passive solar design is that it absorbs & traps all the heat directly from sunlight & the architecture lets us store it for long.

The Indian army had invited this initiative to its seminars on warm habitats in cold places like Ladakh. A prototype has been made of a cost- effective solar-heated mud-built house for officers & the army has been testing it. "The Indian Army spends a lot of money & carbon for keeping soldiers warm in a cold place like Ladakh which is one of the sunniest places". We don't really need to drain national treasures to buy Qatar oil & become vulnerable to enemy fire on our supply line. We can be independent in every way by using the energy from sun. Through this youngster would build careers in the mountains & army will get cleaner habitats wit lower costs & carbon footprints. It will be safer too, because many soldiers are burnt in fire accidents because of kerosene.

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Bio Formulations of indigenous biocontrol agents - A Potential Alternative for Pests and Disease Management in Meghalaya

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Abstract

Bio formulation products consisting of native strains of beneficial microorganisms provide efficient strategies for eco-friendly management of agricultural pests and diseases in sustainable manner. These bioformulations are prepared by native/indigenous strains of *Bacillus subtilis*, *Beauveria bassiana*, *Metarhizium anisopliae*, *Paecilomyces lilacinous*, *Psuedomonas fluorescens*, *Trichoderma harzianum* and *T. viride.* A series of *in vitro* studies showed potentiality of some strains of the mentioned biocontrol agents few soil borne plant pathogens as well as some insect pests of Meghalaya. Similarly *in vivo* study also showed positive results in pot condition with enhancing plant growth and development and significantly reduced the targeted diseases and pests of agricultural crops. Liquid bioformulation protocol has been standardized and tested in field conditions. Farmers field demonstration is in progress with positive feed back. Exploration of local strains into a low cost liquid bio formulation products not only paves way for niche management of biotic stresses but also provides scope for employment among local youths, women as well as farmers.

Introduction

Bio formulations are defined as any biologically active substances derived from microbial biomass or product containing microbes and their metabolites or botanicals or plant incorporated products etc that could be used either in plant growth promotion, nutrient acquisition or pests and disease management without harming the environment. Bio formulated products offer green alternative to conventionally used chemical pesticides that have degraded 25% of the productive agricultural lands into arid and non-fertile soils (Berger *et al.*, 2018). It also provides eco-friendly solutions to most hazardous impacts of agrochemicals such as loss of soil fertility, beneficial microbial populations as well as rapidly changing environmental scenario impacting agriculture *viz.* drought, temperature stress, soil salinity, depletion of mineral nutrients. Development of indigenous bio formulations involves efficient use of native agroecosystem that enhance agricultural production in sustainable manner with their immense potential to ameliorate the drastic effects of biotic stress.

Mechanisms of bioformulations:

Mechanism of biocontrol agents of bioformulation is guided by the principles of host, pathogen, environment and microbes as biocontrol agents and their understandings is essential for improvement as well as wider use of biological methods. There are different types of direct and indirect mecahnisms of biological suppression or control of plant pathogen or insect pests. Here the main mechanisms are discussed briefly as follows:

- **Mycoparasitism:** It is defined as a phenomenon under which a fungus parasitizes host fungus by invading the cell through coiling of hyphae or direct penetration *via* production of haustoria and lysis of hyphae (Baker and Cook, 1974). Eg. Mycoparasitism of *Rhizoctonia solani* and *Pythium ultimum* by *T. harzianum.*
- **Antibiosis:** Production of low molecular weight non-polar volatile compounds/ antibiotics which at low concentration are deleterious to the growth or other metabolic activities of other microorganisms (Handelsman and Parke, 1989). These metabolites include volatile organic compounds (VOCs), siderophore cell wall degrading enzymes *viz.* chitinases, cellulases, proteases, glucanases (Lo, 1998). Eg. 2,4-diacetylphloroglucinol (*P. fluorescens),* zwittermycin *(B. subtilis),* Harzianic acid *(T. harzianum) etc.*
- **Competition:** Intra- or Interspecific competition occurs when individuals attempt to obtain a resource that is inadequate to support all the individuals seeking it or even if resources competed for, such as nutrients and space to grow, nest and hide from predators (Lorito *et al.*, 1984). Eg. Competition of *T. harzianum* with *Sclerotinia sclerotiorum* and *Fusarium solani.*

Advantages of bio formulations:

- Bio pesticides usually are inherently less harmful than conventional pesticides.
- It generally affects only the target pest and closely related organisms, in contrast to broad-spectrum conventional pesticides that may affect organism.

- They are effective in very small quantities and often decompose quickly, therefore resulting in lower exposures and largely avoiding the pollution problems caused by conventional pesticides.
- When used as component of integrated pest management (IPM) programme, bio pesticides can greatly decrease the use of conventional pesticides, while crop yields remain high.

Materials and Methodology:

Materials required:

Media {potato 200g, dextrose 20g in 1000 ml distilled water}, beakers (1000 ml), spatula, electric heater, cotton plugs, autoclave or pressure cooker, glass bottle (250ml, 500ml, 1000 ml), muslin cloth, spirit lamp, dehydrating alcohol

Techniques for mass production and bio formulation:

a) Media preparation- Potato dextrose broth (PDB) media:

- Potato extract was prepared by boiling washed, peeled-off potato cubes (200g) for 10-15 minutes in 500 ml of water and squeezed through muslin cloth.
- Add dextrose (20g) and agar agar (20g) to the extract, stir to dissolve and make up volume to 1000 ml. Dispense the media into glass bottles filling up to 2/3rd of its capacity using plastic funnel and plug the bottles tightly with non-absorbent cotton.
- Cover the cotton plugs with brown paper or waste paper and tie with rubber band and sterilize the media in pressure cooker on a LPG and store for 20 minutes after first whistle.

b) Inoculation process:

- Sterilized media were inoculated with 10 ml of mother culture (Table 1) in sterilized inoculation chamber and incubated either at room temperature (25 ± 1 ˚ C) or in BOD incubator at (25 ± 1˚C) at least for 7-10 days.
- **Organisms used for bio formulation:**

Table 1: List of organisms used to prepare indigenous bio formulation

Type	Bio agents	Source
Insect pathogens	*Beauveria bassiana* (NCFT 9097.17)	School of Crop Protection, College of Post-Graduate Studies in Agricultural
	Metarhizium anisopliae	
	Paecilomyces lilacinus (NCFT 9094.17)	
Microbial	*Trichoderma harzianum*	

antagonists	*Trichoderma viride*	Sciences, Central Agricultural University (Imphal), Umiam, Meghalaya
Bacterial biocontrol agents	*Bacillus subtilis*	
	Psuedomonas fluorescens	

- The colour of media will be green for *Trichoderma*, white for *Beauveria*, dark pink for *Purpuroceocillium*, dark green for *Metarhizium*, grey for *Isaria* at later stage, forming thick mat spores and mycelium after 15-20 days and ready for production of bio formulations.

c) Development of liquid bio formulations:

- Grind the mycelial mat with suspended broth with the help of grinder and filter through a layer of muslin cloth.
- Mix the culture filtrate with appropriate carrier and adjuvants.
- Fill the bottles with prepared formulations, label it and store at room temperature (Plate 1; Table 2).

Results:

Bio formulation produced:

Plate 1: Indigenous bio formulations prepared from native strains of Meghalaya; (A) UmMet (*M. anisopliae*), (B) UmBir (*B. bassiana*), (C) UmCill (*P. lilacinus*) and (D) UmTriv (*T. viride*)

General view of mass production site of biopesticides at CPGSAS, CAU (Imphal), Umiam, Meghalaya

Table 2: List of indigenous bio formulations prepared

Product	Organisms	Target organisms
UmBir	*Beauveria bassiana*	Rice hispa, aphids, leaf hoppers, fruit scaring beetle
UmMet	*Metarrhizium anisopliae*	White grub, aphids, white fly
UmCill	*Paecilomyces lilacinous*	Root knot nematode
UmTricho	*Trichoderma harzianum*	Damping-off, root rot, sheath blight, wilt
UmTriv	*Trichoderma viride*	Root rot, white mold, wilt, damping-off
UmRaj	*Bacillus subtilis*	Bacterial wilt, sheath blight, damping-off
UmPsuedo	*Psudeomonas fluorescens*	Damping-off, sheath blight, Bacterial and fungal wilt

Method of application and dose:

a) Seed treatment:

- Mix 10 ml of bio formulation in 1000 ml of water and soak the seeds/ seedlings into it for 30 minutes.
- Shade dry treated seeds for 1 hour prior sowing.

b) Seedling root dip treatment:

- Mix 100 ml of bio formulation with 10 L of water.

- Dip the seedling root –zone for 10-15 minutes prior to transplanting.

c) Drenching root zone:

Mix 10ml of bio formulation in 1000 ml of water and drench the root zone depending upon the crop up to 1-2 feet from main stem.

d) Soil application:

- Mix 1 L of bio formulation with 1.5 kg of vermicompost and incubate for 7 days.
- Apply 100g of enrich compost in seed bed or in main field 3-4 days before sowing or transplanting of vegetables.
- Apply 100 g of bio formulation enriched compost in pit during transplanting and in soil around the 30 days old crops.
- Apply 5 kg of enriched compost per plant during February/ March and another during September/ October.

e) Foliar spray:

Mix 10 ml of bio formulation in 1000 ml of water and spray the foliar parts of plants twice at an interval of 30 days.

Precautions

- Store in cool, dry and well ventilated place, away from food stuff and animal feeds under lock and key.
- Keep away from direct sunlight and Spray preferably in the afternoon.
- Avoid inhalation and skin contact.
- Use sticker @ 0.02% during rainy days.

Results in field activity:

Plate 2: Foliar application of umBir (A) and site view of rice production (B, C)

a) Disease and pest free production of rice in CPGSAS experimental farm, Umiam

Successful production of rice was reported from rice experimental farm of CPGSAS, Umiam from Ri bhoi district of Meghalaya (Plate 2). It was done by solely limiting to organic agricultural practices that includes:

- Two application of 10 tonne/ha farm yard manure (FYM) during field preparation.

Foliar spray of UmBir, four times from the days of transplanting at an interval of 15 days

b) Management of brown spot and blast diseases of rice in CoA experimental farm, Krydamkulai, RiBhoi district, Meghalaya.

Heavy occurrence of brown spot and blast disease incidence was recorded from rice experimental farms of College of agriculture, krydemkulai under rib hoi district of Meghalaya (Plate 3). The pathogenic agent responsible for the infection was identified as fungus *viz. Bipolaris oryzae* and *Pyricularia oryzae.* The remedial treatment for the management of target disease was:

- Combined application of UmBir and UmTricho as thrice foliar spray at 5 days interval.
- Application of cow dung suspension @ 1:2 in water 4-5 times initially at 3 days interval and later at 7 days interval.

Drastic reduction in disease incidence of brown spot and blast have been reported at 10th day after application along with improvement of growth of plants (Plate 3)

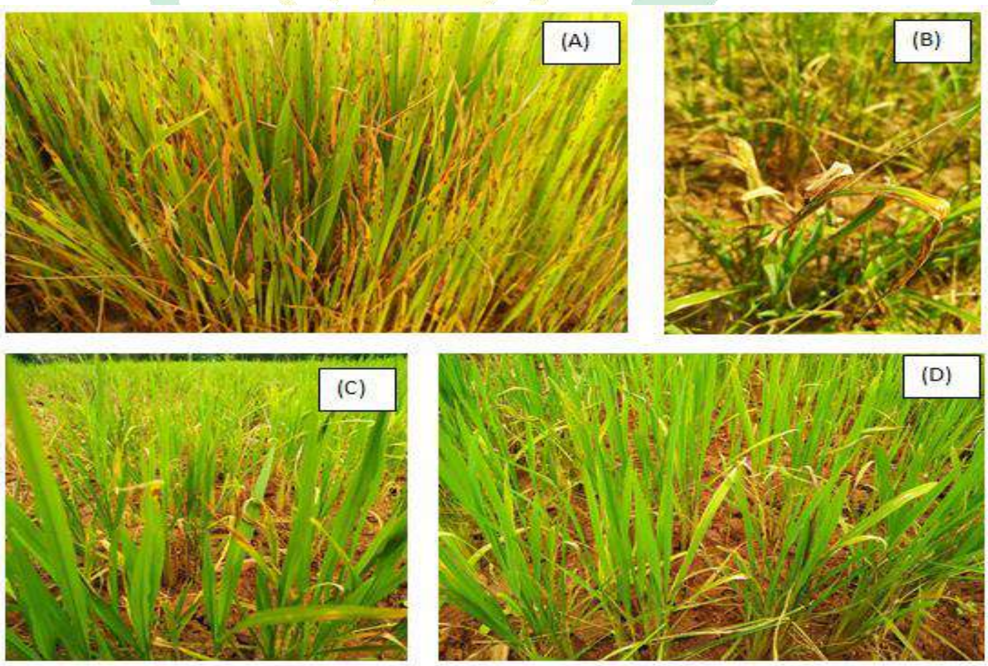

Plate 3: Heavy infection of brown spot (A) and blast of rice (B) and reduced disease incidence post bio formulation application (C, D)

C) Management of fall army worm in maize field of (Kurba Mawlai)

In situ demonstration and application of UmMet in the farmer's field of Kurba Mawlai in Ri bhoi district of Meghalaya for the management of fall army worm of maize Plate 4a and 4b).

Plate 4(L-R). L: Demonstration on field application of UmMet for management of fall army worm, R: Distribution of UmMet to the maize grower

Training were also imparted to create awareness on biopesticides, mass culture technique and technical details of preparation of stray suspension, precautionary measures etc to the progressive farmers, faculties and graduate and post graduate students of Meghalaya, Assam, Mizoram, Tripura, Arunachal Pradesh etc.

Plate 5. Imparting training to farmers, faculties, graduate and PG students

Conclusion

Indigenous bio formulation products are very effective in small scale trials against various pests and diseases. Trainings on mass production of bio formulation of indigenous biocontrol agents can be helpful in establishing small scale cottage industry of bio formulation products as well as to increase bankability of small and marginal farmers as well as youths.

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A review: Farm sector grows as GDP contracts for first time in India

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Abstract

The agricultural sector is one of the most important industries in the Indian economy, which means that it is also a major employer. About 60 percent of the Indian population is employed in the sector, contributing about 18 percent of India's GDP. The farm sector is still growing, but it is not enough to pull off a recession from the first quarter of this fund. The NSO estimated agricultural growth in the last quarter based on production during the rabies season that ended in June 2020. With rainfall in the southwest rainfall is 9.8 percent higher than normal in mid-June and the calories increase 8.6 percent higher than last year - the chances of a developing 'Lina Nina' growing well in a future rabies plant agricultural growth should be buoyant in other currencies as well. This, even though the average GDP growth for 2020-21 is expected to be negative, is unprecedented.

Introduction

India's GDP registered at -5.2% in 1979-80. In the same year, agricultural growth was 012%. Similar reductions have been seen in previous reductions. In 1957-58, GDP growth of -1.2% and agricultural growth of -4.5%. In 1965-66, GDP growth was -3.7% and agricultural growth was –ve 11%. The first quarter of 2020-21 (April-March) may be different. India's growth fortune is tied to agriculture. All years of GDP cuts, the last in 1979-80, were led by the farm sector. April-June 2020 could be the first time that the economy will slow down even though agriculture does not boost positive growth. It would be historic if this were to cover all the remaining funds. But it would not be desirable - agriculture can only support growth, not earn.

The farm sector, however, is expected to deliver good annual growth. Agricultural GDP for the first quarter includes production from the rabbi season, which ends in April-June. The Department of Agriculture has released wheat flour, chana and other rabies foods during this period at 151.72 million tones, 5.6% higher than last year. While oilseeds (especially mustard) dropped by 3.2% to 10.49 mt, many agricultural rabies crops - from onions, tomatoes, guavas, beans and jera to mangoes, grapes and watermelons - showed an increase. Probably the only difference is the potatoes.

India's GDP from Agriculture fell to 4546.58 INR Billion in the second quarter of 2020 from 5306.26 INR Billion in the first quarter of 2020.

Challenges faced by Agriculture sector in India

- Farm Holdings: About 50% of the population works in agriculture in India. However, as farmland is divided among family members, farm size is half of what it was 40 years ago.
- Irrigation: Most farmland is still under unsustainable farm practices such as pumping, flooding that drains water.
- Subsidies: Government subsidies to farmers increased eightfold between 1990-91 and 2006-07.
- Although fruits and vegetables contain only 13.6% of total production, contributing to 30% of post-harvest losses due to lack of cold storage.
- About 60% of India's agricultural lands are at risk due to poor manure, nutrient deficiencies and poor planting patterns.

India's Agricultural Target

India is on track to double the farmers' income by 2022. A recent APEDA report suggests that India has the highest chance of achieving an export target of USD 60 billion by 2022. As a result of the agricultural export policy this has improved communication between the Department of Trade and the Department of Agriculture.

Agricultural schemes in India

1. Soil Health Card Scheme
2. Pradhan Mantri Fasal Bima Yojana (PMFBY)
3. Neem Coated Urea (NCU)
4. Radhan Mantri Krishi Sinchai Yojana (PMKSY)

5. Paramparagat Krishi Vikas Yojana (PKVY)
6. National Agriculture Market (e-NAM)
7. Micro Irrigation Fund (MIF)
8. Agriculture Contingency Plan
9. Rainfed Area Development Programme (RADP)
10. National Watershed Development Project for Rainfed Areas (NWDPRA)
11. National Mission for Sustainable Agriculture (NMSA)
12. Livestock insurance Scheme
13. National Scheme on Welfare of Fishermen
14. Scheme on Fisheries Training and Extension

Conclusion:

Overall, the agricultural sector would have grown at least 3-4% in real terms in the first quarter of 2020-21, just as GDP as a whole could have reached a double digit agreement. For farmers, however, agricultural growth in terms of, after adding inflation, is what matters. It is estimated that India's agricultural sector accounts for only 14 percent of the country's economy but 42 percent of total employment. With about 55 percent of India's arable land dependent on rainfall, rainfall during the rainy season is crucial to economic activity.

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Enhancement Income of Farmers by Seed Production of Open Pollinated Varieties of Carrot

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Healthy, vigorous and true to type (genetically pure) seed is the basic requirement for commercial crop production for farmers. Good quality seed confirms to establish seed standards of germination, uniformity, genetic purity, free from seed born pathogen and other prescribed parameters. Timely availability of good quality seed is urgent need for food security of increasing population of India. Sowing of good quality seeds is primary requirement of growing good quality seed. Planting material and quality seed is critical to agricultural production because it contributes substantially to enhance crop yield as high as 30%. Thus, Seed is a critical input for enhancing productivity of all crops. The response of all other inputs depends on improved seeds to a large extent and it can be further raised up to 45 per cent with efficient management of other inputs. So, it is urgent need to replacement of poor quality seed by using quality seeds of high yielding varieties. Open pollinated varieties seeds have significant importance for farmers due to contribution of 70% alone of total vegetable seed. Open pollinated varieties seeds are results of either natural or human selection for specific traits which are then reselected in every crop. The seed is kept true to type through selection and isolation. The flowers of open pollinated varieties are pollinated by bees or wind. Open pollinated varieties are beneficial for farmers than hybrid seeds because farmers himself can produce these varieties seeds in less efforts by repeatedly sowing seeds of them. Open pollinated varieties are also less infested by diseases due to a little undetected variation between plants in the field in comparison to genetically identically hybrid varieties.

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Carrot is highly cross pollinated crops in nature and demands extra efforts and caution for its seed production. Carrot belongs to two different groups based on climatic requirement, one is Asiatic type and another group is European type. Under, Indian conditions, only Asiatic groups are better suited for seed production.

Figure: Umbel initiation and seed formation in carrot

In India Important varieties of carrot and their novel and distinguish characteristics are as follows:

1. **Pusa Rudhira:** Developed by ICAR-IARI, New Delhi. A tropical variety of carrot and roots take about 85-90 days for maturity after sowing. Roots have dark red in color with self core, 27 cm long and 3.4 cm diameter. It's leaves color is dark and

green. Plant height is about 65 cm with late bolting. Average root yield is 230q/ha which is 50% higher yield over national check Pusa Kesar. Suitable for growing in NCR region.

2. **Pusa Kesar:** Roots are rich in carotene and have deep red in color. Self core with small deep red in color. Period of roots maturity is about 80-90 days after sowing. Average root yield is about 300 q/ha. Suitable for cultivation in all over India.
3. **Pusa Meghali:** It has short tops with smooth roots, orange flesh, self colored core and stumpy to slightly tapering roots. Variety is suitable for sowing early (August-September) as well as late (October-November). Its roots mature in about 110-120 days. Average yield 250-280 q/ha. Suitable for cultivation in Madhya Pradesh and Maharashtra.
4. **Pusa Ashita:** Developed by ICAR-IARI, New Delhi. This tropical variety is late bolter type. Maturity of roots is about 95-100 days after sowing. Roots have self black color core with 26 length and 3.2cm diameter. Fresh carrots are suitable for making pickles, salad, juice, and kanji. Leaves show dark green color while petioles show purple color. Average yield of it is 300 q/ha. Gives more than 30% higher yield over national check Pusa Kesar. Suitable for growing in NCR.
5. **Pusa Yamdagni:** It is temperate type variety of carrot. Roots attain edible maturity 90-100 days. After sowing crops take 86-130 days to harvest which is earlier than Nantes by a week. Roots are orange in color with self colored core, slightly tapering or semi stumpy with medium tops, rich in carotene. Root yield is 120 q/ha. Recommended for cultivation all over India.
6. **Pusa Vrishti:** Developed by ICAR-IARI, New Delhi. It is a new heat tolerant tropical carrot variety. It is suitable for early sowing beginning in July under North Indian plains. Root maturity is in about 85-90 days. Average yield 250 q/ha. Suitable for cultivation in NCR.
7. **Selection 223:** Developed by PAU, Ludhiana. Roots are orange in color with light orange flesh.
8. **No. 29:** Developed by PAU, Ludhiana. Roots are long tapering and light red in color.

Climate requirement:

For proper vegetative growth and root development of Asiatic type, cooler or moderate cool climate is required. From seed production point of view, the area should be selected where rainfall is negligible during summer. A dry warm atmosphere is required for proper maturity and drying of seeds.

Land requirement:

The seed plot should be free from off types, volunteer plants, and weed species. The soil should be well drained.

Isolation requirement:

To maintain genetic purity (trueness type) of the seeds, it is essential to maintain proper and recommended isolation distance because carrot is cross pollinated in nature, pollination is made by insects.

The seed field of a particular variety of carrot must be isolated from field of:

- Same variety but not conforming to varietal purity requirements and
- Different varieties of carrot crop growing in that particular variety.

Table: Isolation distance (in m)

Mother Root Production		**Seed Production Stage**	
Foundation Seed	Certified Seed	Foundation Seed	Certified Seed
5	**5**	**1000**	**800**

Rouging:

Remove dissimilar type of plants from the variety whose seed is produced is known as rouging. Following points are considered for rouging during seed production of carrot:

- Remove plants which show different type of foliage from foliage characteristics of the variety and flower color whose seed production is made. Bolting type of plants is removed in seed to mother root phase and early bolting type of plants during mother root to seed phase.
- Diseases (Cercospora, Alternaria etc.) and insect pests (spider mites, aphids and lygus bugs) infected plants and blunted type plants are removed.
- After uprooting to roots at maturity stage, only true to type roots are selected on basis of root shape, size, color and rest forked, cracked, light colored, different colored,

rough surface, high hairy and green or purple shoulder colored and mechanically damaged roots are discarded.

Main method of seed production of carrot in India:

In carrot, "Mother Root to Seed Method" is followed for seed production due to less attack of root rot disease in transplanted roots. The carrot roots with self core color are only planted, keeping the crown exposed. Seed production through mother root to seed method has two stages i.e. (A) Mother seed production stage

(B) Seed production stage

(A) **Mother root production stage**-A initial step of first season:

Carrot seeds are sown in first season to produce mother roots which is called stecklings. The procedure of stecklings production is according to following points:

I. **Preparation of land:** Frequent pulverization of soil is essential for carrot field. It is achieved by tilth of soil through continuous deep ploughing, harrowing followed by leveling. Carrot crop require deep, loose soil for better development of their roots.

II. **Fertilizer and manure requirement:**

- Apply 15-20 tones well decomposed farm yard manure per hectare into soil and mix well before sowing.
- At the time of sowing add 40-50 Kg phosphorus and potash per hectare.
- In standing crop of carrot add 75-100 Kg ammonium sulphate per hectare, one or two times after weeding.

III. **Source of seed:**

Seed (Nucleus/Breeder's/Foundation) must obtain from a source approved by seed certification agency.

IV. **Seed rate:**

Seed rate of 8-10 Kg vary on seed size is enough for sowing of one hectare land. The carrot's roots produced from one hectare land are sufficient for transplanting of 3-4 hectare land under seed production

Time of sowing:

The sowing of seeds of carrot seed depend on suitable climate conditions and duration of variety. The suitable time of carrot sowing is mid July to mid August.

V. Method of seed sowing and spacing:

Seed sowing on double row ridge is best method for proper root development of roots of carrot than flat method.

- For this, double row ridge of 75 cm are made.
- Seeds are treated with Thiram /Capton/Carbendezim @ of 2 gm /Kg seeds. Seeds are sown in line by using hand and covered by soil.
- Just after sowing of seed, field is irrigated to keep soil moist till germination. Seed are germinated in 7-8 days.
- Thinning is also essential for proper growth and maintains a distance of 6-7 cm between plant to plant on a plant height of 5-6 cm.

VI. Irrigation:

Irrigate to field at an interval of 8-10 days accordingly moisture condition of soil.

VII. Intercultural operations:

In the early stages of soil, weeding and hoeing should frequently be done. Carrot requires 2-3 hoeing for effective weed control. One earthing up by end of September, or early October will keep the crop clean till the close of autumn, when it is uprooted for planting.

VIII. Plant protection:

Spray Rogor 30 EC .05% solution for control of carrot weevil, spotted leaf hopper and carrot rust fly.

IX. Harvesting of roots:

Uproot the plants, when they have fully developed roots.

X. Selection of roots for transplanting:

Selection of roots for transplanting is made on basis:-

- Character of tops (short or heavy)
- Color of skin (red/purple/black/creamy)
- Color of shoulder (greenish is discarded)
- Shape and size of roots

- The color of flesh, color and size of the core are most important characters to be considered.
- The core (xylem) should be very small and self core color.
- The core should be same color as the flesh (phloem).

(B) **Mother Root to Seed Production Stage**- Second season (Autumn season)

(i) Preparation of land:

Land should be prepared by repeated ploughing, harrowing followed by leveling.

(ii) Selection of roots (Steckling preparation):

It is very significant and crucial stage for producing genetically pure and high quality seed. Root of carrot become ready for steckling preparation in 90 days. Mother roots raised in an acre (0.25 hectare) are sufficient to plant four acre (1 hectare) of seed production. Roots should be true to type and carefully selection should be done on the basis of uniformity in shape, size and color. Carrots roots with similar to core color (self core) are selected. After selecting true to type roots, steckling are prepared by chopping off 3/4th of the root and 2/3rd of the leaf portion. This facilitates better establishment of steckling, leading to more number and better shoot growth for obtaining higher seed yield.

(iii) Method of transplanting of steckling and spacing:

Generally transplanting of roots for seed production is made on flat plot. The roots of carrot are transplanted at a distance of 75 cm from row to row and 30 cm from plant to plant.

(iv) Intercultural operation:

One weeding during March and another hoeing and earthing up during April-May is required.

(v) Rouging:

Rouging should be made at bloom stage. Early bolting type and off type plants should be removed.

(vi) Harvesting:

Seeds of carrot are harvested by handpicking. The best time for harvesting is when the secondary umbels are fully ripe (turn completely brown) and tertiary umbels begin to turn brown. Generally harvesting should be start when 60-70% seeds become brown. Since carrot crop ripens unevenly. So, 2-3 handpicking should be made.

(vii) Threshing:

After sun drying, the heads are threshed and cleaned. After cleaning, the seed is rubbed by hand to remove the brittles on the surface and graded by means of sifters and sieves.

(viii) Seed yield:

The seed yield per hectare is 500-600 Kg.

(ix) Storage: Store the seed on 8% moisture content.

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Forest Fires: Causes and Impact on Environment

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Forest fire is as old as the forest itself. It is a common phenomenon in environment and a part of nature. Although, forest fires act as an agent of regeration, change and plays an important role in shaping ecosystems, but it can be deadly by destroying wildlife habitats, timber, houses and polluting the air with harmful emissions. According to a report of Forest Survey of India (2019), India has forest cover of about 7, 12,249 sq. km, comprising 21.67 per cent of the total geographic area of the country. Although, the rural population of the country has an intimate relationship with forests, the tropical moist and dry deciduous forests are extensively affected by the forest fire. The main problem with forest fires is that the forests are usually remote, abandoned/unmanaged areas filled with trees, dry and parching wood leaves which act as a fuel source. These elements form a highly combustible material and represent the perfect context for initial-fire ignition and act as fuel for later stages of the fire. On a hot summer day, drought conditions are at peak and something as small as a spark has the potential to create a large wildfire with devastating results. A typical forest fire cycle depends on spatiotemporal variations in topography, climate and fuel composition The initial stage of forest fires is normally referred to as the "surface fire" stage which then leads to feeding on adjoining trees and results higher and higher flames, thus becoming "crown fire". A crown fire is particularly very dangerous in a coniferous forest because resinous material given off burning logs burn furiously.

Causes of Forest Fires

The list of reasons for the fires in our forests lies within human activity carried out whether intentionally or unintentionally. Some of the causes of forest fires are listed below:

a) In India, most of the forest fires are deliberately set by small/marginal farmers or landless rural people. For example, in the North eastern parts of India, the practice of slash and burn shifting cultivation is the leading cause of forest fires.

b) Local people do forest floor burning for various traditional reasons like grasses rejuvenation, *mahua* flower and *sal* seed collection on the clean forest floor, to promote a better flush of tendu leaves and shifting cultivation, etc.

c) Another one of the most important cause of forest fires is related to the need of fodder for grazing animals. Although, the availability of permanent pasture or grazing land is about 12.5 million ha, but most of this area is virtually devoid of grass. Therefore, most of the grazing requirement is met from forest area by setting fires to produce new flushes of grass in the dry season.

d) Campfires and open burning of the waste garbage nearby forest areas also leads to forest fires in some cases.

e) Some fires occur naturally by lightening, rubbing of *bamboo*, rolling stones, etc.

f) Fire climate (high temperature, low humidity & high wind velocity) and fire material (leaves litter & grasses) are accelerating factors for the fast spread of fires.

Impact of Forest Fires on Environment

Fire is a major factor of destruction of human settlement and often causes deterioration of site by subsequently increased erosion. If the weather conditions are very dry or windy, the fire burns much faster. A fire may be either beneficial or detrimental to individuals of a particular species but the effect of a single fire is not as environmentally significant as a change to the fire regime. Damage also can be caused by smoke. Smoke in the building smells unpleasant, leaves ashes, and impacts human health. Some of the impacts of forest fires on the environment are listed as below:

a) One of the most important environmental effects of burning is the increased probability of further burning in subsequent years, as dead trees topple to the ground, opening up the forest to drying by sunlight, and building up the fuel load with an increase in fire-prone species, such as pyrophytic grasses. The most destructive fires occur in forests that have burned previously

b) Forest fires results in loss of valuable timber resources, degradation of a catchment area, loss of biodiversity and extinction of plants and animals and loss to agriculture and horticulture crops.

c) Forest fires have a great impact on the physical environment including land cover, biodiversity, climate change, forest ecosystem, and socio-economic system of affected countries. The loss caused by a forest fire is difficult to quantify but an estimate by the economy and environ group has estimated the cost of damage from the Southeast Asian fires .It cause air pollution and depletion of ozone stratum

d) Forest fires results in loss of carbon sink resource and increase in the percentage of CO_2 in the atmosphere. As per the estimate, 20 million people are in danger of respiratory problems from the fire in Southeast Asia.

e) The burning of dead leaves and debris contributed immensely to wildfire in the Amazon, total timber losses resulting from surface fires exceed several million dollars per year and may reach tens of millions when large areas of un-logged forest catch fire because of drought-induced fire susceptibility

Conclusions

Forest fires have been a local issue with global impact, which may happen more frequently than the recent past due to impact of rising temperature and global warming. As populations grow with expansion of industrial development into forested areas and climate change alters fire regimes, the risk to communities and infrastructure will likely increase. Mischievous fires and fires which originated from villages near the forest areas are the major causal factors for fire incidences, therefore, sensitization of people and their social awakening through various meeting with villagers/ settlers and awareness campaigns about the negative consequences of forest fires on their health, environment and degradation of natural resources, by State Forest Department can be very effective to prevent forest fires.

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JUST AGRICULTURE multidisciplinary e-Newsletter

Food Safety in Current Scenario & How To Ensure Safe Food Practices at Your Place

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ARTICLE ID: 013

Graphical Abstract

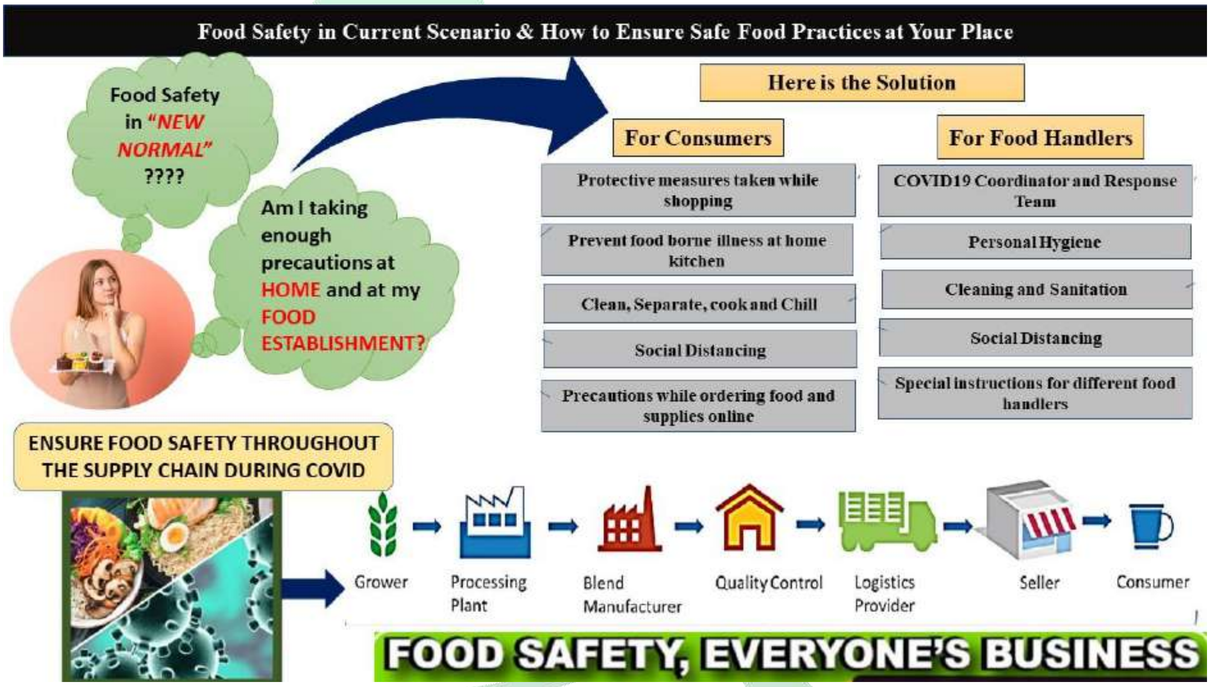

Fig: 1 Graphical Abstract (author's creation)

Since the beginning of 2020, the world is fighting the pandemic COVID19- the novel corona virus. This unending cease to the normal functioning worldwide has given a rise to debate over "NEW NORMAL" which applies to each and every sector which supports livelihood of all the species sharing some space at our mother earth. Be it us- the homo sapiens, the wildlife, the ecological habitat, marine life and others. Amongst all this the food supply chain is one of the most discussed one and ensuring food safety from farm to fork is one of the major pillars of it. Right from the cultivation and harvest of crop, up to the consumption of product by consumer, there is certain degree of value addition in every product and the role

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of food safety in this value addition can be of numerous types. As it goes from producer, to wholesaler, to retailer and finally to consumer, every stage needs some safe practices throughout.

Though there has not been a single evidence found on the spread of corona virus through food, food package or improper food safety measure but the retention time of novel corona virus on various articles such as: plastic, paper, wood, metal, fibre etc is well defined by World Health organisation (WHO) in which the retention time varies from four hours to five days.

Fig: 2. Retention time of Corona virus on various surfaces, January 2020
(Source: World Health Organisation (WHO)

Though the spread is not evident yet, but the food safety measures from farm to fork has been increased worldwide. There are many challenges which is being faced by the food industry to keep up with the food safety measures which is required as per the governing bodies of the respective countries. There are common challenges and their safety measures which has taken a rise since the inception of COVID19. The need for strict food safety measures is very much applicable to food handlers and consumers while buying food and other miscellaneous items from the stores, at their homes while cooking and doing other household chores. United State Food and Drugs administration (USFDA) and Food Safety and Standards Authority of India (FSSAI) has also laid out plans and measures for food handlers as well as to the general population also, which are as followed:

For Food handlers:

All the Food handlers and Food Business Operators (FBOs) are at major risk in viewpoint of consumers because of the multiple contact points and perishable nature of the food. There are various measures which has been suggested for the challenges faced by all the food handlers by the governing bodies of the respective countries. These measures should be taken care of in the food processing or handling premises whether an owner is restarting the business after lockdown or was continuing to do so, it applies to all of them who by anyway is coming in contact of any food material be it a supply chain, cold chain, production, manufacturer, packaging or reselling.

1. **Responsibilities of FBOs**
   - Establish a Local Emergency Response team and nominate a COVID-19 coordinator.
   - Team should develop company protocols/ guidelines on the disease outbreak (COVID19)
2. **For personal hygiene of food handlers**

   There should be strict protocols of personal hygiene for all the members in the premises such as hand washing, face mask/ cover and clean protective clothing, gloves, respiratory hygiene, reporting of illness, quarantine and isolation, discontinuation of few protocols such as biometric/ fingerprint attendance, no sharing of belongings etc, cleaning of premises after every use and the FSSAI guidelines posters should be stacked at appropriate places (refer the link in reference section for FSSAI and Centre for disease control (CDC), Atlanta Georgia posters)

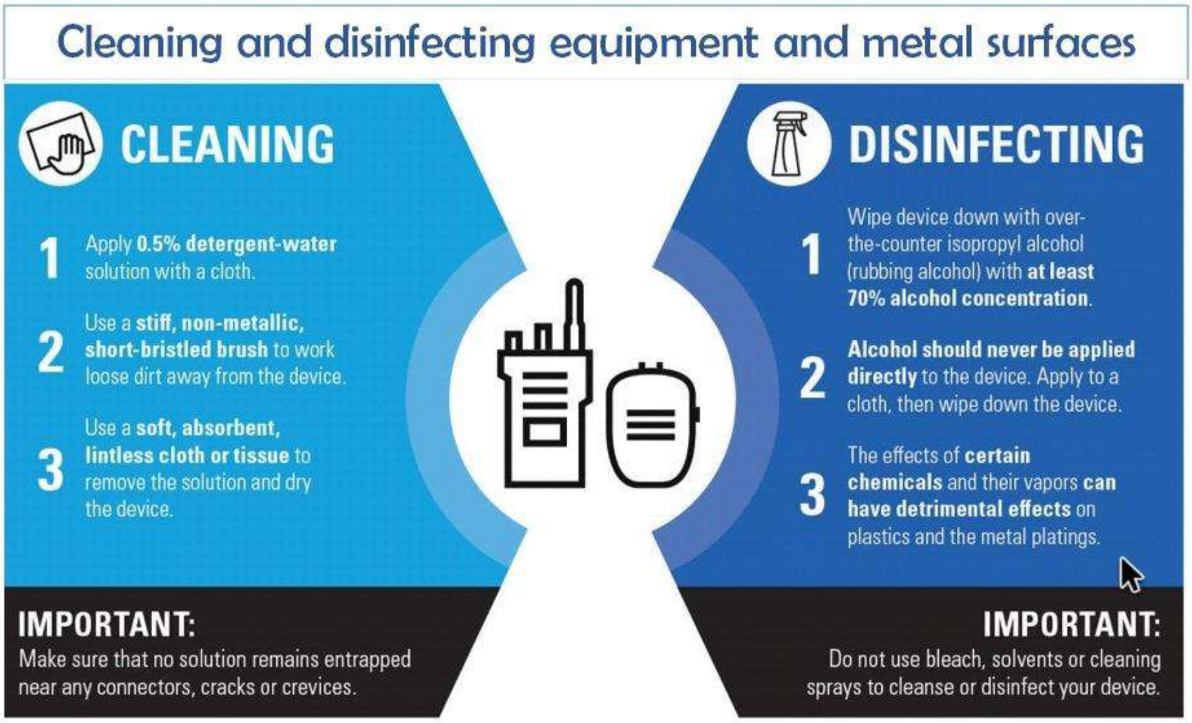

Fig:3 Cleaning and Disinfection parameters of a food premises (Source: GFC May, 2020)

3. **Social distancing: A minimum of 1-meter distance should be maintained in a food establishment and to do this FBO's should do the following:**
   - Restrict no. of employees to 3-4 in an area of 10 ft at any given point of time.
   - Reviewing the functioning lines and duties
   - Using spacing measures like stickers, tapes and markers at required places
   - Restricting usage of common lockers, belongings and face to face meetings.
   - Encouraging takeaways instead of dine in.
4. **Special Instructions for different food handlers**
   - For Food services/Delivery/ Takeaways: Important nodes such as food service area, hand wash and sanitation facility, prevention of surface contamination, no open display, visual display and pickup zones should be highly taken care of and self-service, buffet and mass gathering should be prohibited, eco-friendly disposable items, e payments, e wallets, online order and contactless delivery should be encouraged.

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- For food retail premises: Clean uniforms and safety gears should be worn and the customers inflow and outflow should be safely maintained constant by markings for social distancing, making announcements, flexi glass barriers at checkout, rotating stock and by taking appropriate sanitation measures.

FOR CUSTOMERS

FOR STAFF

Fig:4 Posters released by FSSAI for customers and staff for safe practices to minimize risk of COVID-19 (Published April, 2020)

- For Food Transportation and Distribution: Appropriate training should be provided to all the people involved in food transportation for COVID19 symptoms and measures for prevention, cleaning and sanitizing the vehicles and deliveries, personal hygiene, maintaining relevant records and measures to be taken while cleaning a vehicle which had entered a red marked zone.

Apart from all these measures, it is really encouraged if the owner of a food establishment shall ensure basic ethical measures for their employees such as not asking sick employees to come to work and sending suspected employees (if they develop symptoms at work) for test rather than sending them home.

For Consumers:

To help protect yourself, grocery store workers, and other shoppers, it is important to keep a few things in mind:

1. Prepare a shopping list in advance. Buy just 1 to 2 weeks-worth of groceries at a time. Buying more than you need can create unnecessary demand and temporary shortages.
2. Wear a face covering or mask while you are in the store. Some stores and localities may require it. Check your state, county or city guidelines for any other requirements.
3. Carry your own wipes, or use one provided by the store to wipe down the handles of the shopping cart or basket. If you use reusable shopping bags, ensure they are cleaned or washed before each use.
4. Practice social distancing while shopping – keeping at least 6 feet between you, other shoppers, and store employees. Keep your hands away from your face.
5. Wash your hands with warm water and soap for at least 20 seconds when you return home and again after you put away your groceries.

Again, there is no evidence of food packaging being associated with the transmission of COVID-19. However, if you wish, you can wipe down product packaging and allow it to air dry, as an extra precaution.

As always, it is important to follow these food safety practices to help prevent food borne illness at home kitchen:

1. Before eating, rinse fresh fruits and vegetables under running tap water, including those with skins and rinds that are not eaten. Scrub firm produce with a clean produce brush. For canned goods, remember to clean lids before opening.
2. When unpacking groceries, refrigerate or freeze meat, poultry, eggs, seafood, and other perishables- like berries, lettuce, herbs, and mushrooms- within 2 hours of purchasing.
3. Regularly clean and sanitize kitchen counters using a commercially available disinfectant product or a DIY sanitizing solution with 5 tablespoons (1/3rd cup) unscented liquid chlorine bleach to 1 gallon of water or 4 teaspoons of bleach per quart of water. WARNING: Do not use this solution or other disinfecting products on food.
4. Always keep in mind the basic 4 food safety steps- Clean, Separate, Cook, and Chill.

As food is a source of comfort, as well as nourishment for you and your family, especially now and this advice might help you continue to buy groceries with care and confidence.

Conclusion

According to a study by FORBES, in which team of experts collected and analysed data generated for 200 countries around the world, it has been outlined that India stands far behind in safety measures adopted for combating COVID-19 than many of the countries such as Israel, Germany, Australia, New Zealand, Taiwan, Singapore, Japan and Hong Kong who are amongst top 10 countries in COVID-19 overall safety ranking. For India, there is a huge scope for improvement in every sector. Food safety being the one should be highly taken care by accepting and implementing the guidelines provided by all the major governing bodies. FSSAI should be appreciated for their efforts to train every food handler and for the efforts done on awareness of general population of India. Despite of all these measures releasing continuously, there lies a huge gap to train small and petty food businesses, uneducated population and to the ones who are planning to resume their services but are confused about the guidelines. As always said, that **"food safety is everyone's business"** it is a moral duty of each one of us who in any way acknowledge these guidelines and safety measures to guide people around us about the same.

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Israel- A Revolution In Agriculture

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History of Agriculture in Israel

Israel was established on 14th may 1948 and Jews from all over the world became the permanent residents of Israel. Jews considered Israel as their own homeland. Jews never know the farming system but the onslaught of World War – II has forced the residents of Israel to do farming. They converted the barren lands into useful one keeping beside all the unsuitable conditions.

Status of Agriculture in Israel

Now a day, Israel produces 90% of its own food requirement and feeds major parts of the world. It is the major exporter of fresh foods and leader of the world in agriculture technology. Israel has its independent food security. In Israel, 17% of the total agriculture budget is allocated to research and development only. Israel doesn't import anything except some tropical foods.

As it is well known that geographical conditions of Israel are not suitable for agriculture but despite that the development in agriculture sector over there is at its peak and tremendous. The climatic conditions are worst as seen from agriculture perspective. The water availability is too poor and most of it is saline in nature. Over half of the total soil found there is either arid or semiarid. In beginning only 20% of the total land was arable but now Israel tripled the territory use of farming. Its production has multiplied 16 times since then changing the whole scenario of Israel. Israel is the home to two main agriculture communities i.e. Kibbutz and Moshav community.A very successful practice is noticed for water conservation in Israel which can be implemented on any type of crops.

Successful examples of Agriculture from Israel:

Here are some examples related to the success of agriculture in Israel

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1. **Use of Plastic Tunnel**: Plastic tunnel is a device used to save plats from excessive water. Holes present in the tunnel helps to respire the plants. It is well said that a country facing water scarcity for years knows how to save each single drop.
2. Mandarins are a special type of orange cultivated in Israel having thin skin, seedless and very sweet. The plants are covered with a special type of plastics to protect them from acid rain and hailstorms. After harvesting the trees are trained and pruned to allow more and more sunlight.
3. Cactus is the major plantation in Israel. It can be eaten and can be used in many more ways like as ornamental plant.
4. They also produce fishes in deserts and grow wheat in low quantity of sand.

What Israel used to do?

As we know that Indian farmers mainly depend upon monsoon for farming but on the other hand Israel farmers don't wait for the perfect weather. Israel also employs Thai labourers as it is a very small country having small population. They praise their farmers very well. Israel exports agriculture technology all over the world. As agricultural equipments are the backbone of agriculture so Israel produces most of these equipments locally. They don't depend upon other countries for import of latest & advanced machines and technologies. Scientific and proper use of these equipments under complete expert guidance leads to successful journey of agriculture sector over there. Now, here are some of the key points highlighting the key of success of Israel-

- Use of different sprayers, sprinklers and drip irrigation system for different crops under properly controlled computerized system.
- Computerized early warning system for leaks in the pipes and nozzles.
- Thermal imaging for crop water stress detection.
- Biological pest control.
- Introduction of new varieties of fruits and vegetables.
- Dairy and desert farming practices are superb.
- 86% of water is reused and stored after desalination through plants.
- Livestock farming is a big source of income for Israelis. Israel Holstein breed is high milk yielding breed.

- All the agricultural inputs i.e from seed to sprayers etc everything is available in one shop/store.

Conclusion:

If a country like Israel which is having very limited resources can develop its agriculture sector at such a faster rate then why can't our country with such a wide range of diversification. Though India is also one of the leading countries in the production of vegetables and fruits but still the productivity per unit area is very low. In addition to this, India also exports some agricultural commodities and machineries from foreign countries. Indian farmers are still poor because they do not get the appropriate price for their produce. Productivity of crops per unit area & farmer's satisfaction can also be increased in India too but for this Government has to come with strong agricultural policies and it will require higher investment in beginning but this will be beneficial in long run.

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"One Nation One Market"- Nation v/s Farmer

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Introduction:-

In the time of crisis the GDP (Gross Domestic Product) of India is falling day by day due to the lockdown of three months. On May 12, 2020 Prime minister of India calls for "Atamnirbhar Bharat" and announces 20 lakh Crore of package as a opportunity farmers to enhance their income. On June 3, 2020 the Indian union Cabinet announce the approval of three new policies in agriculture sector for the betterment of exisisting agriculture marketing system. It is for holding up the farming systems. On June 5, 2020 Indian Ministry Of Law and Justice announce the three ordinances that will release the presently marketing restrictions free trading hurdles and gave power to farmers for directly engaging with the buyers just before the harvesting. Those three ordinances are:-

1. **The farmer produce trade and commerce (promotional facilitation) ordinance 2020**

In this farmer have liberty to sale his produce wherever they want. It can be inter state or Intra state. There will be no Involvement of state government in it. There will be no involvement of APMC (Agriculture Produce Marketing Committee). in this farmer can compare prices from digital sources.

2. **The farmer (Empowerment and protection) Agreement on price assurance and farm services ordinance 2020.**

In this government of India giving freedom to farmer to directly sale their produce to the wholesaler, traders, processors and agitator in a single area. Also GOI (Government of India) promoting the contract farming among farmers. They are inviting the US based companies to invest in India. By adopting these techniques the agitation losses can be minimized which occur due to unsuitability of market.

3. **The essential commodities (Amendment) ordinance, 2020**

According to this ordinance the food items like cereals, pulses, oilseeds, onions , potatoes will be removed from the list of essentials, which will help the private investors in the farming business operations. This ordinance specifies that these commodities can be regulated to the stock limit under situations like war, famine and price fluctuations. The processors and exporters will free from stock limits.

Pros and Cons of these Ordinances

The farmer has freedom to sale his commodities whoever they want .They can compare prices and sell their produce where price is high. They have digital platforms i.e E- marketing on his hands where he can compare the prices of his produce. There will be no involvement of APMC's. the traders and farmers can be in touch directly. Farmer will know buyers who is buying their produce. Any person who is having PAN (Permanent Account Number) and Aadhar card can buy the produce .by contract farming the farmers can sell their produce before harvesting. The contract will be made for three year, in which 2/3 will be paid before harvesting and rest amount will be paid in the three days after sale of the produce. The price will be dependent on the quality of the produce. The traders/ farmers or buyers can store their produce and can sell freely when they want or when demand is high. Farmers can adopt new technologies and techniques for farming.

If we see all three ordinances together, then only large farmers, traders or business men can have fully benefits of all these opportunities. A small farmer who have less than 2 hectare land grown with a variety which is having less price in local market or more in the far places. If he try to sell at far places the have to bare extra charges of labour, transportation which will enhance the benefit cost ration of the farmer.

In the contract farming the certain parameters are written in the contract but if the farmers unable to me the parameters written in the contract. In these situation the contractor will not pay the enough amount to the farmer one they need, also they will buy the produce on less value. The other main con of these ordinances is that the private business men will buy the produce at low prices and sell it on high prices, when the demand is more.

According to the rule of economics the price decreases with the decrease in demand and increase with the increase in demand. so, when the market has less demand i.e in harvesting season the price will fall down which is beneficial for the business men and in off season demand will automatically increase and sudden price fluctuations can be seen clearly. Thus the losses will be faced by a farmer only.

The private traders can store the grains for the long time and can sell whenever they need. If farmer try to store its commodities they don't have proper storage facilities and storage of grains will put additional wages on a farmer. Also farmer have to feed his family and fulfil needs of their own. In this situation farmer has to sale his produce to the traders.

In village there are Arhatias from where they can take small amount of money whenever they need for seed, fertilizers and household needs. By excluding APMC these farmer will also have to be dependent on the banks and Kissan Credit Card (KCC) which is a time consuming process. The arhatias, sailor owners who have made large sheds for the processing will also go in the loss. The labour, which is working in mandis will also be effected by these ordinances.

By doing agriculture privatization the government will also be affected because government have to store grains for the long time period for war or famine conditions. They also have to supply food to people those are Below Poverty Line (BPL) or Blue Card holders. government have to buy food grains from private sector which will leads to loss for the government sector.

If any kind of disruption occurs in between producer and trader, the farmer can only file the application to the Sub-divisional Magistrate(SDM) .they have to solve it in 30 days. But in this condition mostly farmers avoid to go in the legal activities due to wastage of time and money.

Causes:-

By the passing of this ordinances which are not in the favor of a a farmer. There will be rise of loans on farmers. The small farmer can't agrue with contractor or trader for the price of their produce. They will accept which is given to them by the traders. The Arhtias will be bank corrupted due to in supply of commodities, sailor, owners will also be affected.

Effects:-

- Corruption will be more. The farmers those have good relations in private sector will sell their produces on good prices.
- Farmer suicides will be more because farmer will be unable to pay their loans to banks.
- The private sector can purchase farmer produce on their choice of prices.
- The poverty of farmers will be increased.
- Most of the farmers are not educated , so they can't compare online prices of their produce.

For Example:- In Bihar the rule of MSP breakout from 2006. The farmer produce is purchased by the local Lala's. They don't give them MSP for their crops. Last year paddy was sell on Rupees 700 and maize is purchased on Rupees 400-500 per quintal, rather then the MSP of paddy was Rupees 1770 and maize was Rupees 1850. This can be occur in the other states by passing of these ordinances.

Before making the rules the government should concern with the farmer associations, and clear all the doubts of the farmers. Also government should fix the certain amount for storing the commodities, so there is no black marketing and price fluctuation in market.

Conclusion

The government is initiating these rules for the farmers but all they have a very little effect on the farmer's lifestyle. With all these rules the small/marginal farmers will not get benefited, But the large farmers and businessmen can have full opportunities by these rules. Before initiating the government should be concerned with the needs of farmer. In the history this is the first rule which is opposed by the farmer on the large scale. In the present time more than 250 associations in India are opposing these rules. For solving these issues government should aware the people and clear their all doubts, if they are meant for farmers. On the other hand the government should not initiate these rules because in current situation India is a developing country not developed country. But if they have to imply these rules, According to the WTO (World Trade Organization). First government must imply these laws according to the need of the farmer

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Precision Nutrient Management in Conservation Agriculture Systems

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Introduction

Global food security, environmental preservation as well as farmer's level increased livelihood should be the main goals of a sustainable farming system in today's world plagued by degraded soils as a result of unsustainable crop management practices (Kumar *et al*., 2018). Under conservation agriculture (CA), a special attention has been given to crop and nutrient management with particular emphasis on the three major CA principles–minimal tillage, crop rotation and crop residue management. Keeping in view the distinct influence of CA on plant nutrient dynamics, now the nutrient management has become the 4th principle of CA. The NPK ratio is likely to vary with crops, cropping systems, management practices and there is a need to work out the NPK ratios for basing fertilizer allocations for different regions especially in the CA based systems. Therefore, the paradigm shift from conventional tilled to no-till CA systems require a serious thrust on nutrient management research to improve soil and crop productivity and environmental quality.

Why does CA represent a new paradigm?

Attaining food security for a growing population and alleviating poverty while sustaining agricultural systems under the current scenario of depleting natural resources, negative impacts of climatic variability, spiralling cost of inputs and volatile food prices are the major challenges before most of the Asian countries. These are caused mainly by intensive tillage induced soil organic matter decline, soil structural degradation, water and wind erosion, insufficient return of organic material and mono-cropping. Therefore, a paradigm shift in farming practices through eliminating/upgrading unsustainable parts of conventional agriculture such as ploughing/tilling the soil, removing all organic material and monoculture is crucial for future productivity gains while sustaining the natural resources. Conventional agriculture over the years leads to threats:

- Declining factor productivity
- Declining ground water table
- Development of salinity hazards
- Deterioration in soil fertility
- Deterioration in soil physical environment
- Biotic interferences, declining biodiversity
- High energy requirements
- Reduced availability of protective foods
- Air and ground water pollution
- Stagnating farm incomes

Conservation Agriculture

Conservation agriculture (CA) can be defined by a statement given by the Food and Agricultural Organization of the United Nations as “a concept for resource saving agricultural crop production that strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment” (FAO, 2008)**.** Conservation has become critical because the global population has increased over the years and more food needs to be produced every year.

Status of conservation agriculture in India and abroad

According to FAO, 2016, globally, CA is being practiced on about 156.99 M ha and major CA practicing countries are USA (35.61 M ha), Brazil (31.81 M ha), Argentina (29.18 M ha), Canada (18.3 M ha) and Australia(17.0 M ha).In India, CA adoption is still in the initial phases. Over the past few years, adoption of zero tillage and CA has expanded to cover about 2.0 M ha (FAO, 2016). The major CA based technologies being adopted is zero-till (ZT) wheat in the rice-wheat (RW) system of the Indo-Gangetic plains (IGP). In other crops and cropping systems, the conventional agriculture based crop management systems are gradually undergoing a paradigm shift from intensive tillage to reduced/zero-tillage operations. The CA adoption also offers avenues for much needed diversification through crop intensification, relay cropping of sugarcane, pulses, vegetables etc. as intercrop with wheat and maize and to intensify and diversify the RW system.

Principles of CA

1. Minimum mechanical soil disturbance
2. Residue retention
3. Crop rotation

Benefits of conservation agriculture

Agronomic benefits- It improves soil productivity by enhancing the soil physical, chemical, biological properties. It increases organic matter content of soil by adding crop residue continuously. Due covering of soil by crop residue it conserve moisture thereby increase water use efficiency.

Environmental benefits- Conservation agriculture involving zero-till and surface managed crop residue systems are an excellent opportunity to eliminate burning of crop residue which contribute to large amounts of greenhouse gases like CO_2, CH_4 and N_2O, sequester carbon, improve biodiversity and to improve air and water quality.

Economic benefits- CA practices reduce cost of production which is attributed to savings on account of diesel, labour and input costs, particularly herbicides Most studies showed that the cost of wheat production is reduced by Rs. 2,000 to 3,000.

Limitations related to nutrient management in conservation agriculture

Precision nutrient management under CA is more comprehensive and difficult task. Strategies of nutrient management under CA depend upon certain factors which affects efficacy of nutrient management practices. Therefore, it is recommended to keep in mind, the following things before making a sound nutrient management programme under conservation agriculture:

- Difficult to handle crop residues during sowing and other operations
- Surface acidification
- Nitrogen loss due to volatilization and leaching
- Run-off loss of P and K
- Nutrient immobilization in the initial phase
- Presence of surface residues which limit contact between the soil and the fertilizer

Precision nutrient management strategies in CA

Conventional agricultural practices depends upon certain classical approaches of nutrient management such as blanket recommendation but nutrient management under CA is more comprehensive and require diverse knowledge of certain things such as soil fertility status, crop nutrient removal, crop nutrient response, sensitive stage of nutrient demand etc. An integrated and comprehensive nutrient management under conservation agriculture systems could be possible by following strategies:

1. **Crop residue management:** If the crop residue retention on the soil surface after some time they decompose, add organic matter in the soil that results improve the physical, chemical and biological properties of soils (Kumar *et al.*, 2014). SOM content and quality affects many soil functions which are related to soil health such as moisture retention, infiltration, release, availability of nutrients and plant health (Behera *et al.*, 2007).
2. **Management of soil acidity:** Soil acidity has a major influence on the availability of essential nutrients. Soil acidity is caused by hydrogen (H^+) and aluminium (Al^{+3}) ions in the soil solution. Most of the soil microorganisms are sensitive to soil acidity, which has an influence on nutrients availability (especially nitrogen, phosphorus and sulphur), soil organic matter and soil health(Kinsey and Walters, 2006). The most beneficial soil fungi, for instance, do not like a high pH and soil bacteria have problems at lower pH. Where soils are acidic managed by applying liming materials, primarily ground limestone. The carbonates in these materials react to neutralize the acidity in the soil.

$$CaCO_3+2H^+=Ca^{2+}+CO_2+H_2O$$

3. **N losses management strategies**

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Nitrogenous fertilizer applied on the soil surface Nitrogen (N) can be lost from the field through three principal pathways: denitrification, leaching and surface volatilization. These losses can be minimised through various ways-

- Split application of nitrogenous fertilizer
- Banding liquid UAN is a common practice in no till for reducing N loss
- Injecting the fertilizer below the surface residue
- Increase the basal dose of nitrogenous fertilizer
- Place the fertilizer closer to the plant root zone
- Use of variable rate applicators
- Use of slow release nitrogenous fertilizer
- Use of fertilizer additives (urease inhibitors, nitrification inhibitors, etc.)
- Urease inhibitors –NBPT, Thiosulphate
- Nitrification inhibitors-Nitrapyrin, DCD

4.Management of other nutrients

Phosphorus and Potassium:

- Shallow band placement of P and K
- Higher levels of P and K fertilisation in low soil temperature and excessively wet soils
- Knifing in fertilizer reduced losses of total P, bio-available P and soluble P
- Reduce the K-dose when crop residues are incorporated

Calcium and Magnesium: Application of dolomite lime

Sulphur: Applications of sulphate-S fertilizers such as Ammonium Sulphate (24.2% S), Urea Sulphur (10% S) and Potassium Magnesium Sulphate (22.3% S) etc.

Micronutrients: Foliar applications-correcting in-season deficiency

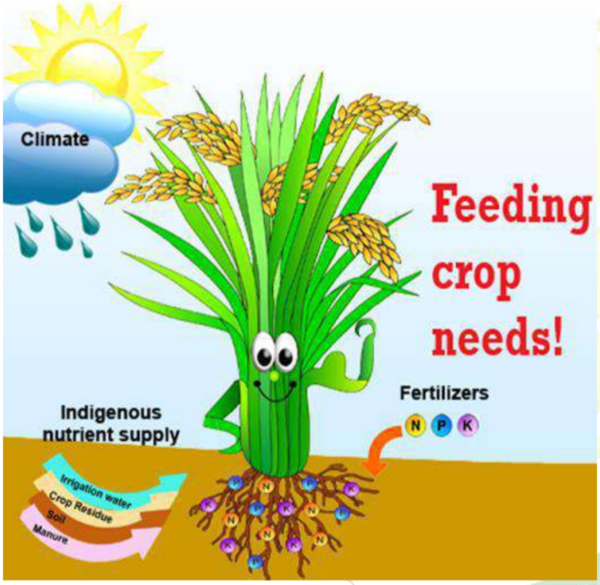
5. Adoption of efficient crop rotation:

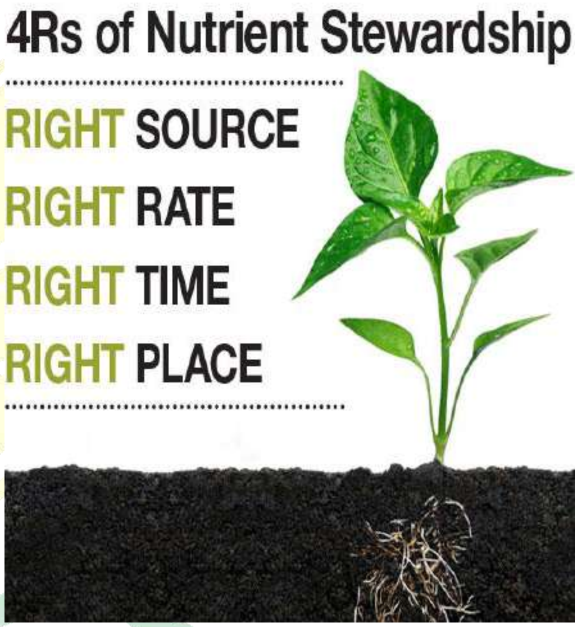
Crop rotation is the practice of growing a sequence of different crops on the same field. In crop rotation inclusion of legumes (crops andgreen manure) can affect the availability of N and other nutrients such as P and K (Parihar *et al*., 2016). Most green manure species can fix

N with N-fixing bacteria and increase soil N levels by 459 kg N/ha. Green manures can also affect the availability of other nutrients such as P, Mn, Zn, which can affect disease and pest tolerance and crop growth and yield.

6. **Site-specific nutrient management:**

SSNM is dynamic, plant-based, farm-specific management of nutrients in a particular crop or cropping system to optimize the supply and demand. SSNM based on principles of 4R i.e. right source, right amount, right time and right place. It requires 3 steps.





Nitrogen application based on LCC: The leaf color chart (LCC) is an innovative cost effective tool for real-time or crop need-based N management. It measures leaf color intensity that is related to leaf N status. LCC is an ideal tool to optimize N use at high yield levels, irrespective of the source of N applied, viz., organic manure, biologically fixed N or chemical fertilizers.

Measuring SPAD values in the field: It is a simple, quick and non destructive in situ tool for measuring the relative leaf chlorophyll content that is directly proportional to leaf N content.

Optical sensor (Green-Seeker): Optical sensor used rapidly through measurement of visible and near infrared spectral response from plant canopies to detect the nitrogen status.

Nutrient-Expert based nutrient management: A recently developed decision support systems (DSS), Nutrient Expert is an easy-to-use. It is a computer-based decision tool that can rapidly provide nutrient recommendation for individual farmers' field in presence or absence of soil testing data.

7. Other agronomic management practices

Management of cover crops: Soil permanent/semi-permanent cover by green manure crops/crop residues. The principle of managing the top soil to create a permanent organic soil cover can allow for growth of organisms within the soil structure. The breaking down of this mulch will produce a high organic matter level which will act as a fertilizer for the soil surface. It raised cation-exchange capacity (CEC) for nutrient capture retention and slow-release in the soil (Singh *et al*., 2004).Placement of fertilizers: Improving the nutrients use efficiency because fertilizers are applied band placement that results reduce the loss of nutrients from the soil.

Summary

Conventional agricultural practices depends upon certain classical approaches of nutrient management such as blanket recommendation but nutrient management under CA is more comprehensive and require diverse knowledge of certain things such as soil fertility status, crop nutrient removal, crop nutrient response, sensitive stage of nutrient demand etc. Therefore, the paradigm shift from conventional tilled to no-till CA systems require a serious thrust on nutrient management research to improve soil and crop productivity and environmental quality. It shows that the use of some tools for *in-season* N management like Soil-Plant-Analysis-Development (SPAD) chlorophyll meter or green-seeker sensor or site-specific nutrient management (SSNM) through soil-test crop response (STCR) or nutrient expert, helps in fulfilling the crop nutrient requirement with more precision and less environmental footprints.

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Production Distribution and Export Value of Tea in India

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Abstract

This article in depth analyses the tea production in the state of Assam and how much each area produces annually and the fiscal value of its export. This article also enlightens about the climatic requirements it variety and major types. It also gives us the statistical data of the tea produced, tea exported, which state has the highest export value and which type is exported in the global market. It also dwells on the problems faced in plantation and export.

Introduction

Tea invariably has become an important part of our life, most people in India starts their morning with a cup of tea, it has almost become a morning ritual. Be it a meeting or a small gathering tea has become a must. It gives a boost of freshness and energy, but what makes tea so special? The main ingredient in a tea is its tea leaves, it has that aroma and taste that makes it different from any other beverages and thus the specialty about it.

Globally India is the 2nd highest producer of Tea right after China. The production of tea in India according to the recent data of 2017-18 was 1325.05 kg which was recorded as the highest in the history of tea production in India. If we look into the states of India with their yearly production, Assam holds the first position with almost 51% and in terms of area under cultivation around 53.2%. Factors such as strong geographical indications, latest innovations, enormous amount invested in the tea processing units, different marketing strategies and augmented mix of product has made the Indian Tea among the finest in the world. Major tea growing areas are the North eastern part of India such as Assam and the foothills of Darjeeling in West Bengal. A great amount of tea is also produced in the foothills of Nilgiri hills. Therefore it tells us about amount of tea India produces what is its effect on the export value and on the farmers who grow it and its impact on the fiscal growth.

Origin- China.

Climatic requirements – For tea production , warm, humid climate along with an annual rain of 100 cm is required for proper growth and yield. A well drained and slightly acidic, deep soil is preferable. With this conditions being fulfilled tea's altitudes requirements can vary from sea level upto 2100 m above it.

There are two major variety :

1. *Camellia sinensis sinensis* .
2. *Camellia sinensis assamica*,

Camellia sinensis sinensis – It is also called as the Chinese variety due to its origin being in China along the areas of northern Burma, Yunnan and the province of Sichuan. The height can reach upto a length of 2m having small leaf and it can also tolerate cold temperatures. The leaves are dark colored. And the buds have brownish hue. The tea tastes soft.

Figure.1 *Camellia sinensis sinensis* , small leaf Chinese variety

Camellia sinensis assamica - This variety is mostly grown in the region of Assam in India. The leaves are broader than the Chinese variety. It grows well in low altitude and in tropical areas. This tea is my mostly grown in Indian region.

Figure 2 *Camellia sinensis var. assamica large and broad leaf Assam variety.*

STATE WISE TEA PRODUCTION DATA.

In the state wise tea production Assam leads the overall production and also has the most area under tea cultivation, followed by West Bengal :-

- Total production in North India – **1008.56 million kg**
- Total production in South India**- 224.58 million kg**
- Overall grand total production in India**– 1233.14 million kg**

TOP FIVE TEA EXPORTING STATES IN INDIA

In 2017, India has exported different types of tea from its 22 states. West Bengal is the largest tea exporter state of India and recorded 68.47% value total tea exports. Maharashtra is the second largest tea exporter state and recorded 11.74% of the total output. Let's check the tea export figures of top 5 Indian states during the year 2017.

States of India	Value (%)
West Bengal	68.47%
Maharashtra	11.74%
Tamil Nadu	8.33%
Kerala	4.55%
Delhi	2.84%

Figure 3- Top Five Tea Exporting States In India

LIST OF TEA EXPORTERS IN INDIA

According to tea export data of India, there are more than 1000 tea suppliers in India currently supplying different types of tea to the world. SSK exports limited is one of the largest tea exporting companies in India which did 5.61% of the total sales. Here is the list of main Indian tea exporters.

- SSK Exports Ltd.
- Girnar Food & Beverages Pvt Ltd
- Shah Brothers
- Swiss Singapore India Private Limited
- Asian Tea Company Private Limited

DIFFERENT TYPES OF TEA EXPORTED BY INDIA

Amongst all the different types of tea, black tea has the largest share in the export of tea in the global market. Out of the total tea exported by India black tea accounts for 80.46%, and then 15.66%of value shared by regular tea. Other tea such as green, herbal , masala tea also contributes in the export. One major confusion is when people tend to think that green and herbal tea is same, on the contrary green tea is different from herbal tea by the presence of caffeine in green tea n herbal tea being free from it. Here are the graphical and tabular representation presenting share values of tea types exported from India in 2017.

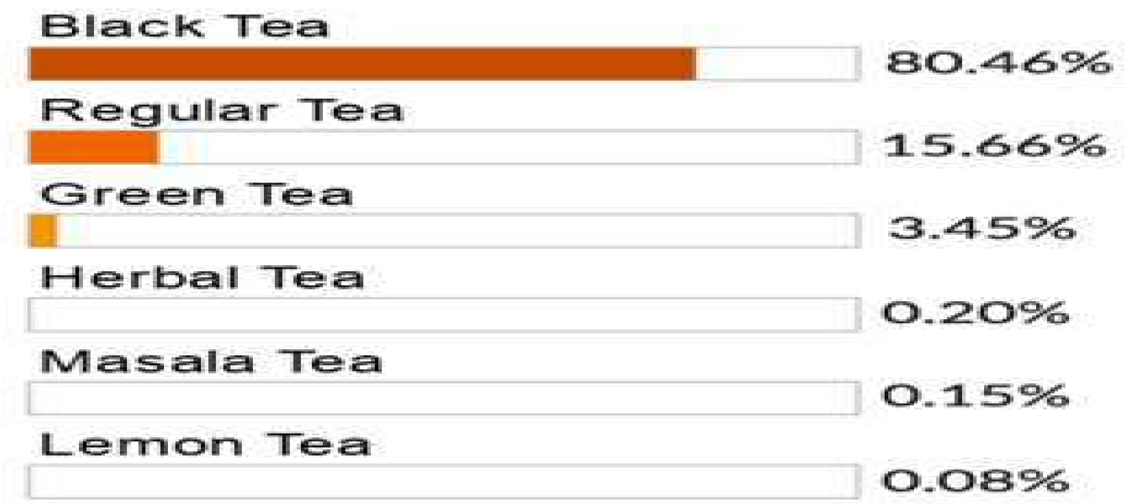

Figure 4- Different Types Of Tea Exported By India

MAJOR PROBLEMS FACED IN TEA PLANTATION AND EXPORT

1. One of the major problem our Indian tea industry is currently facing is over production of tea. The international market as well as in our domestic circuit the current demand is not enough to deal with the overproduction in our country. More supply to the international market means decrease in the monetary value.
2. Unlike India where most of the black tea gets consumed in the country itself, China produces a huge amount of Black tea , yet the do not consume it hence the surplus of black tea is being forced to be sold in the international market causing threat to India's tea export.

3. Due to the system of Six digit codification of tea the produced tea doesn't remain as where it came from and hence the same tea exported by Indian tea industry re-enters with value addition posing threat to Indian export.
4. Also in India there are large number of small scale tea producer which are highly un-organized.

CONCLUSION

The tea as a plantation crop has a huge scope in the international market as well as in the nation itself. It already generates a huge amount of revenue but with proper management in production level and in export level with the understanding of the world trade it can be a great source of income for many. The collaboration of the small scale producer under one umbrella could easily help in the procurement of the product as well as distribution and return the dedicated monetary value to the producers. Thus all in all it has a great opportunity to boom in the world trade with correct measurements.

The Indian Chamber Of Commerce has always played a very active role in the Indian tea industry and it keeps on promoting the different and new practices which is a great sign for the future of tea industry in India.

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Stevia : A Zero Calorie Natural Sweet Fix

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Abstract

Stevia is a sweetner and a sugar substitute. It is a natural substitute and It's made from a leaf related to popular garden flowers like aster and chrysanthemums. Stevia sweetness are extracted and purified from the *stevia rebaudiana* bertoni plant. With continued increasing rate of obesity, diabetes, and other problems, in conjunction with global public policies calling for reductions in sugar intake. This appeal is related to stevia being plant based , zero calorie and with a sweet taste that is 45-350 times sweeter than sugar, making it an excellent choice for use in sugar and calorie reduced food and beverage product. Low and no calorie sweetners such as stevia are gaining interest among consumers and food manufacturers. "In 1991, stevia was banned from U.S. due to early studies that suggested that it may cause cancer." Multiple companies argued with FDA to be categorized as GRAS (generally recognized as safe) so that it could be a sweetener in food and beverages. Stevia seems to be king sweetner not only for diabetics looking for a zero-carb natural sweetner but for a wide array of the population as well.

Introduction

Stevia rebaudiana bertoni is small perennial woody shrub of the Asteraceae (compositae) family that is native to Paraguay, brazil. The leaves of this plant have been used by people for centuries in medicines and to sweeten drinks such as a green herbal tea. The plant was first brought to the attention of the botanist Moises Santiago Bertoni in 1887, who learned of its properties. The chemical characterization of the natural constituents of plants known as steviol glycosides, which are responsible for its distinct sweet taste. *Stevia rebaudiana* is a small perennial growing upto 65-80 cm tall, with sessile, oppositely arranged leaves. Different species of stevia contain potential sweetening compounds, with S. rebaudiana being the sweetest of all. Stevia is a semi-humid subtropical plant that can be grown easily like any other vegetable crop even in the kitchen garden. The soil should be in the PH range 6.5- 7.5; well-drained red soil and sandy loam soil.

Saline soils should be avoided to cultivate this plant. Stevia has been cultivated successfully in recent years in many areas of Indian states: Rajasthan, Maharashtra, kerela. The increasing demand for natural sweeteners have driven the farmers in india towards large scale production of stevia cultivation.

Composition of stevia

It has been reported that ,"six sweet-tasting compounds are there in the leaves of *Stevia rebaudiana* bertoni- stevioside, rebaudioside A,D, and E, dulcoside Aand B. Stevioside is a glycoside with a glucosyl and sophorosyl residue attached to the aglycon steviol; the latter has a cyclo-pentanoperhydrophenanthrene skeleton. The stevioside is a natural sweetener extracted from leaves of stevia .

The sesquiterpene lactones are responsible for the bitter after taste.a european patent held by the stevia company, which attributes the bitter after taste to the presence of essential oils, tannins, and flovonoids. The poined out thing is, stevioside and rebaudioside A are partially responsible for the after taste. The S.rebaudiana bertoni contains a complex mixture of labdane diterpenes, triterpenes, stigmasterol, tannis, volatile oils, and eight diterpenenic glycosides; stevioside, dulcoside and rebaudioside A,B,C,D, and E. According to Pederson (1987), stevioside is a white, crystalline powder extracted from the leaves of the stevia plant. It must be kept in an air –tight package to prevent moisture absorption. Researchers reported that 3000 g stevia could produce 101.56g light yellow fine powder of stevioside and its products.

Table I. Proximate composition of *S. rebaudiana* Bertoni.

Sample number	Constituent	Value (%)
1	Aluminium	0.0072
2	Manganese	0.0147
3	Ash	6.3000
4	Phosphorus	0.3180
5	β-Carotene	0.0075
6	Potassium	1.7800
7	Calcium	0.5440
8	Protein	11.200
9	Chromium	0.0039
10	Selenium	0.0025
11	Cobalt	0.0025
12	Silicon	0.0132
13	Fat	1.9000
14	Sodium	0.0892
15	Fibre	15.200
16	Tin	0.0015
17	Iron	0.0039
18	Vitamin	0.0110
19	Magnesium	0.3490
20	Water	82.300

Cultivation

Stevia is a semi-humid subtropical plant that can be easily like any other vegetable crop. Many agrotechnologies are involved in the cultivation and study of various parameters like mean height, weight of leaves, growth per day, total biomass yield and stevioside content in the plant. The crop could be transplanted in February or march and seed collected in the late summer. Flowering under these conditions should occour between 54^{th}-104^{th} day this transplanting depending on the day length sensitivity of cultivars used for seed production. Leaf yield increased with increasing density upto 83,000 and 111,000 plants/ha for the first year of production.

Climate

Nutrition and climate conditions play important roles pn the growth and secondary metabolites of stevia. Some varieties appear to be photoperiod insensitive. Early flowering lines tend to have higher stevioside content but lower total yield.

- Vegetative growth is reduced when temperatures are below 20 deg/C and when day length is less than 12 hours.
- Increasing day length to 16 hours and increasing light intensity can increase vegetative growth and stevioside levels.
- Concentration of stevioside in the leaves increases when the plants are grown under long day conditions where the vegetative period is longer.

- the natural habitat of stevia is semi humid subtropical climate on the tropic of Capricorn (22-23 deg/S latitude). It is semi humid subtropical plant that shows higher leaf production under high light intensity and warm temperature.

Soil

The nutritional dosage is strongly governed by the soil properties and climate conditions of the growing region.

- Stevia grows in well drained fertile sandy loam or loamy soil, richin organic matter.
- It prefers acidic to neutral (ph 6-7) soil for better growth and require consistent soil moisture but not water logged field.
- Urea fertilizer should be applied in three split doses as once at basal and remaining two after the first and second cutting of leaves.
- Sometimes stevia shows the symptoms of boron deficiency, which leads to leaf spot that can be rectified by spraying borax 6%.

Propagation

- Vegetative propagation is the best way for seed multiplication of stevia due to low seed germination capacity.
- In vitro propagation can become an important alternative to conventional propagation and breeding procedures for a wide range of plant species.
- Stevia is grown in the same field after uprooting the mother plant.

Various types of propagations are:

a) Vegetative propagation- shoot cutting
b) Micro-propagation
c) Seed propagation

Vegetative propagation Shoot cutting

propagation of stevia is usually done by stem cutting, which root easily but require high labour inputs. Some plants varities/selections produce virtually no viable seed and vegetative propagation is the only way of multiplication. In this a vigorous branch is cut at the base with a sharp blade and planting in the field, keeping two to three nodes above the soil. The cut portion of branch is dipped in neem oil or any fungicide (Maiti and Purohit 2008). Cuttings of new stems and shoots can be propagated successfully.

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Micro-popagation

Many different parts of the plant viz, leaves, auxiliary shoots, roots-neck sprouts, shoot primordial, internodal explants etc. can be used successfully for tissue culture propagation . in vitro multiplication has frequently been used to multiply individually selected or bred clones and successful procedures have been documented. Explants from leaf, nodal and inter-nodal segments were cultured on MS medium containing 2,4-D at 2.0, 3.0, 4.0, mg L^{-1} for callus induction and the greatest amount of callus was produced in MS medium with 3.0 mgL^{-1}. The plant growth and stevioside content in the leaves of the plants grown from stem cuttings were more uniform than the plant grown from seeds. The number of roots, shoots biomass and stevioside content were greater in the vegetatively grown plants.

Seed propagation

Reproduction in the wild mainly by seed, but germination and establishment from seen are often poor and sometimes unsuccessful. Seed germination with 7-10 d after sowing propagation through seeds is not a common method of propagation owing to the problem low seed production and poor germination capacity. Using seed to establish crops of stevia is more successful in tropical climates, where there is no climate restriction on the length of growing season. Seed production and fertility studies suggest that high germination rates are possible from selected lines timing of flowering, seed harvest and pollination methods play important role in seed production. Direct seedling to the field is not practiced but may be a requirement for large scale commercial production.

Irrigation

- **Stevia** cannot grow in dry conditions.
- Sprinkler irrigation is found to be advantageous since the herb is highly sensitive to water stress.
- Requires frequent light irrigation.
- During summers, watering at an interval of 3-5 days gives best results.
- To reduces the impact of high temperature and drought addition of mulches around the plant is recommended.

Harvesting

Harvesting of stevia depends on land type, variety, and growing season. Following are the major points for harvesting:

- 1st harvest of crop can be done four months after planning and after every 3 months.
- Best harvest time is mid-september to late September when plants are 50-70 cm in height. As short days induce harvesting.
- The easiest harvesting technique is by cutting the branches off with pruning shears.
- On average, three commercial harvests can be obtained in year. It is better to cut the plant leaving about 10cm stem portionfrom the ground.
- For domestic use, leaves may be used fresh for tea or may be combined with mint leaves.

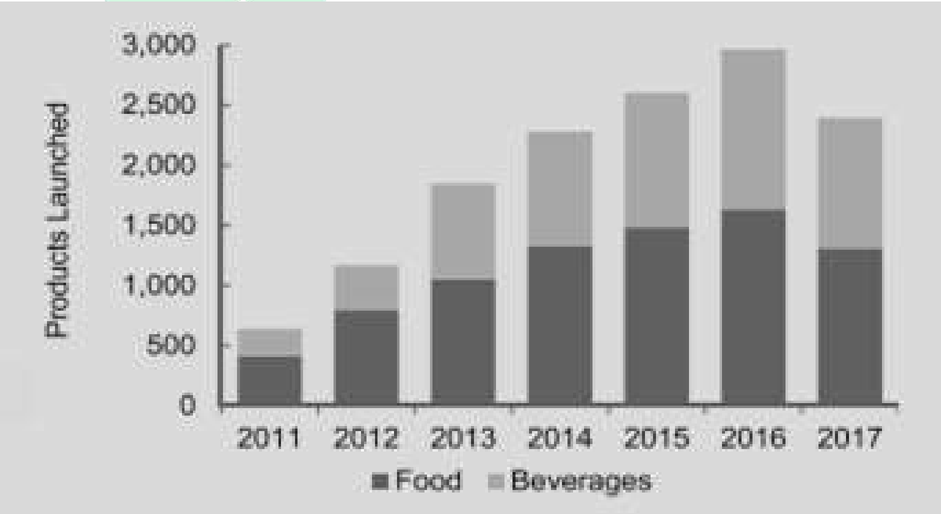

Fig. number of stevia food and beverages

Medicinal properties

- Stevia is a sugar substitute. Using stevia instead of sugar is an excellent way to improve your health. Make teas from it or dry the leaves and make stevia powder to add to your dishes, sooft drinks etc.
- Stevia has a stronger flavor, its taste and texture is more durable than sugar, as it is composed of glucose and rebaudioside, elements that naturally make it sweet. Stevia extract contains upto 300 times the sweetness of sugar.
- Stevia plant have very low calorie, which makes it perfect for people who are on diet.it is not digested by our digestive system means that we don’t absorb the calories that it contains.

- It is ideal for losing weight, being sweet but low in calorie.
- Helps to reduce anxiety levels, cravings or the need to constanly eat sweet things.
- It doesn't affect blood sugar level, its properties means that eating this plant improves glucose tolerance, which makes it a wonderful sugar substitute for diabetics.
- Besides being the perfect sugar substitute, stevia is characterised by having other beneficial effects for both fat absorption and blood pressure.
- Stevia has antibiotic properties making it effective againt bacteria or fungi.
- Growing stevia at home can be great help in your everyday life. This plant relieves fatigue, aids digestion, and can be used as treatment for blotchy skin and spots.
- In Japan, artificial sweeteners were banned some 40 years ago. So, stevia has been their chosen alternative to sweeten their food and beverages. Japanese have performed over 40,000 clinical studies and found stevia to be the safe.

Uses of stevia

- Stevia is safe for diabetes, as it does not affect blood sugar levels.
- Mild stevia leaf tea offers excellent relief for an upset stomach.
- Stevia doesn't have neurological pr renal side effects as other artificial sweeteners.
- Stevia possess antifungal and anti-bacterial properties in addition to its other versatile uses.
- It can be safely used in herbal medicines, tonics for diabetic patients.
- It is also added in daily usage products such as mouthwashes and toothpastes

Conclusion

It can be concluded that very exhaustive work has been done on the plant and it is found that stevia is such an natural sweetener with many medicinal properties and also have zero calorie property. Stevia is a plant helps to maintain our healthy lives. Several global and country level authoritative dietary guidelines recommend a reduction in added sugar intake due to the growing prevalence of overweight, obesity, and diabetes around the world and these guidelines include recommendations to keep added sugar intake 10%of total calorie intake. The replacement of calorie sweeteners in food with high purity stevia leaf extract sweeteners is a useful and cost effective tool in reducing added sugar intake. *Stevia rebaudiana* is gaining popularity in various developed and developing countries as an important crop for the production of non nutritive, non toxic, high-potency sweeteners. In the recent past, research has been conducted around the world on various aspects of crop improvement, the development of new varieties, propagation, seed production, cultivation. And cultivation of stevia should be increased compared to previous years.

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Quinoa: A Potential Crop For Nutritional Security

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Introduction:

Quinoa (*Chenopodium quinoa* Willd.) is an annual herbaceous plant belongs to Amaranthaceae family, that originated in the Pacific slopes of the Andes in South America. It was cultivated and used by the Inca (ruling class) people since 5,000 B.C. Quinoa was the principal crop for the Inca Empire. They named to it as the "mother of all grains" and accept it to be sanctified. Quinoa has been ingested for thousands of years in South America, although it only became popular as "super-food status" a few years ago. It's production in the world is 158 thousand tonnes. Peru is the biggest producer of quinoa with 54 per cent of world production followed by Bolivia with 44 per cent. (FAOSTAT of the United Nations: 2018). The Food and Agriculture Organization of the United Nations (FAO) has officially announced the year 2013 as" The International Year of the Quinoa."

Fig 1: Quinoa crop

It is a pseudo cereal, climate-change-resilient crop and adaptable crop with potential to meet the global food demand. Quinoa is a gluten-free and highly nutritious seed crop which will be play important role in nutritional secturity because it have unique agronomic adaptations to different adverse climatic conditions, making it appropriate for cultivating in countries which susceptible to the effects of climate change on food production. Quinoa adapts to extreme and unforgiving weather conditions, drought, high salinity, and frost. It has great level of adaptability, can survive in lowlands, deserts, and areas over 4000 meters above mean sea level. Quinoa tolerates a wide range of pH of the soil, from pH 6.0 to 8.5 and not affected from low temperature at –1°C and high temperatures up to 35°C. Quinoa is frost resistant before flowering and significant damage if frost occur at later stage of crop. It is grow and give sufficient yield at regions receive annual rainfall is 200–400 mm (Valencia-Chamorro.,2003). The unique benefits of quinoa are its high nutritional value, it is the rich source of protein content, ranges between 13.81 to 21.9% depending on the variety. Due to the high content of essential amino acids in its protein so it is only plant food that provides all essential amino acids and very close to human nutrition standards established by the FAO.

Reasons for Quinoa acceptance in India:

In India 65% population was dependent on agriculture, though more than 50% population practiced it was very difficult to feed the rapidly growing population, hence India import food grains from other countries, but during 1966-67 green revolution in India played an important role especially on rice and wheat production, the dwarf gene varieties of rice and wheat were introduced from Mexico to India for the higher cereal production. In the similar way it is the right time to introduce the crop like quinoa in India to check the some of the health problems facing by Indian population. Security of food production for a increasing population by low-input use is a major task for research in the present time. In present scarcity of water resources and the increasing salinization of soil and water are the main reason behind low crop yield and high loss of crops in India and worldwide and become more severe as a out-turn of desertification (FAO 2011).

Quinoa's extraordinary tolerance to adverse environments like drought, low temperature, salinity and wide range of pH makes it a good option for food security in these challenging Indian conditions.(Martínez *et al*., 2009) We may also increasingly need of plants like quinoa for revegetation and restitution of salt affected and low rainfall reciving lands and quinoa is very useful for investigating the mechanisms that plants adopt and deal with high salinity and drought conditions.

Interesting facts about this popular super food:

- Quinoa is not truly a grain, we cook and eat quinoa like many other grains, but botanically similarly to spinach and beets and Its leaves are also edible.
- In many researches, studies and authors of "Nutritive Values of Crops, Nutrient Content and Protein Quality of Quinoa" found the nutritional ability of quinoa and Extract that quinoa is a complete protein.
- You should rinse quinoa before eating because dried seeds would taste preety sour due to a compound by which quinoa is coated with, but mostly in modern-day packaged quinoa has been already rinsed and processed.

Nutritional status of quinoa vs cereal crops:

In comparison to cereal crops like wheat, rice, maize, pearl millet and sorghum, quinoa provide higher amount of energy, fat, fibre, protein, vitamins and minerals; that's why quinoa is called world's most nutritious crop. Quinoa provides good amounts of heart-healthy fats such as monounsaturated fat (oleic acid) and also provide small amounts of the alpha-linolenic acid (ALA) and omega-3 fatty acid. Recent studies have shown that it does not get oxidized as rapidly even higher fat content. During boiling, simmering, and steaming do not reduction in quality of quinoa's fatty acids, allowing us to enjoy its cooked texture and flavour while maintaining this nutrient benefit at the final eating product. Quinoa has diverse array of antioxidants including various members of the vitamin E family such as alpha, beta, gamma and delta-tocopherol. It also contains flavonoids such as quercetin and kaempferol that contribute in protection of oxidation.

Nutritional value of quinoa (per 100 gram)

Energy	1539KJ(368 Kcal)
Carbohydrate	64.2 g
Dietary fibre	7.0 g
Fat	6.1 g
Protein	14.1 g

Vitamins	
Vitamin A	1 µg
Thiamine	0.36 g
Riboflavin	0.35 g
Niacin	1.52 g
Pyridoxine	0.49 g
Vitamin E	2.4 g
Minerals	
Calcium	47 mg
Iron	4.6 mg
Magnesium	1.97 mg
Manganese	2.0 mg
Phosphorus	457 mg
Potassium	563 mg
Sodium	5 mg
Zinc	3.1 mg

Source: Nutrient data laboratory, USDA

Health benefits of Quinoa:

1.Very nutritious

An article published in the Journal of the Science of Food and Agriculture, in 2009 stated that quinoa has "unusual composition and exceptional balance" of oil, protein, vitamins as well as its minerals, fatty acids, and antioxidants, making it a most nutritious food. Quinoa also accommodate plant hormones which help in regulating plant growth. Phyto-estrogens are a type of phyto-harmone which is being studied for the treatment of menopause symptoms because these phyto-estrogens have the potentiality to act like estrogens in the human body. Quinoa is non-GMO, gluten free and generally grown organically.

2. Rich in fibre

Quinoa is high in fibre. Its high fibre content can help to lower cholesterol levels, reduce blood sugar levels and increase fullness. Digestion is stimulated by fibre, that requires bile acids which are made partially with cholesterol. As your digestion process improves, the liver drags cholesterol from the blood for the production of more bile acid, in that way reducing the amount of cholesterol. According to a study conducted by the German Institute of Human Nutrition has found that the consumption of dietary fibre contributes to a lot of surprising metabolic effects which independent from changes in body weight, which include improvement of insulin sensitivity and modulation of the secretion of some gut hormones.

3. Gluten-free

People who are suffering from celiac disease are suggested for the consumption of gluten free diet. A gluten-free diet can be healthy as it is based on foods that are naturally gluten free. People who are on a gluten-free diet can face difficulty to getting all the essential nutrients they need. Quinoa has been suggested for incorporating as a gluten-free product which significantly improve their polyphenol content as compared with other gluten-free ingredients, such as refined tapioca, potato, rice flour, and corn. Polyphenols are those substances which protect cells and body chemicals against damage caused by free radicals. Quinoa made products can significantly improve the antioxidant value and nutrients of the diet compared with both control gluten – free products and the wheat products.

4. High and essential amino acids

Amino acids are essential for protein. Some of the amino acids which cannot produce by our body are called “essential”. We can get them from the diet. If a food comprise all the essential amino acids, it is considered a “complete” protein. Problem is that a certain essential amino acids are not present in many plant foods whereas quinoa offers all essential amino acids in a healthy balance, including lysine. According to a study of the Ohio Agricultural Research and Development Centre, quinoa is a good source of lysine. Moreover, it contain 25% more and better quality protein than refined grains. Quinoa is considered as an excellent plant based protein source for vegetarians as it contains 14 grams of quality protein.

5. Rich in iron and prevents anemia

Quinoa also very helpful of peoples who have trouble in maintaining their iron needs by daily dite. In only one cup of quinoa, fill the 15% of the daily recommendation of iron, which is

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improve to system, and reduce chance of any deficiencies. Iron is essential for brain function and muscles. Because of very small amounts of zinc are necessary for human health and one cup of quinoa contains 13% of the daily recommendation of zinc, so it makes one of the greatest sources of zinc. Zinc is very play important role in the liver functioning, in antioxidants are especially for keeping healthy skin, in antioxidant which protecting against free radical induced oxidative damage and protects against UV radiation and enhances wound healing.

6. Protects the liver

Another health benefit of quinoa to help in proper liver functioning because it use as a source of zinc. Zinc is essential for human because it provides normal growth, development, and differentiation of cell. Generally zinc deficiency has been noted in patients with liver disease. It observed that patients who take a recommended dose of zinc for treatment of liver disease make faster progress toward curing the disease. The recommended dose of zinc for treating liver disease is 50 mg of elemental zinc taken with a meal to decrease the potential side effect of nausea. quinoa is good source of zinc and when include 100 gram of quinoain in dite it provide 3.1mg zinc.

7. Supports weight loss

For weight loss, people require to take in less calories than they burn everyday. Certain foods can include in our diet which either reduce apatite or boost metabolism. Quinoa has several such properties therefore if you are on a diet, you will likely allowed to eat quinoa. It is a good source of protein, which can both decrease appetite and increase metabolism significantly. It is high in fibre, which should help you improve the feeling of satisfaction, making you ingest fewer calories overall. Another important feature for losing weight is that it has a lower glycemic index.

8. Anti-inflammatory properties

Quinoa contains many anti-inflammatory nutrients, like saponins to hindering inflammation, metabolic disease and obesity. According to the Chinese Academy of Agricultural Sciences, Beijing, quinoa may be used as functional food components for hindering and treating inflammation. Flavonoids, cell wall polysaccharides, vitamin E family nutrients, e.g., gamma tocopherol, and phenolic acids are also reported to have anti – inflammatory properties.

9. Improves digestion

Now a- days millions of people are suffering from digestive disorder. These can be minor problems, such as constipation, diarrhea, gallstones, or more serious diseases, like as cancer, ulcers, and diverticulitis. It is a good source of soluble and insoluble fibre, which help to improve digestion. Quinoa contains high amount of insoluble fibre which can help digestive disorders like diverticulosis. The soluble fibre content of quinoa can help to rid the intestines of cholesterol and also help with weight management if you have a habit of eating too frequently and suffering from digestive disorders.

How to incorporate quinoa more into your diet

Quinoa have coating substances such as saponins that keep insects away without application of pesticides. You can use quinoa in place of rice. Its small grains become soft in 15 minutes. It a versatile ingredient in the kitchen due to its subtle nutty taste. Quinoa keeps its pleasant, chewy texture when served chilled, warm, or at room temperature. We can use quinoa as a breakfast grain as well in cold salads, in burgers or even hot side dishes. We can also use it to thicken stews or soups.

Conclusion

Quinoa is helps in preventing the danger from a lot of maladies and contains good amount of fat, fiber, carbohydrates, protein, antioxidants, omega-3 fatty-acids, vitamins and minerals than any other food grain crops which make it a complete food. In long term consumption of quinoa reduces the obesity. Quinoa is mostly organically produced and have no harmfull effect on human as well as on animal health.Quinoa adapts to extreme and unforgiving conditions like drought, high salinity, and frost and great level of adaptability in lowlands, deserts, in higher altitude, wide range of pH and in extreme low temperature which is make It complete package of nutritional, qualitative and essential ingredients of food for healthy life style and healthy world in a present changing climatic conditions.

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Silicon Nano-particle: Role in Agriculture

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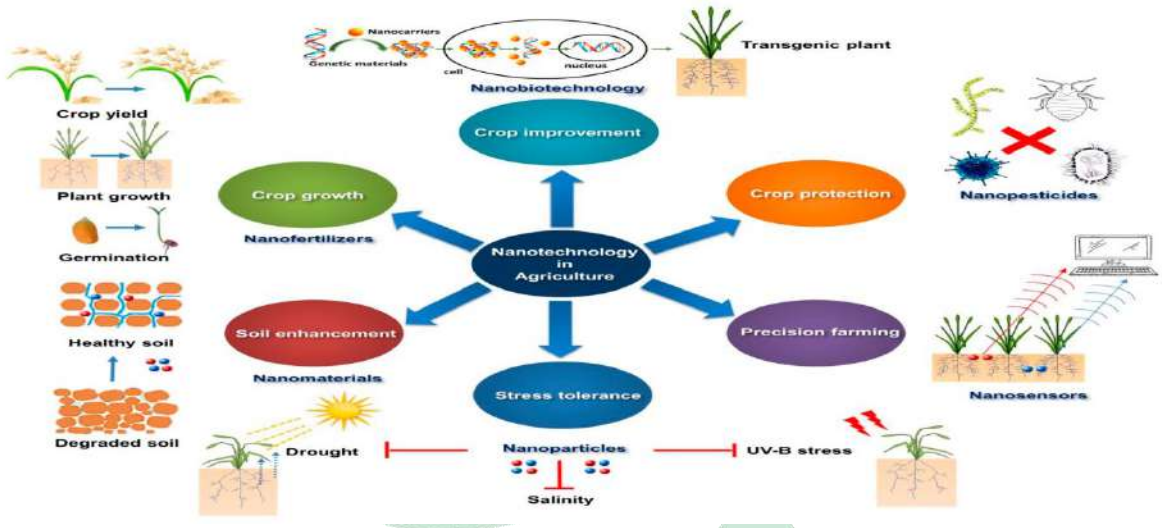
Introduction

Nanoparticles are basically fine particles whose dimensions are about 100nm or even less. Because of their unique size and dimensions they are used in the agriculture sector. The human eye cannot see the physical and chemical behaviour which it causes to its counterparts.



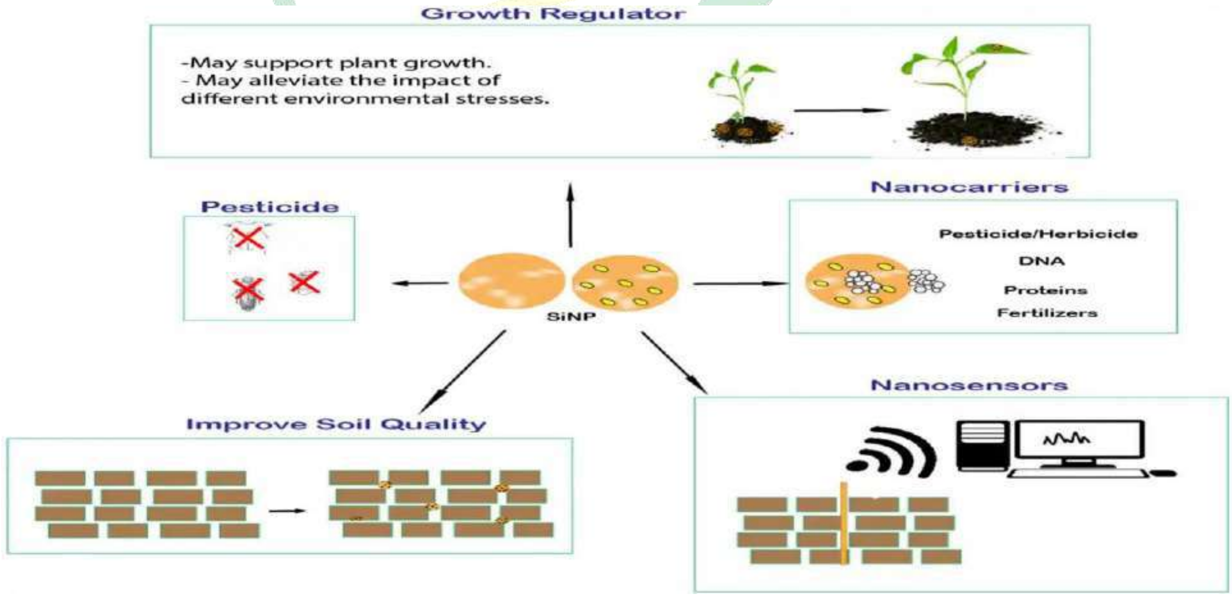
What is the role of silicon in agriculture?

The element silicon whose atomic number is 14 is the member of group 14 of the periodic table. It has a dynamic role in promoting the growth and the yield of the crops. The use of silicon in crops makes them stronger with thick stems and small internodes. It also helps tackling several abiotic stresses like temperature, salinity, UVB-rays etc and at the same time prevents the crop from getting affected by several bacterial and fungal diseases.

Nano-capsules and nano-chips are used as fertilizers, herbicides or pesticides for the proper and slow distribution of the nutrients to the plants. They are also used as nano-sensores. The use of Si-NPs helps the farmer to cope with the damages caused by the biotic and abiotic stresses. Si-NPs are used in various fields like food processing, treatment of waste-water, agriculture, and many more.

Advantages:

- The use of Si-NPs helps in slow releasing of the chemicals to the plants which helps in providing a proper dosage of the agrochemicals to the plants. It is suitable for delivery of boron, urea and nitrogenous fertilizers.
- They can be efficient in their roles as herbicides as they remove weeds without leaving any harmful residues in the soil. They are eco-friendly herbicides and do not hamper the environment.
- The unique property of the Si-NPs gives them a smooth entry in the plant system. This property is the key to the fast development and plant growth of the crop which is ultimately seen on the yield of the crop.
- Si-NPs are also used as pesticides and show their effectiveness on adult insects as compared to larvae. This could be the result of the dehydrating nature of the silica which ultimately kills the insects. It even damages the trachea, spiracles and waxy coating of the insect and protects the plants from their infestation.
- Helps in the efficient germination of the seed and growth of the seedling as experimented and proved on a tomato plant.



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Response of Si-NPs on plants facing abiotic stress:

There are number of strategies which are carried out by genetic-engineering in the agricultural sector to develop some modified gene varieties to control the production and quality damage of the plants under stress conditions. The use of Si-NPs has reduced this burden. As the Si-NPs have a very high mobility it easily enhances the water uptake and root hydraulic conductance of the plant under water stress condition.

The salinity stress condition is also reduced by the use of silicon fertilizers. This is proved by an experiment which was conducted on Basil plant. A/c to the results of the experiment the content of chlorophyll was reduced in the condition of salinity stress but the use of Si-NPs led to increase in the content. When the seedling of wheat is treated prior with the Si-NPs it saves the plant and the yield of the wheat it saves the plant and the quality from the UV-B stress. When Si-NPs are used in the squash plant it showed an improve in the germination of the seed and an enhanced photosynthetic matter in the plant. Salinity stress of the tomato plant is reduced by the use of the Si-NPs which increases the seedling length, fresh weight and germination rate of the plant.

Conclusion:

This article shows the potential of Si-NPs and how it can turn the latest technologies in the area of agriculture. In the era of sustainable agriculture, the introduction of the nanotechnology is bliss for the environment. There are several experiments which are going on Si-NPs and are yet to be introduced in the field. It can easily be extracted from wastes like rice husk and can be stored even at room temperature or at -4^{o}C. It has the current focus because the excessive use of the chemical based fertilizers and pesticides has already degraded the environment and there is an urgent need for the introduction of eco-friendly measures. Seeing the various success of introduction of silicon nanoparticles in agriculture researchers are giving emphasis on this for the healthy functioning of the environment in contrast to the conventional inputs.

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Speed Breeding: An Advance Approach

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Introduction

The globalization replaces the agriculture land areas with the maximum industrial plant, which is causing climate change along with varied abiotic and biotic stresses. The increasing stresses demanding for prompt release of new resistant varieties. The breeding methods of both self and cross-pollinated crops gave insight towards how to develop specific varieties but the evolution through these methods has a very low pace. The contemporary world has increases the gear with more work in the least time from a quick solution to quick communication; everything is increasing its rate. This depicted that in future fastness is another name modernization and advances. The era where everything reaches into the next generation by increasing its rate then why not Plants? The question initiate from here lead to a discovery of the eminent method of breeding, which is Speed Breeding. The drought, flood and global losses due to weed, insect and pest ask for immediate resistant varieties and through convention breeding the release took approx 14 years for the new variety to come in the market for sale. This is the major cons from which breeders are suffering, although the molecular breeding supplemented the conventional one, but it can't be taken as the sole method of application. Thus, considering all this a new method developed with accelerated growth and reduced breeding cycle called Speed Breeding. It is known as accelerated breeding. The higher selection intensity and rate of generation turnover under Speed Breeding may enable a greater rate of genetic gain than direct field phenotyping (Watson and Lee et al, 2019). The working was initiated by Dr. Lee along with Amy Watson and Shreya gosh on wheat crop and got a successful result with six generations per year.

How Speed Breeding Is Better Than Other Accelerated Breeding?

When the question arises of reducing the breeding cycles many methods come into consideration and few such methods amongst them are discussed here with their major drawback. The acceleration of breeding is done through both molecular and non-molecular breeding methods.

A. Non-molecular breeding methods

1. Rapid generation advancement shortens the development of variety by two years through the manipulation of growing conditions like good seed set in less time.
2. In shuttle breeding, one can take breeding in offseason also by growing it in different suitable locations. Therefore two generations per year can be taken which reduces the time of the cycle to just half.
3. The double haploid production through bulbosum technique, anther or ovary culture or chromosome elimination techniques. It reduces the time of cycle from seven-year to just two years but it also reduces the genetic gain as the variability is lost due to homozygosity.

B. Molecular breeding methods

1. Marker-assisted selection gave authentification of the selected variety through phenotyping along with genotyping, which increases accuracy, cost and reduces time by a few years.
2. Genome selection focuses on a large amount of DNA, not just one or two genes as done in MAS. This made the accurate selection to increase genetic gain.

Now the speeding breeding is better than all because it reduces the time of crossing and breeding from 3-7 to 1-2 years with the potential to double the rate of genetic gain. The speeding up of the method without loss of potential gain makes it the popular and advance future method.

How Speed Breeding Is Done?

To know the exact working, fist we have started with its principle of working. The speed breeding is the combination of principles of above acceleration breeding aspects. The breeding is done under the controlled artificial environment with artificial conditions like rapid generation advanced and it can also be grown in offseason as we do in the shuttle breeding method. The main idea of such innovation comes from NASA which has the aim to grow food crops and wheat in space. Then further Dr. Lee Hickey initiated his work in this along with some co-workers at the University of Queensland, John Innes Centre and the University of Sydney in Australia in wheat and peanut crop.

Fig 02:- A Set-Up for Speed Breeding

The artificial environment created in a glasshouse is different from sped breeding as in the former one alternative 12 hours light and darkness is given but in speed breeding, the plants are exposed to continuous light for 22 hours. This prolonged light hour increases the photoperiodic hours which help in accelerating the developmental rate of plants. The speed breeding chamber has temperature controlled fitted with light with some LEDs of low-cost growth room. The speed breeding set up is shown in fig -02. The speed breeding fulfils the breeder’s equation with six generations per year.

Procedure Of Speed Breeding

1. Initially, the seeds are prepared for sowing by providing the proper treatment and environmental conditions.
2. The significant growing stages are taken into consideration and specific emphasis is given to phenotyping of only those stages. Like the time of anthesis or flowering is observed and their associated parameters are observed.
3. Majorly seed is harvested at an immature stage and then given specific cold treatment for maturation. Although the seed produces this process somewhat shriveled on hydration they regain their shape and vigour and germinated. But this process reduces the time from 15 days to 3 days.

4. The energy monitoring helps us to be specific while providing light, temperature and other biological setups.

Application

1. Useful in developing multiple disease resistance crops
2. Can collaborate with new technology like CRISPER CAS9 and give result in a shorter period.
3. Spring wheat, durum wheat, barley and *Brachypodium distachyon* has given amazing result by decreasing the time of progression to anthesis to just half.
4. According to some protocols, even 8-9 generations of barley were found.
5. There are many opportunities to combine it with transgenic and genomic selections to get good results.
6. The first varieties originated through speed breeding are "DS Faraday" using speed breeding with high protein, milling and tolerant to post-harvest sprouting.
7. The disentangling of photoperiod revealed that vernalization and dormancy, two plant traits previously considered necessary to the proliferation of *Humulus lupulus L.* (hop flowers), do not influence hop flower yield and quality, this finding paves the way for speed breeding and controlled-environment production to achieve 4 hops generation cycles per year, as opposed to 1 under field-grown conditions. (Bauerle et al, 2019).
8. In Peanut: - Speed breeding was successful in reducing generation time of full-season maturity cultivars from 145 to 89 days. Speed breeding can rapidly progress the inbreeding of F2, F3 and F4 generations in less than 12 months, and potentially accelerate the development of the first cross to commercial release in around six to seven years. (O'Connora et al, 2013)
9. Application of a high-speed breeding programme for disease resistance in apple. (Flachowsky et al, 2011)
10. Multiple quantities traits in durum wheat.
11. Mutant transformation for waxy traits in barley.

Future Challenges

1. There is a very high initial investment.

2. As there is great diversity on this earth therefore the protocols are different for different crops. The response towards photoperiod is different for the different crops therefore the protocols of glasshouse differ among them.
3. There is an early harvest of immature spikes which interferes with the phenotyping of seed parameters.

Conclusion

The science in agriculture has explored every corner of research and plants are fully exploited for improvement of the trait. The recent technology inspired by NASA and elaborated by Dr. Lee, Amy Watson and Shreya Gosh that combines the advantages of all the methods and put them in a single canvas termed as Speed Breeding. The procedure utilizes the currently available information of plant biology and its ecology to form a crop-specific protocol, manipulate the photoperiod to shorten their life cycle, boost the growth through controlled environment condition such as temperature, humidity, light, etc and stage peculiar assessment to ultimately gain more than five-generation per year without reduction of yield is speed breeding. The scenario is not only focused on glasshouse control measures but also taken plant requirements as the priority for setting up the protocols. The article discusses the key aspects with major cynosure on wheat crops. The limitations which the method involves are high initial cost and the protocols differ in concern with crops.

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Sustainable Water Management in Rice through "AutoMon^{ph}"

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Agriculture uses approximately 70% of the planet's freshwater supply, of which 40% is used for rice cultivation. The field level, rice receives up to 2-3 times more water than other irrigated crops. Worldwide, water for agriculture is becoming increasingly scarce. The causes are diverse and location-specific, but include decreasing resources, malfunctioning of irrigation systems and increased competition from other sectors such as urban and industrial users. Currently, rice constitutes a staple food for half of the world's population; more than three billion people rely on the grain for their main source of livelihood. Enhancing rice production and increasing water productivity will be essential to ensure food security for this population. We present sustainable water management options to help farmers to cope with water scarcity at the field level.

Sustainable water management at field scale

There are many technologies that can reduce irrigation water input and increase water productivity. These include:

- Field design and land gradient
- Land levelling
- Tillage: reducing soil permeability
- Bund preparation and maintenance

- Alternate establishment method-changing crop establishment to dry seeding or non-puddle transplanting
- The System of Rice Intensification
- Saturated soil culture
- Irrigation scheduling using safe alternate wetting and drying (safe AWD) principles
- Micro-irrigation
- Drought-tolerant rice varieties
- Improved crop management - includes altering planting calendar to reduce evaporation losses, mulch and harnessing residual moisture
- Conservation agriculture.

AutoMon^{PH}

Despite these, the World‘s irrigation sector faces many challenges, such as water scarcity, the absence of effective and real-time water-use monitoring system, multifaceted water governance and inequitable distribution of irrigation water within the basin. To address these problems, the Philippine Rice Research Institute (PhilRice) and the International Rice Research Institute (IRRI) are developing an irrigation advisory service using internet of things (IoT) tool called AutoMon^{PH} for catalyzing the adoption of sustainable water management and improving irrigation operational efficiency. The AutoMon^{PH} is based on a scientifically proven method for irrigation scheduling called alternate wetting and drying (AWD), which saves water up to 30% without a yield penalty.

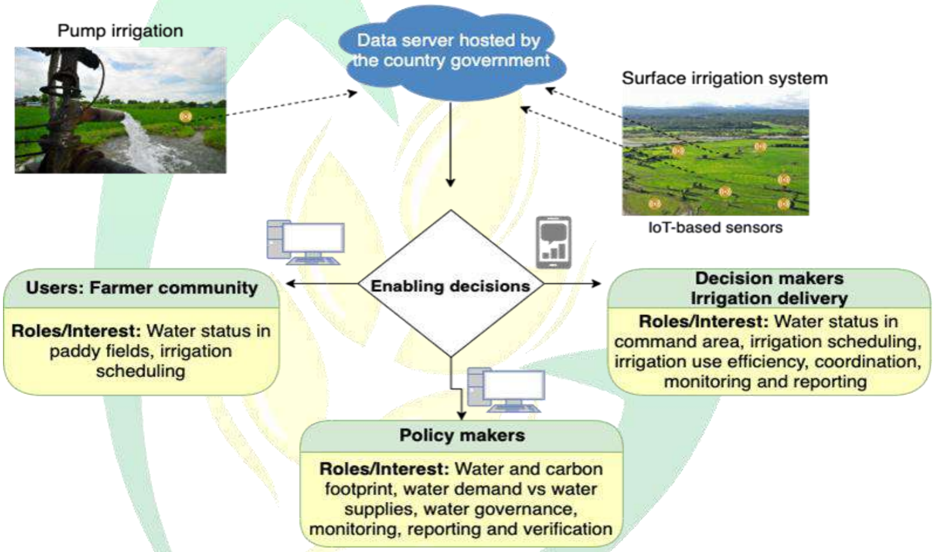
The digital tool for water management will

AutoMon^{PH} is an Internet of Things (IoT) solution, which refers to a network of objects – things-that communicate with water level sensors using wireless connectivity. As an IoT solution, it provides;

- Efficient water management.
- Allow effective and real-time monitoring of water status at multiple levels (from plot to river basin).
- Enable computation of water demand at multi-scale.

- Provide improved access to information that will guide decision-making of different stakeholders.
- Reduce transaction time and cost of effective coordination among stakeholders.
- Enhance transparency in water governance.
- Create a real-time analytics platform for monitoring, evaluation, and learning.
- Establish an evidence repository to trigger policy change. Facilitate computation of methane emission/C-footprint in rice with real time water management information.

Conceptual framework of AutoMon^{PH} operation



Challenge

AutoMon^{PH} aims to address the following core issues;

- Inefficient water use and management for irrigation.
- Uncoordinated, ineffective water governance.
- Lack of sustainable, scalable programs providing holistic solutions from field to policy.
- Lack of real-time data to drive decision making for irrigation.

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Urban Agriculture in India: Advantages and Challenges

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Introduction

The word 'urban' means city or town area and 'agriculture' means the practice of farming which includes cultivation of soil for the growing of crops and rearing of animals to provide food, wool and other products. So combinedly, urban agriculture can be defined as the practice of farming in or around city or town areas. According to Wagstaff and Wortman (2013) urban agriculture has been concisely defined as, "all forms of agricultural production (food and non-food products) occurring within or around cities." Urban agriculture may include all the other branches of agriculture such as floriculture, apiculture, animal husbandry, agroforestry, aqua culture and horticulture. These activities can be done in peri urban areas also which means cultivation in those areas which are in the form of transformation totally form rural to urban.

In India, the idea of urban agriculture is not very popular yet. The food crops and all other agriculture commodities in India have been supplied from the villages. The percentage of urban population growing their own food is extremely low and the population there is increasing in a rapid pace. According to a recent data, 34.47% of total population of India live in urban areas which is increasing rapidly day by day. By the year 2050, 50% of the total population would be living in urban areas. With the increasing urban population, the difficulty in living there is also increasing day by day. The Indian cities are facing various problems such as no clean and quality food, lack of greenery and fresh breathing air, scarcity of fresh water, no proper waste management, etc. The people living in these areas also do not realize the need for producing their own food. People must be made aware about the importance of urban cultivation, proper and quality nutrition, organic local produce, etc.

Advantages

There is a high scope of urban agriculture in India. It has various advantages that can uplift the urban dwellers in various aspects. Some of the advantages are enlisted below:

- The urban population have very less control over the quality, price and supply of food that they consume. At times, there are very heavy fluctuation of prices of food which they have no control over. It has been reported that farmers grow organic chemical free food commodities for their own consumption and use high doses of chemicals to the food that for selling purpose. All these problems can be overcome through urban agriculture by producing their own quality and price managed food produces.
- It helps in reducing carbon emission in urban areas by cutting down the significant amount of fossil fuel consumption which was necessary for transportation, packaging and selling food.
- It generates employment opportunity. The maximum percentage of people migrating to urban areas are poor. They come to cities in search of employment and other facilities. So, this can provide employment to those in need.
- It provides food and nutrition security. It helps to meet the nutritional requirement of increasing urban population and reduce the diseases caused by various nutrition deficiency.
- It helps to provide fresh and quality food crops to the urban population.
- It motivates the people for innovative techniques such as hydroponics, rooftop gardens, landscaping, urban livestock, etc.
- It provides proximity to markets.
- It helps to make the neighbourhood green.

Challenges of urban agriculture

Many cities of India such as Mumbai, Delhi, Chennai, Bengaluru and Kolkata has adopted urban agriculture under the leadership of state government, private sectors and individuals. However, still it is not that developed and is still facing many challenges. The challenges in urban agriculture are:

- Availability of land: The availability of land in urban areas is very hard and even if it is available then the price can be very high. The outskirts of town are also very highly priced. For example, according to the report by The Economic Times, in 2013 an acre of farmland in Vadicherla in Mehaboobnagar district currently Telangana which is not near any big city, which cost Rs.25000 in 2003 rose to Rs.12 lakh by 2012. So, by now, the price may have increased to a great extent.
- Water availability: For farming, huge amount of water is required for irrigation purpose. The urban areas in India are facing the water scarcity problems and could not meet the populations requirement.
- Soil and air pollution: There are high level of pollution in the soil and air of urban areas. Emissions from factories and vehicles lead to the presence of heavy metals and other toxic chemicals in water soil and air.
- Theft and vandalism: There is a high chance of food produces being theft and destroyed by the people, street dogs, etc.
- Viability: Farmers may get difficulty in earning a living by only growing and selling food produces and would be hard to pay for the land and workers. The yield also are very less which could not meet the demands of the people.

All these challenges can be tackled by preparing a proper plan or scheme by the government especially for urban agriculture. For the difficulty in availability of land each state government can make scheme to lease the empty plots for cultivation. People must be encouraged to utilize the rooftops, balconies and backyards of their houses, apartments and school colleges for cultivation. New sources of water should be found to meet the water requirements.

Conclusion

One of the best strategies to contribute to local food security is urban agriculture and there is a high scope of it in India. It provides the availability and access to fresh and healthy produce. In near future, there is a high chance of urban agriculture to produce at least a portion of their own food supply.

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Utility of Internet of Things in Agriculture: From Concept to Reality

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In this global era of digitizations and smart devices surrounding us twenty-four by seven, the utilization of Internet of Things (IoT) is inevitable. As the phrase "Internet of things" signifies, it consists of things that have a unique identity and are connected to the internet connection. Sensor network, cloud computing, embedded systems, wireless communication and remote technologies form the core of IoT technology. With the advent of information and communication technology and now IoT that make use of artificial intelligence and cloud computing, it is like concept shaping into reality which makes nonliving items interact among themselves and to the surroundings as well. These new technologies provide modern solution to the emerging problems. Agriculture (along with animal husbandry, fishing, forestry etc.) which is the largest sector of the Indian economy, faces many challenges be it climate nge, pest attack, drought, or unforeseen circumstances that lead to lower productivity and food shortage. The sector holds phenomenal challenge of meeting the increased demand for food. According to the Global Opportunity Analysis and Industry Forecast, 2018 – 2025, IoT in agriculture market size that was valued at 16, 330 million U.S dollars in 2017, is projected to reach 48,714 million U.S. dollars by 2025, growing at a CAGR (Compound Annual Growth Rate) of 14.7% from 2018 to 2025. This seems to play a crucial role in solving agriculture related issues.

What IoT have in stock for farmers?

IoT aids in farming automation, which helps in shaping farmer's workspace, ensuring connectivity management, and productivity along with remote management. A water system that makes use of remote sensors to detect surrounding heat and soil dampness esteem, moistness esteems & water altitude, along with assistance android application provides field data to the farmers.

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The detected information along with the assistance of water system calculation controls the water supply subsystem without farmer being involved in whole process. By the use of IoT driven irrigation system, water utilization is lessened with the use of soil dampness, humidity, moisture content in soil, temperature sensors and soil water altitude based computerized system. Internet of Things (IoT) in agriculture is used for monitoring the soil conditions, drones for monitoring yield conditions and natural change, small drones to recognize the diseases of plants and pest attack by using sensors so that precautions can be taken at earlier stage, monitoring environmental conditions in greenhouses and decision support systems for agriculture field operations. Radio Frequency Identification (RFID) tags or sensor nodes are attached to the agricultural produce, cold storages, grain/seeds bags, livestock, and farm machinery for effective tracking and management from warehouses to the time they reach final consumers. Harvest and post harvest losses can be minimized by intelligently using IoT and cloud based platforms. Tracking the health of cows and buffalos, along with their vaccination pattern can help maintain animal health and productivity. These are a few applications of IoT and list is endless.

Issues regarding utilization of IoT by farmers.

IoT based system in agriculture, although proved to be very successful in developed countries, are in very primitive stage of implementation in India. India being a developing country where majority of farmers belong to small and marginal groups. The major challenge is to spread the knowledge and awareness about IoT to various stakeholders, particularly to the farmers. Some of the research direction in the area is development of need specific and more effective sensors that are affordable. The research and analysis of the data generated can guide the ways to improve production with optimized use of resources, and can bridge the demand and supply gap of the agricultural produce. The data can also be used for policies and programme formulation by public and private firms. Processing, correlating, analyzing and inferring correct information from the data, which is coming from a variety of sensors, is the most challenging task in any IOT system. The data created by IoT is huge hence the storage and security of private data is another issue to ponder upon. For realizing technology driven precision agriculture visions, it's high time to seed the IoT knowledge and utilization to harvest the fruit of productivity and profitability in the near future.

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Women's Friendly Drudgery Reducing Tools

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1. HAND RIDGER

Function

For making ridges in field to sow vegetables on ridges. The equipment can also be used for making furrows in field for irrigation.

Brief description

A manually operated hand ridger has been developed for making ridges. It consists of ridger and pulling beam with T- type handle. Field needs to be well prepared for getting better performance of equipment for making ridges/furrows. The equipment is operated by two women workers, one for pulling and another for pushing and guiding.

Bene fits

- About 67% saving in cardiac cost of worker per unit output with the ridger in comparison to the traditional method of making ridges.
- It avoids bending posture, which is generally adopted in traditional method with short handled tools for making ridges.
- Productivity of worker doubles with the equipment than traditional practice.

2. SEED TREATMENT DRUM

Function

For uniform mixing of chemicals in seeds for its treatment before sowing.

Brief description

The seed treatment drum consists of frame, handle and cylindrical drum. The cylindrical drum is mounted on a tri-pod angle iron frame. Three pieces of mild steel flat are welded inside the drum for helping in uniform mixing. Prior to start mixing of chemicals, workers are advised for wearing plastic hand gloves and mask on nose for health protection. After adding chemicals in drum, add little water, close the lid of drum tightly and rotate the drum for 20 to 25 revolutions. After 1-2 minutes of completing the work, open the lid and take the treated seed in a separate bag/container. A batch of 20 kg seeds takes about 5-6 minutes for complete operation i.e. filling, treating and emptying. Hand gloves and mask should not be removed till completion of the work. Children's should be kept away from the work place. After completing the work, workers are advised for thorough washing of hand, legs, face and eyes.

**Bene
fits**

- Equipment provides safety to worker as direct contact with chemicals is avoided.
- Uniform mixing of chemical is done.
- It also avoids bending/squatting posture as done in traditional method of treating the seed.

3. FERTILIZER BROADCASTER

Function

For uniform application of granular fertilizer in field.

Brief description

Based on observations and feed back received from women workers during the experiment with commercially available fertilizer broadcaster, the broadcaster was refined to make it suitable for them using anthropometrical data of women workers. It consists of a hopper with agitator, spreading disk, gear, crank with handle, rear cushioning pad and straps with shoulder pad for mounting. The broadcaster needs to be cross-mounted, as it is a belly-mounted equipment. A woman worker should start the broadcasting work keeping 2.5 m away from bund of field and maintain 5 m spacing during the operation in subsequent passes. The quantity of fertilizer in hopper may be observed from its transparent lid and when required it may be filled. The broadcaster may be cleaned thoroughly after use. A woman can easily mount and dismount the refined broadcaster.

Benefits

- About 6% saving in cardiac cost of worker per ha with refined broadcaster in comparison to traditional practice was found.
- Uniform application of fertilizer is done.
- It saves workers from dust of urea at the time of application thereby enhancing safety of workers.
- Productivity of worker increased more than thrice with the equipment than traditional method.

4. CIAE SEED DRILL

Function

For row sowing seeds of wheat, soybean, maize, gram, pigeon pea etc.

Brief description

The CIAE seed drill have been refined for women workers using anthropometric data. It consists of a handle, hopper for seed and fertilizer, peg type ground wheel, a roller with cells and a hook for pulling the drill. The metering roller is directly mounted on the ground wheel shaft. The seed drill needs to be operated in well-prepared field. The seed drill is operated by two workers, i.e. one for pulling and another for pushing and guiding. Rope is tied to hook provided in front of the seed drill for pulling.

Benefits:

- Output is 18 times than traditional practice.
- Apart 87% saving in cardiac cost of workers per unit of output.
- By the use of seed drill, bending posture which is generally adopted in traditional method can be avoided.
- Line sowing is done with the equipment that promotes use of mechanical weeders for weeding thereby reducing cost and drudgery during weeding operation.
- Seed saving is also achieved.

5. NAVEEN DIBBLER

Function

For dibbling bold (like maize, soybean) or costly/scarce seeds in less area and for gap filling purpose.

Brief description

This dibbler consists of jaw type seed placement device, cell type metering mechanism, lever type power transmission system for roller and jaws and seed box with delivery system. After filling the desired seed to be sown in field, the worker should keep the dibbler at desired place and gently push the lever (front of dibbler) for opening the jaw so that seed may drop.

- About 13% saving in cardiac cost of workers per unit of output with the dibbler as compared to traditional.
- It also avoids bending posture, which is generally adopted in traditional method.
- Line sowing is done with the equipment that promotes use of mechanical weeders thereby reducing drudgery and cost during weeding operation.
- Seed saving is also achieved.

6. TWIN WHEEL HOE

Function

For weeding and intercultural in up land row crops in black soil region.

Brief description

Twin wheel hoe consists of two wheels, frame, V-blade fixed on a tyne, U-clamp and a handle. The cutting and uprooting of weeds in field is done through push and pull type action of the equipment. The equipment is operated at optimum soil moisture condition and preferably after 20 -25 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance.

Benefits

- About 43 % saving in cardiac cost of workers per unit of output.
- It avoids bending/squatting postures, which is generally adopted with short handled hand hoe in traditional method.
- Productivity of worker increased more than three times with the equipment than traditional method.

7. IMPROVED SICKLE

Function

For harvesting wheat, rice, soybean, chickpea, grasses and thin stalked crops.

Brief description

It consists of serrated blade, ferrule and wooden handle. Cutting of crop stalk is being done with the improved (serrated) sickle by sawing action as against by impact or pulling action in case of local (plain) sickle. Due its less weight i.e. about 180 g the fatigue coming on wrist is less and the drudgery involved in harvesting is reduced as compared to local sickles which are heavier i.e. weighing about 350 g.

Bene fits

- About 15% saving in cardiac cost of workers per unit of output with improved sickl e as compared to local sickle.
- Serrated sickles does not require the sharpening of cutting edge frequently.
- It also provides safety to the workers due to its better construction.

8. MAIZE SHELLER

Function

For shelling maize from dehusked cob.

Brief description

It is made of mild steel sheet and is octagonal in shape. Four tapered fins are provided in the maize sheller, which helps in shelling the maize grain from dehusked cobs. A cob is inserted into it and by twisting action shelling is achieved.

**Bene
fits**

- About 15% saving in cardiac cost of workers per unit of output in comparison to the traditional practice.
- The productivity of workers increased 1.6 times than traditional practice i.e. shelling with the help of sickle.
- The chances of injury to fingers are eliminated thus making the operation safer for workers.

9. CONO WEEDER

Function

Uprooting and burying of weeds in between standing rows of rice crop in wetlands.

Brief description

Two truncated rollers one behind other are fitted at the bottom of a long handle. The conical rollers have serrated blades on the periphery. A float provided in front portion prevents the unit from sinking into the soil. The cono weeder can also be used for trampling green manure crop in addition to weeding operation. It disturbs the top soil and increases aeration also. The equipment is operated in standing posture thus avoiding bending involved during uprooting of weeds by hands in traditional practice.

- Bending posture is avoided thus reducing drudgery of workers in weeding operation in wetlands.

- Output is increased significantly.

10. COTTON STALK PULLER (JAW TYPE)

Function

To uproot cotton plant stalks from soil.

Brief description

The cotton stalk puller consists of long handle designed in such a way that when the handle is moved downwards, the front jaws firmly hold the stalk due to press plate hinged at the bottom of the main frame. On further downward movement the press plate acts as a pivot and the front jaw portion gets lifted up along the stalk. Once the operation is over the press plate comes to its original position with help of a tension spring fitted between press plate and mainframe. The unit can easily be moved to next plant with the help of ground wheel.

- Bending posture is avoided thus reducing drudgery and chances of backache of workers in cotton stalk pulling operation.

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Strategies for enhancing linseed production for self sufficiency in oil & industrial demands

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Linseed (*Linum usitatissium* L.) is an important oilseed crop grown almost every part of the country. Traditionally cultivated for oil meant for edible as well as industrial purposes. Almost every part of its plant is commercially utilized either direct or after processing. On small scale, the seed and its oil are directly used for human consumption as flax seed breads, bagels and other baked and fried food stuffs. Linseed is highly nutritious. It is a source of complete protein (all 8 essential amino acids), high order linolenic acid (an essential polyunsaturated Omega-3 fatty acid), complex carbohydrates, vitamins and minerals. Recent advances in medical research have found linseed as best herbal source of Omega-3 and Omega -6 fatty acids which have immense nutritional/ medicinal effect on human body. Now a days, this crop is emerging as very good source of nutrition special reference to having ample amount of Omega-3, which is a cheap and best source of essential nutrition for pregnant women, children and all category of human beings. Its cake is a very good source of cattle feed for production and nutrition point of view. The state contributed 56 % both in area and production of the country which proved Madhya Pradesh is the major state as regard area and production of linseed crop.

Scope of increasing area with cropping system and crops to be replaced

The area, production and productivity is lowering in the region, state and also in country. The problem of decreasing the area, production and productivity can be solved by using high yielding, multiple resistant varieties for different biotic and abiotic stressess. At present, number of improved varieties namely JLS-9, JLS-27, JLS-66, JLS-67, JLS 73, JLS 79 and

JLS 95 have been developed by the centre having high seed & oil yield but the extension of the transfer of technology is very poor. Hence, ultimate users are not being benefited. The conduction of large numbers of front line demonstrations of improved varieties may be a effective tool to convince the cultivators by implementing higher production technology. Although, we have developed good varieties maturing within 110-120 days which is suitable to fit in double cropping system after paddy, soybean, maize, urd and mung as per the requirement of the cultivators. The area under crop is being increased gradually since last four years and this trend will continue due to lower input cost crop coupled with high market premium and early maturing varieties. Secondly, its area can be enhanced through adopting linseed as an intercrop with major crops of the state viz, Wheat, gram and lentil. Thirdly, it possesses least abiotic risk especially able to give 70-80 % yield even after heavy flush of frost hence, there is no another crop is being grown during rabi season with having such tolerance ability against frost. Lentil, lathyrus, pea, gram and even rainfed wheat can easily be replaced by this crop owing to low input technology crop, most suitable under adverse environmental conditions (biotic and abiotic stresses), rich in omega 3 and fibre quality it always having very attractive market premium.

Short term strategies for area expansion:

With securing the availability of foundation, certified seed and large scale varietal as well as intercropping demonstration of improved varieties could play significant role in area expansion and adoption of linseed as low input cost technology as compared to wheat, gram, lentil lathyrus and wheat in rainfed and semi irrigated area of of the state. In the region pulses occupied a sizeable area and heavily affected by wilt disease. Intercropping of linseed with pulsed could help in minimization of wilt problem in pulses. By the use of high yielding multi-resistant and short duration varieties of the linseed, cultivators will be benefited on the one hand and varieties containing high level of oil and quality, industrialist will also be benefitted on other hand by getting good nutritive raw material for their industries especially Omega-3 as a medicine and used . Its fiber is also very useful in making cloths (lenin), ropes and being used in making parashoot, very good matrix for making plywood and other hardboards . More than 80% of its oil is being used in paint and varnish industries owing to its fast drying property.

Long term strategies for area expansion:

Cultivar development of linseed is currently focused on early maturing and enhancing the oil content and nutritional value to meet the demand of nutraceutical market supply, as an alternate source of fish oil, flax is the richest source of ALA, a precursor for the synthesis of very long chain polyunsaturated fatty acids (VLCPUFA), a rich source of eicosapentaenoic acid (EPA, C20:5) and docosahexaenoic acid (DHA, C22:6). Linseed seed is also rich in soluble and insoluble fibers and lignans, makes it useful as a dietary supplement. Intake of flaxseed in daily diet may reduce the risk of cardiovascular diseases such as coronary heart disease and stroke. There is also evidence that flax has anticancer effects in breast, prostate and colon cancers. Flax fiber is used in the textile industry for linen cloth and also in paper industry. The residues remaining after the oil extraction from linseed contains about 35-40% protein and 3-4% oil, a rich source of feed to livestock like cattle and buffalo. Flax is naturally high in polyunsaturated fatty acids (PUFA), more specifically in ω-3 fatty acids; and hence flax seed as a component of poultry meal, can provide ω-3 enriched eggs. Rapid drying linseed oil is used for several purposes in industry, including paint and flooring (linoleum) industries. Because of its novel oil profile, flax may also be a suitable platform crop for synthesis of specialized industrial and nutraceutical products. Due to value addition in cultivars farmers will get more price. The time has come to formulate the research program based on the quality parameters as descried aforesaid. The centre has already been developed number of varieties having such quality as mentioned above. Blending of linseed oil with other edible oils ie., Palmolein, rice bran and coconut oil will give an appropriate plate farm to reduce its rancidity and self life beyond three months. Futher long term studies to be needed for confirmation of results. For achieving more, an intensified research program is needed to generate new materials having above mentioned qualities which are need of the day.

The area under crop will increase in the state definitely due to more profitable and most suitable crop under varying eco- edaphic condition. For the above purpose (area expansion) more number of front line demonstration under different component technologies viz, whole package, nutrition, varietal, plant protection and intercropping has to be undertaken.

1. **Potential technologies which need to be promoted**

Package of practices along with attainable yield levels

Selection of field/land preparation: Loam soils, 2-3 ploughing with planking

Seed treatment : Thairum+Carbendazim @ 3.0 g/kg of seed

Sowing time : First fortnight of November

Seed rate/sowing method : 25 kg/ha, Line sowing with Row to row & Plant to plant distance

25 X 5 cm^2

Fertilizer doses : Irrigated condition

80:40:20:20: 5:: N:P:K:S:Zn kg/ha along with 5 t FYM /ha

: Rainfed condition

40:20:20:10: 5:: N:P:K:S:Zn kg/ha

Weed control : Metsulfuron methyl 4g ai /ha along with clodinaphop 60 g /ha is effective against broad and narrow leaf weed management as post emergence at 25-30 DAS.

Disease & Pest Control : Deep summer ploughing at the interval of 3-5 years, seed treatment with Thirum+Carbendazim @ 3 g /kg seed and biofertilizer viz, *Azatobactor* and *Pseudomonas* @ 5 g /kg seed.

Table 1. Insect pest of linseed and systematic approach for their management

Time of practices/ growth stage	Target Pests	Control measures
Pre-sowing	Bud fly and other insect pests	Solarization of soil through summer ploughing, avoid continuous cultivation of linseed in same field.
Land preparation	Termite	Apply 2.5 q neem cake /ha or chloropyriphos 20 EC @ 1 litter/ha. in soil when termites are regular and heavily damaging pest.
Sowing	All major pests	Sowing may be restored 10-15 days earlier to minimize the bud fly infestation; selection of suitable resistant varieties Neela, Kiran, and moderately resistant high yielding varities like JLS 27, JLS 66, JLS 67, JLS 73, JLS 79 , JLS 95, Sharda, PKVNL 260, Kartika and Sharda etc.
Seedling stage	Cut worm and termite (moderate infestation)	Dusting of the crop with methyl parathion 2 % @ 25 kg/ha
Vegetative stage	Leaf minor, sap sucking pests and	Apply dimethioate 30 EC (0.03%) or spray imidacloprid 17.8 SL @ 50 ml/ha as and

	defoliators	when required
Flowering stage	Bud fly, leaf minor, defoliators and sap sucking pests (6.0% ETL for bud fly and moderate to severe damage for other pests)	Use light trap for bud fly. Use of attractant (1 kg jaggery in 75 lit. of water and chloropyriphos @ 1 ml/lit) for bud fly, use of bamboo/wooden pegs as dead perches for predatory birds, spray forthnightly neem based formulations (0.5%) or spray imidacloprid 17.8 SL (0.04%) or spinosad 45 SC (0.015%) alone or with mancozeb (0.2%) for control of leaf minor , defoliaror and other sap sucking pests as per above given schedules.
Capsule formation stage	Gram pod borer (Moderate to heavy damage)	Apply HaNPV @ 250-300 LE/la

Table 2. Diseases of linseed and systematic approach for their management

Disease with causal organism	Prevalence in the country/ specific area	Control measures
Wilt (*Fusarium oxysporum*)	Incidence throughout the country but more prevalent in central part. Average loss 12-15 % if continues certification loss up to 70 %	Timely sowing, Soil solarization by ploughing; avoid continuous cultivation of linseed in the same field; 2-3 years rotation is most effective prevention ; use of the resistant varieties, effective technology for management of better germination and crop growth as well as linseed wilt by use of biofertilizers (*Azatobactor* and *Pseudomonas* 5 gm / kg seed) after seed treatment with mixed fungicide (carboxin + thiram) fungicide @ 2.5 g/kg seed and soil treatment before planking @ 2.5 kg/ha *Trichoderma virdae* .
Alternaria blight (*Alternaria lini and Alternaria linicoa*)	Prevalent in Northern region having humidity range of 90-95% and temperature 25-30 0C. average loss 20-35% if atmospheric conditions suitable loss up to 60%	Timely sowing, Use of the resistant varieties, seed treatment with mixed fungicide (carboxin + thiram) @ 2.5 g/kg seed. Spray of carbendazim +mancozeb @ 2.5 g/lit. water.
Rust (*Melampsora lini*)	Prevalent in Northern region of the country & serious in colder hilly regions.	Timely sowing, Use of resistant/tolerant varieties. Destroy plant debris and weeds to reduce the primary source of infection. Use of clean seed, seed treatment with

		Carbendazim. Spray Propiconozole or hexaconazole (0.1%)) at 15 days interval to control the disease.
Powdery mildew (*Oidium lini*)	Throughout the country loss were depend on time of sowing, early sown (15 October) no loss, late sown (25 November) loss upto 20%	Timely sowing, Use of resistant/tolerant varieties, early sowing, 2-3 spray of Calixin (0.05%) or Sulphex (0.02) or Wettable sulphur (0.3%) reduce the disease.
Dodder/cascuta (*Cascuta hylina*) Plant parasite	Chhattisgarh, Madhya Pradesh and Vidarbh region of Maharasthra, Losses upto 5-8 %	Mechanical removing of parasitic vine from fields and parasitic seeds lot; Preventing the movement of grazing animals from infested fields, Restricting the flow of irrigation water from infested area. Spray 2-4 D @ 0.5 kg/ha.

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Annadaata v/s Ordinances

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We all are quite aware of all what happened on the day of protest. But was it the way through our farmer need to pass for his own rights as a return of providing us with food to sustain. In the race towards doubling the farmer's income by 2022, our governance is passing different rules and moving on into innumerable schemes that are supposed to uplift the farmers position in our country. In this run, two of the three farm reforms Bills were passed by Rajya Sabha that have been a ground to widespread protests in the recent weeks, particularly in Haryana and Punjab. Doubling farmer's income will require labelling innumerable issues such as access to credit, insurance coverage, and investments in agriculture. India has relatively lower farm mechanization that too needs to be undertaken. But here, lets go through some content regarding the recently passed ordinances by our systems and different quandary thoughts our farmer has about these

Let's get into the depth of each of the ordinance passed by our government.

What is an ordinance?

It is a rule or law enacted by any local government.

1. **Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020**

   According to the existing rules, sale of farmer produce was within the boundaries of government mandis, which was associated with a hiked rate of agricultural produce due to bid competition among arhatiyas (middle-man). Under the Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance, traders have to mandatorily pay farmers on the same day or within maximum three working days. Also, it allows inter-state and intra-state trade of farmers' produce outside mandis. The Ordinance also allows electronic trading of "scheduled farmers' produce" in a "trade area". "Trade area" as defined under Section 2(m), as "any area or location, place of production, collection and aggregation including — farm gate; factory premises; warehouses; silos; cold storages; or any other structure or place, from where trade of farmers' produce may be undertaken." APMC mandis and private market yards have been excluded from the definition of trade area. Basically, the ordinance aims to end the monopoly of the Agricultural Produce Market Committees (APMCs) and allow anyone to buy and sell agricultural produce. A person will be penalized up to Rs. 10 lakhs for non-compliance of provisions under the Ordinance.

2. **Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance, 2020**

   The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance essentially talks about contract farming that allows farmers to sell their produce outside of the APMC via a "proper channel for farmers to enter into direct contracts with those who wish to buy farm produce". And allows farmers to sell their agricultural produce to private players. This Ordinance also attracts a penalty if a business fails to pay farmers on time.

3. **Essential commodities Ordinance (amendment), 2020**

   Finance minister Nirmala Sitharaman in May introduced an amendment to the Essential Commodities Act, 1955 as part of a COVID-19 relief measure. The Union Cabinet passed it in June and is now an ordinance. Under the amended Essential Commodities Act, 1955, essential food commodities such as cereals, pulses, edible oil and sugar will be deregulated. Simply put, there will be no storage limit or movement restriction for the aforementioned commodities. Only under emergency situations, such as a natural calamity when production collapses, would limits on stocks be imposed.

What do our farmers points against the respective Ordinance?

1. First ordinance aims to end the monopoly of the Agricultural Produce Market Committees (APMCs) and allow anyone to buy and sell agricultural produce, but the MSP values need to be fixed by government to limit the lowest selling price, before implementing this ordinance. This will save the farmers from trader's whimsicality of buying the produce at lower values than the MSP. For an instance, in Bihar the price of

rice is around Rs.1200 as the similar practice of selling the produce outside the market is in existence since many years. While, the MSP for rice is around 1900 in Haryana. This difference in the prices are only due to the free trading in Bihar.

2. In second ordinance, is related contract farming which is not feasible at all in a country like India, where most of the farmers are marginal and illiterate. The farmers, in most of the cases is not able to get the contracts conditions properly, which can be taken in an advantageous way by the contractor hence affecting the farmer.
3. Earlier there were pre fixed limits on storage of different food grains and pulses. The third ordinance will remove the restrictions on storage amount allowing traders to store as much as they want. With this there are enhanced chances of black marketing, in which the traders could create an artificial demand/or crisis in market, which will make the traders prosper and worse the farmer's conditions.

Which view is correct?

Frankly saying there is no perfect answer to this heading or question apart from saying that both have some valid points. As the newly formed laws are neither shutting down APMC mandis, nor are they imposing that MSPs will not be active. Moreover, truth is this— across different sectors of the economy, liberalization has grown friendlier the size of the pie and improved wellbeing across the board.

But why should our farmer cannot have more options?

If the private deal is not markedly finer, a farmer can keep going on as before. If corporate farming does manage to weaken the APMC mandis system, it would only be because multitude of farmers prefer and chose corporate farming or selling there produce outside existing mandis.

Could it be the case where the arhatiyas are the ones who are threatened by these reforms?

Furthermore, there is an unentertained fascination with MSPs in our country. As observed in the Agriculture Census of 2015-16, showed that more than 85% of all land holdings belong to small and marginal farmers (i.e. less than 2 hectares).

These farmers with such small land holdings are totally dependent on them are net buyers of food. This is why, even a small fluctuation in MSPs they feel troublesome and hurt. This is not at all withstanding the observations that depict more and more selling of farm produce to private players instead of the government via MSPs.

On the other side, one can easily understand why our farmers are so skeptical about markets. A great illustration is the situation when the government impelled a restriction on the onion exports. The government weighted the profits of the consumers over those of the producers (the farmers). This is not the only example. There are numerous past situations where government's firmness to save consumers from inflated prices have come up with farmers being robbed.

Where is all this pointing and moving towards?

At the end, the real conclusion of the ills and wills of the three ordinances can only be determined by the implementation.

It would not be good if farmers feel swindles and exploited when they involved in the reforms passed by the governance, they will blame the political masters. However, if they tasted favorable outcomes via better returns on a sustained state with elevated profits that make them to move towards better living standards, then numerous long-laid doubts and misfaiths about governance, markets and reforms will surely vanish away.

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Crop Residues Management for pollution free agriculture

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India is an agrarian economy. A vast majority of land is used for farming and a wide range of crops are cultivated in its different agro-ecological regions. It is but natural that a huge volume of crop residues are produced both on-farm and off-farm. It is estimated that approximately 500-550 Mt of crop residues are produced per year in the country. These crop residues are used for animal feeding, soil mulching, bio- manure making, thatching for rural homes and fuel for domestic and industrial use. Thus crop residues are of tremendous value to the farmers. However, a large portion of the residues is burnt on-farm primarily to clear the field for sowing of the succeeding crop. The problem of on-farm burning of crop residues is intensifying in recent years due to shortage of human labour, high cost of removing the crop residues by conventional methods and use of combines for harvesting of crops. It is a paradox that burning of crop residues and scarcity of fodder coexists in this country, leading to significant increase in prices of fodder in recent years. Industrial demand for crop residues is also increasing. To manage the residues in a productive and profitable manner, conservation agriculture (CA) offers a good promise. With the adoption of conservation agriculture-based technologies these residues can be used for improving soil health, increasing crop productivity, reducing pollution and enhancing sustainability and resilience of agriculture. The resource conserving technologies (RCTs) involving no or minimum tillage, direct seeding, bed planting and crop diversification with innovations in residues management are the possible alternatives to the conventional energy and input-intensive agriculture.

Adverse consequences of on-farm burning of crop residues Burning of crop residues leads to release of soot particles and smoke causing human and animal health problems. It also leads to emission of greenhouse gases namely carbon dioxide, methane and nitrous oxide, causing global warming and loss of plant nutrients like N, P, K and S. The burning of crop residues is wastage of valuable resources which could be a source of carbon, bio-active compounds, feed and energy for rural households and small industries. Heat generated from the burning of crop residues elevates soil temperature causing death of active beneficial microbial population, though the effect is temporary, as the microbes regenerate after a few days. Repeated burnings in a field, however, diminishes the microbial population permanently. The burning of crop residues immediately increases the exchangeable NH_4^+-N and bicarbonate-extractable P content, but there is no build up of nutrients in the profile. Long-term burning reduces total N and C, and potentially mineralizable N in the upper soil layer.

Reasons behind on-farm burning of crop residues Farmers and policy makers are well-aware of the adverse consequences of on-farm burning of crop residues. However, because of increased mechanization, particularly the use of combine harvesters, declining numbers of livestocks, long period required for composting and unavailability of alternative economically viable solutions, farmers are compelled to burn the residues.

Competing uses of crop residues

The crop residues can be gainfully utilized for livestock feed, composting, power generation, biofuel production and mushroom cultivation besides several other uses like thatching,mat-making and toy making.

Livestock feed

In India, the crop residues are traditionally utilized as animal feed as such or by supplementing with some additives. However, crop residues, being unpalatable and low in digestibility, cannot form a sole ration for livestock. Crop residues are low-density fibrous materials, low in nitrogen, soluble carbohydrates, minerals and vitamins with varying amounts of lignin which acts as a physical barrier and impedes the process of microbial breakdown. To meet the nutritional requirements of animals, the residues need processing and enriching with urea and molasses, and supplementing with green fodders (leguminous/non-leguminous) and legume (sunhemp, horse gram, cowpea, gram) straws

Compost making

The crop residues have been traditionally used for preparing compost. For this, crop residues are used as animal bedding and are then heaped in dung pits. In the animal shed each kilogram of straw absorbs about 2-3 kg of urine, which enriches it with N. The residues of rice crop from one hectare land, on composting, give about 3 tons of manure as rich in nutrients as farmyard manure (FYM). The decomposition process, which is hastened by a consortium of microorganisms, takes 75-90 days.

Energy source

Biomass can be efficiently utilized as a source of energy and is of interest worldwide because of its environmental advantages. In recent years, there has been an increase in the usage of crop residues for energy generation and as substitute for fossil fuels. In comparison with other renewable energy sources such as solar and wind, biomass source is storable, inexpensive, energy-efficient and environment-friendly. However, straw is characterized by low bulk-density and low energy yield per unit weight basis. The logistics for transporting large volumes of straw required for efficient energy generation represents a major cost factor irrespective of the bio-energy technology. Availability of residues, transportation cost and infrastructural settings (harvest machinery, modes of collection, etc.) are some of the limiting factors of using residues for energy generation.

Bio-fuel and bio-oil production

Conversion of ligno-cellulosic biomass into alcohol is of immense importance as ethanol can either be blended with gasoline as a fuel extender and octane-enhancing agent or used as a neat fuel in internal combustion engines. Theoretical estimates of ethanol production from different feedstock The technology of ethanol production from crop residues is, however, evolving in India. There are a few limiting steps in the process of conversion of crop residues into alcohol, which need to be improved. High energy requiring operating conditions, costly hydrolytic cellulase enzyme, and unavailability of natural robust commercial organism to ferment pentose and hexose sugars simultaneously either as single species or in combination of other species are some of the constraints, which require additional research efforts.

Biomethanation

The process of bio-methanation utilizes crop residues in a non-destructive way to extract high quality fuel gas and produce manure to be recycled in soil. Biomass such as rice straw can be converted into biogas, a mixture of carbon dioxide and methane, which can be used as fuel. Biogas of 300 $m^3$with 55-60% of methane can be obtained per ton of dry rice straw. The process also yields good quality spent slurry, which can be used as manure.

Gasification

Gasification is a thermo-chemical process in which gas is formed due to partial combustion of crop residues. The main problem in biomass gasification for power generation is the purification of gas for removal of impurities. The crop residues can be used in the gasifies for 'producer gas' generation The gasification technology can be successfully employed for utilization of crop residues in the form of pellets and briquettes. The generated 'producer gas' is cleaned using bio-filters and used in specially designed gas engines for electricity generation. The Central Institute of Agricultural Engineering (CIAE), Bhopal, has developed a power plant running on 'producer gas' generated from biomass.

Biochar production

Biochar is a high carbon material produced through slow pyrolysis (heating in the absence of oxygen) of biomass It is a fine-grained charcoal and can potentially play a major role in the long-term storage of carbon in soil, i.e., C sequestration and GHG mitigation. However, with the current level of technology, it is not economically viable and cannot be popularized among the farmers. However, once all the valuable products and co-products such as heat energy, gas like H2 and bio-oil are captured and used in the biochar generation process, it would become economically-viable. There is a need to develop low cost pyrolysis kiln for the generation of biochar to utilize surplus crop residues, which are otherwise burnt on-farm.

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Agricultural Mechanization for *In-situ* Management of Crop Residue in Punjab

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Introduction

Punjab is the food stock of India. The main cropping system of Punjab is wheat and rice and about 28.9 lakh hectares of land is cultivated in paddy. About 90 per cent of wheat and paddy are harvested every year with combine. After harvesting wheat with combine, 80 per cent straw is prepared with straw combine from left crop residues.

Crop residue is defined as the non-photosynthetic vegetation and comprised of stalks, cobs and other plant parts left behind after harvesting the crops on the field. Burning crop residue causes phenomenal pollution problems in the atmosphere and huge nutritional loss and physical health deterioration to the soil. The burning of one tonne of paddy straw releases 3 kg particulate matter, 60 kg CO, 1460 kg CO_2, 199 kg ash and 2 kg SO_2. These gases affect human health due to general degradation in air quality resulting in aggravation of eye and skin diseases. Fine particles can also aggravate chronic heart and lung diseases. One ton of paddy straw contains approximately 5.5 kg N, 2.3 kg P_2O_5, 25 kg K_2O, 1.2 kg S, 50-70 per cent of micro-nutrients absorbed by rice and 400 kg of carbon, which are lost due to burning of paddy straw. Apart from loss of these nutrients, some of the soil properties like soil temperature, pH, moisture, available phosphorus and soil organic matter are greatly affected due to burning. Nonetheless, time available between the rice harvesting and wheat sowing is very narrow and in the range of 20-30 days. It is envisaged that appropriate strategies for *in situ* crop residue management are planned for effective implementation to enable zero burning.

Various equipments/machines such as Super Straw Management System (SMS) attached with existing combine harvester, Happy Seeder, Straw Chopper/Mulcher, Rotary

Slasher, Reversible MB Plough, Rotavator etc. have been developed and successfully demonstrated in the farmers, fields.

Availability of crop residues

In India, over 500 million tonnes of agricultural residues are produced every year. Cereal crops (rice, wheat, maize, millets) contribute 70 per cent of the total crop residues (352 million tonnes) comprising 34 per cent by rice and 22 per cent by wheat crops. Every year, Punjab produces 220 lakh tonnes of rice residues due to paddy cultivation. For timely sowing of wheat, 80-85 per cent of farmers consider setting up of burning paddy residues as a simple method. The amount of residue produced by cereals is usually high because of a high straw to grain ratio, low decomposition rate and high carbon to nitrogen ratio (C:N).

Types of crop residues

The combine harvester cut the cereal crops (rice, wheat and maize) at certain height above the ground, thereby creating two distinct straw components after harvesting:

(i) The standing stubble or anchored crop residues
(ii) Loose crop residues-big uneven heaped lines of straw over the harvested field.

It is particularly the latter that cause problem for establishing the subsequent crop.

Crop residues source of plant nutrients

Crop residues are good sources of plant nutrients, are the primary source of organic matter (as carbon constitutes about 40 per cent of the total dry biomass) added to the soil and are important components for the stability of agricultural ecosystems. About 40 per cent of the N, 30-35 per cent of the P, 80-85 per cent of the K and 40-50 per cent of the S absorbed by rice remain in the vegetative parts at maturity. Similarly, about 25-30 per cent of N and P, 35-40 per cent of S and 70-75 per cent of K uptake are retained in wheat residue.

Typical amount of nutrients in rice straw at harvest is 5-8 kg N, 0.7-1.2 kg P, 12-17 kg K, 0.5-1.0 kg S, 3-4 kg Ca, 1.0-3.0 kg Mg, and 40-70 kg Si per ton of straw on a dry weight basis. One ton of wheat residue contains 4-5 kg N, 0.7-0.9 kg P and 9.0-11 kg K. About 50-80 per cent of micronutrient cations (Zn, Fe, Cu and Mn) taken up by rice and wheat crops can be recycled through incorporated residue.

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Why farmers burn crop residues?

RICE: In rice crop, mainly combine harvester is used, which leaves huge quantity of residue inside the field. But there is little turn-around time between rice harvest, residue incorporation and sowing of succeeding crops (mainly wheat), the slow rate of decomposition of rice straw due to high silica content and low temperature. Therefore, after rice harvesting, less time is available for proper decomposition of rice residues and the establishment of next wheat crop. This causes immobilization of N in succeeding crop. Farmers do not generally consider rice straw as a suitable animal feed-due to high silica content (12-16 per cent) and fear of reduced milk yield.

Scarcity of labour, farmers hesitate to invest in cleaning the field by using a chopper. This practice also requires another operation and increases cost. Farmers in North West (NW) India have discovered burning as the cheapest and easiest way of removing large loads of residues produced by rice to establish the wheat crop rapidly after rice. Presently, more than 80 per cent of total rice straw produced is being burnt by the famers in 3-4 weeks during October-November.

WHEAT: To address the potential loss of wheat straw when combine harvester is used, a straw reaper was developed by local manufacturers in Punjab in the mid-1980s. It is tractor-pulled and chops the loose wheat straw and standing stubbles into its preferred feeding form (‘bhusa’) and collects this on the go in an enclosed trailer attached behind. Even this practice, leaving behind about 20 to 25 per cent (1.5-2.0 t/ha) wheat straw in the field. The wheat straw left on the field is also burned by farmers before preparing for rice transplanting. Alternate, crop residues should be incorporated into the soil, which helps to improve fertility status of soil.

Manual wheat harvesting is labour intensive but allows for maximum straw recovery by allowing the crop to be cut at near ground level and subsequent off-site mechanical stationary threshing which separates grain from the finely chopped wheat straw.

Management of crop residues

- Surface retention
- Residue incorporation
- Crop residues used as surface mulch

- For production of good quality compost
- For cultivation of mushroom
- Baling and removing the straw

Surface retention of crop residues

Practice that leaves straw residues from a previous crop on the soil surface without any form of incorporation. It helps to protect the fertile surface soil against wind and water erosion and also reduced evaporation from soil surface. This method is prevalent in no-till or conservation tillage practice where at least 30 per cent of soil surface is covered with crop residues.

Farmers sow wheat crop in standing residues of rice with Happy Seeder, this practice reduces the land preparation costs. Higher weed infestation is observed in field with residues retention under zero tillage, which requires greater use of herbicides, bringing possible problems of herbicide-resistance. Soil compaction under zero-tillage (ZT) responsible for restricted oxygen supply to root zone, which adversely affected vigorous plant growth. Use of Happy Seeder reduces land preparation costs and retention of rice residues helps to increase the organic matter status of soil.

Residue incorporation in soil

Crop residue is incorporated completely or partially into soil mostly by ploughing. Above-ground portion is chopped into small size and incorporated. Incorporation of crop residue increases soil organic matter and nutrient recycling. Incorporation of crop residues on surface soil helps for carbon sequestration because residue incorporation helps in addition of biomass and increase in soil organic carbon content. No emission of GHS as compared to burning of residues. Incorporation of residues leads to temporary immobilization of nutrients (Nitrogen) and the high C:N ratio which needs to be corrected by applying extra fertilizer N at the time of residue incorporation. A crop grown immediately after the incorporation of residues suffers from N deficiency caused by microbial immobilization of soil and fertilizer N in the short term. Rice straw can be managed successfully *in-situ* by allowing sufficient time (10-20 days) between its incorporation and sowing of the wheat crop to avoid N deficiency due to N immobilisation. The practice of *in-situ* rice straw incorporation as an alternate to burning has been adopted by only a few farmers because of high incorporation costs and energy and time intensive. Application of rice residue to wheat typically has a small effect on wheat yields during the short term of 1-3 years but the effect appears in the fourth year with the incorporation of straw.

Crop residues as surface mulch in other crops

The beneficial effects of this practice to improve crop yields at comparable irrigation regimes and saving of irrigation water and fertilizer nitrogen at comparable yields have been reported in several wide row crops- maize, sugarcane, sunflower, soybean, cotton, turmeric, potato and chillies by reducing the evaporation (E) component of the ET and acting as barrier to vapour flow and moderating soil temperature. The response is more under high temperature, low rainfall areas and on coarse texture soils. Higher soil water in the profile, especially the root zone, in the mulched plots caused better stand establishment and early seedling vigour. More favourable soil temperature and higher water content under mulched than un-mulched soil increases mineralization of soil N. Due to the scarcity of labour and high cost involved in collection and applying straw mulch, this technology has not become popular with the farmers.

Suppression of weeds with crop residue mulch because of:

a) Physical presence on the soil surface as mulch.

b) Restricting solar radiation reaching below the mulch layer.

c) Direct suppression caused by allelopathy.

d) It reduces herbicide requirements and weed competition for nutrients and water.

Impact of crop residue management on pest and disease pressure: Retaining residue as mulch in no-till system scan further increase soil-borne diseases (Seed rot, seedling blight etc.) because of the lack of soil disturbance and retention of crop stubble on the soil surface. The crop residue can serve as an inoculums source and maintain favourable moisture and temperature conditions in the top 10-15 cm of soil where the pathogens are most active. In addition to residue-borne diseases, mulch can also favour the survival of some soil-borne pathogens because the pathogens are protected from microbial degradation by residence within the crop debris. On the other hand, mulch may suppress other soil-borne pathogens, because it increases the population of soil micro and meso-fauna, which offer potential for biological disease control as many of these species feed on pathogenic fungi. Periodic residue incorporation in a no-till system can inhibit pathogen growth by forcing it into a place with insufficient air and light. Crop residue as mulch has the potential to control weed growth, thereby suppressing the possible negative effect of increased weed intensity, because weeds also acts as alternate hosts for the survival of pathogen.

Preparing good quality compost

Rice straw can be converted into high-value manure of better quality than FYM and its use, along with chemical fertilizers, can help sustain or even increase the agronomic yield. During composting rice straw can be fortified with P using indigenous cheap source of low grade rock phosphates to make it value added compost with 1.5% N, 2.3% P_2O_5 and 2.5% K_2O. The rice residue can be composted by using it as animal bedding and then heaping it in dung heaps. Each kg of straw can absorb about 2-3 kg of urine from animal shed. The residues of rice from one hectare give about 3.2 tonnes of manure as rich in nutrients as FYM. But farmers do not appreciate the collection of the residues manually for this purpose.

Mushroom cultivation

Paddy mushroom (*Volvariella volvacea*) is also known as Paddy straw or Chinese mushroom. Four crops of this variety can be obtained from April to August. Process the paddy straw (not more than 1 year old) into bundles each weighing 1 kg approx. Tie the bundles at both ends and cut the unequal protruding parts of the bundles. Wet the bundles for 16-20 hours in clean water. Drain off excess water by placing the bundles on sloping surface. Beds are laid on slightly raised platform. One bed comprises of 22 bundles arranged in 4 layers of 5 bundles each, with two loose bundles at the top. 300 g of spawn should be used per bed (75g/layer). Beds should be watered twice a day except for the first 2-3 days after laying. Adjust the watering according to the site and local environmental conditions. Rice straw is stacked into small bundle and *Pleurotus sp*. is also grown for edible mushroom. Rice straw is cheap and easily available substrate for mushroom cultivation.

Baling and removing the straw from field

After bailing crop residues can also be used for paper and ethanol production. Also used for livestock feed, fuel, building materials, livestock bedding, bedding for vegetables cultivation and mulching for orchards and other crops.

Other ways to management of paddy straw

Using paddy straw treated with urea for dairy cattle

To meet the foodstuff of animals, they need a balanced diet. Green fodder, straw, distribution, scrap of scales etc. are part of the diet of animals. Apart from this, paddy straw can be modified with urea and used for dairy cattle. This also takes care of paddy straw.

Fertilizer management practices for higher productivity

No-till systems with surface residue often exhibit suppressed yields due to lesser N availability because of slower soil N mineralization, greater N immobilization, denitrification and NH_3volatilization, particularly in the early part of the growing season compared with conventional-till systems. Reducing fertilizer N contact with the straw by drilling the fertilizer below the soil surface (about 5 cm beside/below the seed row) to minimize immobilization and volatilization may increase N use efficiency in wheat. Greater immobilization in reduced and no-till systems can enhance the conservation of soil and fertilizer N in the long term, with higher initial N fertilizer requirements decreasing over time because of the build-up of a larger pool of readily mineralizable organic N. This transition period may vary from 4-6 years, during which band placement of nutrients below the residue-covered surfaces becomes very important.

Machines developed for crop residue management

Happy seeder

This machine has been upgraded by attaching a press wheel assembly with normal happy seeder. This machine can be used for sowing of wheat in combine harvested paddy fields after cutting and spreading of standing stubbles with PAU Straw Cutter-cum-Spreader. This happy seeder uniformly place and press the chopped paddy straw in inter row area as a mulch, which facilitate better germination, emergence and vigorous initial crop establishment. With happy seeder machine, wheat can be sown directly in the field (7-9 tonnes per hectare straw) of combine harvester rice. This machine can run with 45 horse power tractor and its capacity is 0.6-0.75 acres per hour. It costs about Rs. 125,000/ -. With this machine, the yield of wheat increases by about two quintals per acre, reduces the cost of

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fertilizers, and simultaneously saves time and expenses and wheat sowing can be done in a timely manner.

Zero-till drill machine

This machine can be run after running a four-wheeler or a baler. There is no need to mix the straw with soil in order to run it. Its working capacity is 0.6-1.0 acres per hour and it can be run with 45 horsepower tractors. It costs about Rs. 70,000/-.

Baler

This machine collects paddy straw and makes rectangular or spherical bales. Rectangular bales balers are being used more in Punjab. This machine makes paddy bales in the field, which can be easily collected from the field. This machine can be operated with a 45 horsepower tractor. These straw bundles can be used for making canes, composting, packing, brick kiln and electricity. At present, there are seven power generating plants in the state using paddy straw. These plants buy bales at a rate of Rs 1000-1500 per tonne. Farmers can sell these bales in power plants. The average weight of the bales is 15-35 kg. This machine makes bales out of 6-7 acres of land in one day. The price of the baler is approximately Rs. 10,00,000/- and the cost of the rack is about Rs. 3,00,000/-.

Chopper-cum-Spreader

After running the chopper, apply irrigation to the field and mix it with soil with rotavator. In this way the exposure to soil cause complete and fully decomposing the residues. 20 kg per acre urea can be broadcast for faster decomposing the residues. Depending on the type of soil, after *rauni* the required optimum moisture is comes within 2-3 weeks in the field. Wheat can be sown with a normal drill when necessary. If the last irrigation is given to the paddy crop a few days before the harvest, after running the chopper, the straw can be mixed in the soil. This machine can be run with 45 horse power tractor and its price is approximately Rs. 80,000/-.

All these measures are helpful to farmers to utilize this precocious product in different ways and to reduce the pollution problem. Hope that this article is helpful to every living body to reduce the burning problem and air pollution. This also fulfills the aim of Green India- Pollution Free India.

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Blooming Era of Indian Agritech Start-ups

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We are living in a digital world where technology is continuously transforming our lives. All sectors are being digitalised; agriculture is also not left behind. Agriculture and allied sector is the single largest source of livelihood in our India with 80% of marginal and small farmers. For some years Indian agriculture sector is performing less than its potential capacity. Still in this pandemic time, Indian agriculture attains a growth rate of 3.4% in quarter 1 of FY 2021 and proven its resilient nature. With the increase in internet penetration and mobile connections in rural India, technology is widely integrated into all parts of agriculture supply chain and value chain. There are many start-ups working towards easing various activities related to agriculture and for improving standard of living of farmers.

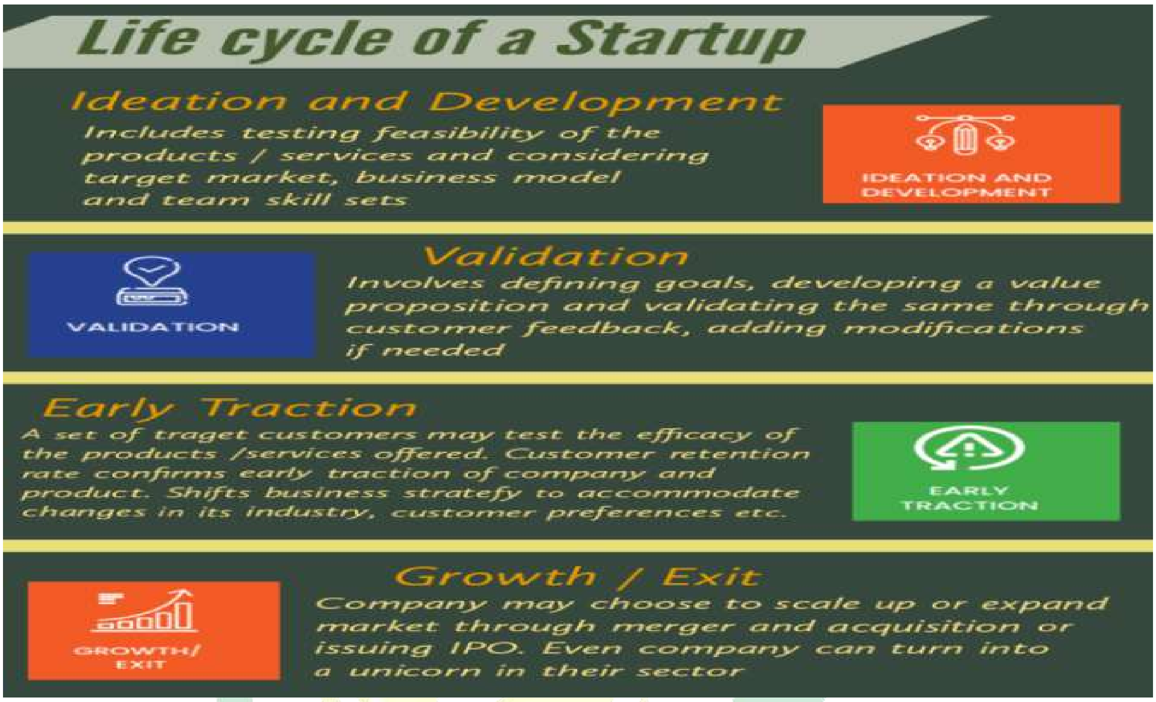
India is the 3rd largest startup ecosystem in the world and Agritech is a prominent segment among startups in India. Agritech is defined as a segment of companies using technology in the field of agriculture leading to increase in productivity, efficiency and output. Agritech can be applied across the agricultural value chain and can be in the form of a product, a service or an application.

According to Department for Promotion of Industry and Internal Trade (DPIIT), any entity fulfilling the following requirements can be considered as a Startup.

- Period of existence and operations should not be exceeding 10 years from the Date of Incorporation
- Incorporated as a Private Limited Company, a Registered Partnership Firm or a Limited Liability Partnership
- Should have an annual turnover not exceeding Rs. 100 crore for any of the financial years since its Incorporation
- Entity should not have been formed by splitting up or reconstructing an already existing business

- Should work towards development or improvement of a product, process or service and/or have scalable business model with high potential for creation of wealth & employment

Lifecycle of start-up



Unicorn

A unicorn is a term used to indicate a privately held startup company with a valuation of over $1 billion. According Govt. of India in 2019 there are 32 unicorns in India across different sectors. But unfortunately there is no unicorn among agritech startups in India yet.

Agritech Start-ups

According to Nasscom 2019 Report, in India there are around 450 agritech startup working in various sub segments and showing 25% year on year growth. Every 9th agritech startup in the world is from India. This increase showing farmers in India are accepting agri tech solutions and there is an increasing digital penetration with 200+ million active users helping farmers access to technology. There is a 1.7 times increase in average farmer income in last decade enabling farmers to trying new tech solutions. They are working with different focus area like improving market linkage and supply chain efficiency, financing various agricultural activities, improving traceability and real time information dissemination to farmers, giving better access to farmers, farming as a service providing a cyclic business model for farmers etc. Now a day apart from B2C segments, B2B is also emerging as a key revenue generating segment.

Focus areas

Different startups are focusing on different areas in the agri value chain. Majorly they are prevalent in the sectors like using big data, IoT etc to give farm management solution through crop monitoring, Market linkage model and Supply chain solutions, Farming as a Service providing affordable technology solutions for efficient farming etc.

In farm input sector, companies are working on providing a digital market place and physical linkage to farm inputs. There are startups who are recommending proper amount of farm inputs to be used according to soil health and plant requirement. Another segment is Farming as a Service category, which includes renting of farm equipments, precision agriculture and farm management using geospatial/weather data, IOT, sensors, robotics etc. to improve productivity, also farm mechanization and automation using machinery, tools and robots in seeding, material handling, harvesting, etc. and building farm infrastructures such as greenhouse systems, indoor/outdoor farming, drip irrigation, environmental control such as heating and ventilation etc. In the post production handling and processing stage, quality management and traceability in storage and transportation is very important functions. There are many emerging agri food tech startups also. The current most focused segment in is supply chain technology and output market linkage.

More than 50% of agritech startups offer supply chain solutions like market linkage, better access to inputs etc and more than 50% of funding goes to supply chain start-ups like Ninjacart etc. This business segment helps in reducing post-harvest losses with stand at 4% to 16% of total output. Raising fund is always a challenging task for Indian farmers. Generally farmers do not have good credit history which makes it difficult for them to raise funds through traditional channels. There are some startups who are offering innovative financial products and services for farmers for buying agricultural equipment, farm management etc.

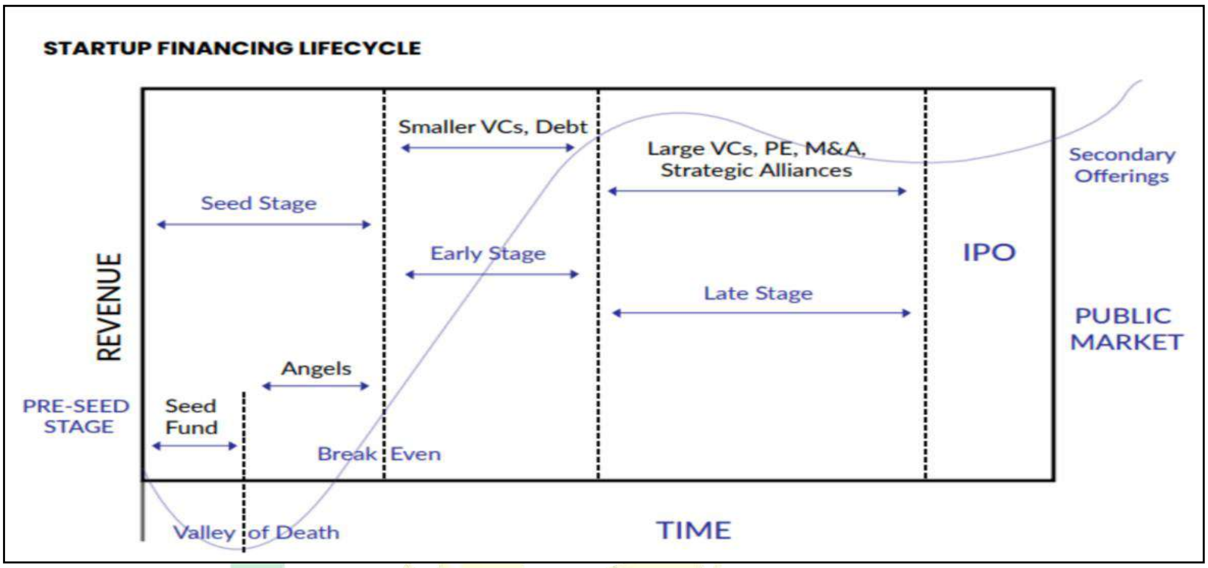
Major Players in each sub segments

Agritech start-up ecosystem

This includes Startups, Mentors, Investors, Incubators, Accelerators and Government body. Government is making various policies and initiatives through different schemes like Start Up India, Atal Innovation Mission (AIM), Aspire (MSME) Venture Capital Finance Assistance (VCA) Scheme promoted by Small Farmers' Agri-Business Consortium etc. for supporting and promoting agritech startups in our country. Apart from the available schemes and policies, an institutional mechanism has been created for smoother take off and successful implementation. For the proper mentorship and managerial support there are accelerators and incubators working like AGRI UDAAN – Food and Agribusiness Accelerator 2.0, Agri-Tech Startup Accelerator CIE, Hyderabad, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) Food Processing Business Incubator/ Agribusiness Incubator (ABIO), Centre For Innovation, Incubation & Entrepreneurship (CIIE) etc. Accelerators, incubators and mentors identified for the agritech start-up ecosystem, along with the pronounced policy and schemes, need to work in tandem with the start-ups to provide the best technical support and reduce their gestation period.

Funding

Funding is very essential for the growth and well-functioning of a startup. According to Nasscom 2019 Indian agritech startup received USD approximately 248 million funding received till June 2019; a growth of 300% as compared to the previous year. Agritech in India is still in infancy stages with just 1% penetration of the addressable market potential of US$24b. Increased investment activity in the last few years has helped accelerate growth in the sector. Investment activity in India is dominated by supply chain tech and output market linkage segment. Key segments that have attracted investor funding include: Supply chain tech and output market linkage, financial services, Market linkage – farm inputs, and Precision agriculture and farm management and the major investors are Aavishkaar, Accel, Ankur Capital, Beenext and Omnivore was the Nexus, Sequoia, Tiger Global etc.



Source: GoI

Top funded Agritech start-ups as of April 2020 (in US $ million)

Start up	Funding	Segment	Investors
Ninjacart	162.1	Supply chain tech and output market linkage	Tiger Global Management, ABG Capital, Steadview Capital
Sammunati	74.8	Financial services	Elevar Equity, responsAbility, Accel Partners, Nuveen
Waycool	64.9	Supply chain tech and output market linkage	Lightbox, LGT Lightstone Aspada, FMO bank
Agrostar	47.1	Market linkage –farm inputs	Bertelsmann India Investments, Accel, Chiratae Ventures
Jumbotail	25.3	Supply chain tech and output market linkage	Heron Rock, William R Jarvis, Cristina Berta Jones

Source: EY Report August 2020

Way Ahead

According to EY Report 2020, Indian agritech market potential is estimated at approximately US $ 24 billion with total current market penetration almost 1% with market linkages (output) and financial services contributing approximately 65% of the market potential. So there is huge untapped potential in the coming years. Financial services, precision agriculture and farm management, and quality management and traceability could drive the next leg of growth in India's agritech. But there are many challenges to address.

Challenges include cost of this technology enabled product and services are sometimes high for large number of users (small and marginal farmers). Some startup is having longer gestation period that affect the return and interest of investors; players should focus on the capacity building across the segments to realize the full potential. Indian government announced several reforms in past few months which are expected to boost private investment in strengthening infrastructure, logistics, processing of agricultural commodities like The Farming Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020, Essential Commodities Amendment Act, The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance, 2020. Proper implementation of these reforms along with public private partnership in this segment can bring out more innovative one stop solution points for farmers. Increasing rate of funding year after year indicates an upcoming unicorn in agritech sector soon in the coming years Apart from supporting farmers to get high productivity with less cost and higher price realisation for their produce, this segment also creating a large number of job opportunities and helping to achieve the goal of Doubling Farmers Income also.

Hope in the upcoming years, agritech startups transforms our agricultural practices and provides cost effective technology enabled solutions to solve problems faced by Indian farmers and further empower them.

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Soil Micronutrients: An Introduction

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ARTICLE ID: 031

Micronutrients are the essential nutrients that are required in very less quantities for the growth of plant and microorganisms. Micronutrients are also called as 'trace elements',' oligo elements' or 'spur elements'. There are 17 essential nutrients for plant growth out of these nutrients 8 are considered as micronutrients. These are – iron (Fe), manganese (Mn), copper (Cu), zinc (Zn), boron (B), molybdenum (Mo), nickel (Ni) and chlorine (Cl). Amongst these eight micronutrients, the content of iron in soil as well as in plants is the highest and sometimes is higher than even P and S contents. Another element, namely cobalt (Co) is also regarded to be essential for the growth of certain higher plants, animals and microorganism and is likely to be added to the list of these eight elements, as it is also required in small quantity. Of the eight nutrients identified so far, Fe, Mn, Zn, Cu and Ni behave like cations and B, Mo and Cl like anions in soil. Thus, the chemistry of micronutrient cations is different from that of micronutrients anions.

(A) Iron

Iron is taken up as ferrous (Fe^{2+}) by plants. Its concentration in the range of 100-500 mg/kg in mature leaf tissues is regarded sufficient for optimum crop production. Iron is a transition metal, exhibits two oxidation states- Fe (II) and Fe (III) – in plants and forms complexes with organic ligands.

Functions: The functions of iron are:

a) Iron is a constituent of two groups of proteins, viz. (a) Heme proteins containing Fe porphyrin complex as a prosthetic group, and (b) Fe-S proteins in which Fe is coordinated to the third group of cysteine.

b) It plays an essential role in the nucleic acid metabolism.

c) It activates a number of enzymes, included aminolevoliaic acid synthetase.

Deficiency symptoms: Plants having less than 50 ppm of Fe are usually classified as iron deficient. Deficiency of iron results in interveinal chlorosis appearing first on the younger leaves with leaf margins and veins remaining green. Under condition of severe Fe deficiency, growth cessation occurs with the whole plant turning necrotic.

(B) Manganese

Manganese is absorbed by the plants as manganous ions (Mn^{2+}). Healthy Mn-sufficient mature plants contain 20 to 300 ppm of Mn. Manganese, a transition metal, is present in plants in Mn (II) form but is easily oxidizable to Mn (III) and Mn (IV) forms. Because ot its variable redox status, Mn plays an important role in photosynthesis.

Functions: The functions of manganese are:

a) Manganese is an integral component of the water-splitting enzyme associated with photosystem II.
b) It has a role in tricarboxylic acid in oxidative and non-oxidative decarboxylation reaction.
c) It is a constituent of superoxide dismutase.

Deficiency symptoms: Manganese deficient plants contain less than 25 ppm Mn. Deficiency symptoms of Mn are more severe on middle leaves than on younger ones. Interveinal chlorosis is characterized by the appearance of chlorotic and necrotic spot in the interveinal areas. Chlorotic leaf areas soon become necrotic and turn red, reddish-brown or brown.

(C) Zinc

Plants absorb Zn as zinc ions (Zn^{2+}). Zinc sufficient plants contain 27 to 150 ppm Zn in mature tissues. Since it does not have variable valency, it has no role in influencing redox processes directly.

Functions: The functions of zinc are:

a) Zinc is a constituent of three enzymes i.e., Carbonic anhydrase, Alcoholic dehydrogenase and Superoxide dismutase.
b) Zinc is involved in synthesis of IAA, metabolism of GA and synthesis of RNA.
c) Zinc plays an important role in translocation and transport of P in plants.

Deficiency symptoms: Plants containing less than 15 ppm Zn are regarded deficient in Zn. Common deficiency symptoms of Zn are interveinal chlorosis, reduction in the size of young leaves, bronzing, and purple, violet reddish brown coloration of the foliage. Shorter internode and decrease in leaf expansion in case of dicots.

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(D) Copper

Like other micronutrients cations, copper is absorbed by plant roots as cupric ions (Cu^{2+}). The concentration of the Cu in Cu-sufficient plants varies from 5 to 30 ppm and its toxicity occurs when Cu concentration is between 20 to 100 ppm. Copper is a transition element existing in the plants as a component of a large number of protein and enzymes.

Functions: The functions of copper are:

a) Copper is a constituent of a large number of enzymes.
b) Copper is important in imparting disease resistance to the plants.
c) It enhances the fertility of male flowers.

Deficiency symptoms: Plants having less than 5 ppm Cu are regarded as Cu-deficient. Male flower sterility, delayed flowering and senescence are the most important effects of Cu deficiency. Chlorosis of the younger shoot tissues, white tip, reclamation diseases, necrosis and die-back are the characteristic Cu deficiency symptoms.

(E) Molybdenum

Molybdenum is the only heavy transition metal taken up by the plants as molybdate ions (MoO_4^{2-}). A healthy Mo-sufficient plant contains 0.1 to 2 ppm of Mo. In the plant system under oxidative environment, it exists as Mo(VI) and Mo(V) and Mo(IV) forms. Ability of Mo to exist in variable valence states imparts it a biochemical role.

Functions: The functions of molybdenum are:

a) Molybdenum is a component of nitrate reductase, nitrogenase, dehydrogenase and sulphate oxidase.
b) Biological nitrogen fixation is catalysed by Mo-containing enzymes, nitrogenase which directly transfer electron to N.
c) It is involved in protein biosynthesis through its effects on ribonuclease activity.

Deficiency symptoms: The critical concentration of Mo-deficiency in plants is usually less than 0.1 ppm. Molybdenum deficiencies resemble the N-deficiencies. In plants with reticulate venation, the earlier effects of Mo-deficiency appear as chlorotic mottling between the veins on old or middle leaves all over the surface. Molybdenum deficiency in cauliflower is termed as whip-tail.

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(F) Boron

Boron is absorbed by the plants mainly as boric acid (H_3BO_3). Normal boron sufficient plants have B-contents ranging from 10 to 200 ppm. Boron is neither a constituent of enzymes nor it activates any of the enzymes. Most important property of boron is to form stable complexes with organic compounds with cis-diol configuration.

Functions: The functions of boron are:

- **a)** It is responsible for cell wall formation and stabilization and lignification.
- **b)** It imparts drought tolerance to crops.
- **c)** It plays a role in pollen germination and pollen tube formation.
- **d)** It facilitates transport of K in guard cells as well as stomatal opening.

Deficiency symptoms: Plants having B-concentrations of the order 5 to 30 ppm are suspected to be B-deficient. Boron deficiency symptoms become conspicuous on the terminal buds or youngest leaves, which become discoloured and may die under acute conditions of B deficiency. Internodes become shorter and give a bushy or rosette appearance.

(G) Nickel

Nickel is absorbed by plants as nickel ions (Ni^{2+}). Its concentration in Ni-sufficient plants varies from 0.1 to 10 ppm. It exits in Ni(II) state but can also assume Ni(I) and Ni(III) states.

Functions: The functions of nickel are:

- a) Nickel is associated with nitrogen metabolism by way of influencing urease activity.
- b) In free-living *Rhizobia*, adequate Ni-supply ensures optimum hydrogenase activity.
- c) It facilitates transport of nutrients to the seeds or grains.

Deficiency symptoms: Critical level of Ni deficiency is 0.1 ppm, as concentrations below this are accompanied by reduction in dry-matter weight, decrease in amino acid content and accumulation of nitrates. Characteristics deficiency symptoms of Ni have not been defined adequately.

(H) Chlorine

Chlorine is ubiquitous in nature. It is absorbed as chloride ions (Cl^-) by the plants. Normal healthy plants have Cl-content ranging from 100 to 500 ppm. It has been neglected because it is present in abundance and is also supplemented through a large number of fertilizer carriers like MOP. etc. and its deficiencies have not been reported from any-where in India.

Functions: The various functions of chlorine are:

a) It plays a major role in osmoregulation and charge compensation in higher plants.
b) It acts as a cofactor in Mn-containing water splitting enzyme of photosystem II.
c) Chlorine supply improves the nutritional quality of vegetables by preferentially lowering the NO_3-N concentration in tissues.

Deficiency symptoms: Plants having less than 100 ppm Cl are usually designated as deficient. Deficiency symptoms of chlorine are similar to that of Mn-deficiency.

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Contribution of agriculture to country's economy under circumstances of Covid -19

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ARTICLE ID: 032

Agriculture called the backbone of Indian economy because most of the part of India is related from village and villagers directly depend upon the farming. As we know whole world is under crisis due to pandemic corona virus – 19 which is acute infectious disease. Whole world is under lockdown to slow down the spread and due to this various activities mainly agriculture is severely affected, but only due to agriculture we are alive today.

Amidst the threat of Covid-19 the rabi crops are approaching to maturity , Harvesting of wheat is approaching in Northern states , sugarcane Harvesting is at peak and also manual planting in north, Harvesting of lentil, maize , chilies and grams is fast approaching for such agriculture operations there has been some guidelines released by government of India which includes

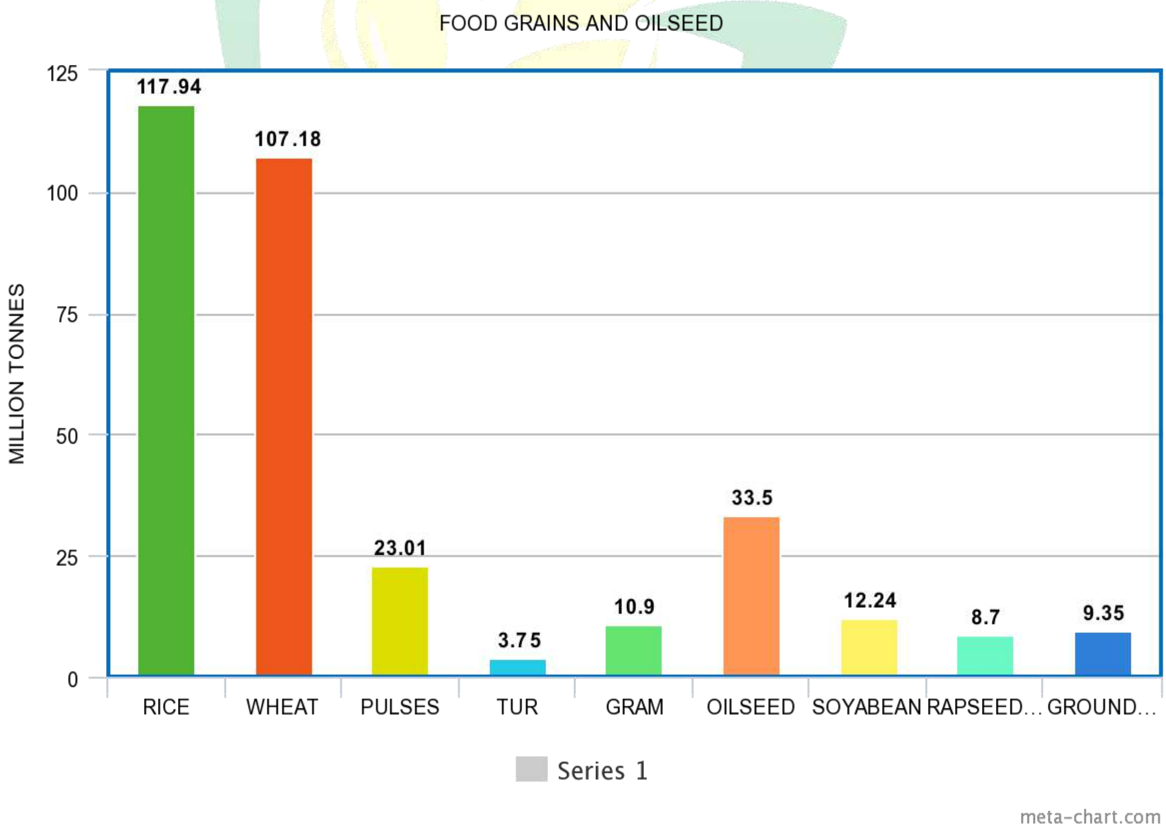
- Social distancing
- Personal hygiene
- Wearing facemasks
- Protective clothing
- Copious washing of machine parts touched with soap is advised

Due to Covid -19 and lockdown – Plantation crop stare at huge loses with few hands to harvest to the standing crop. Plantation crops like Rubber, Coffee and Black pepper, are facing huge losses on standing crop especially impacted the tapping and maintenance of rubber plantations in Kerala and may result losses of RS 3,000 Crore and also a shortage of rubber for medical purpose like- gloves and sanitization masks. The sale of dairy products, fish and poultry has also been hit during the lockdown period .

How the agriculture does plays key role in economy?

FCI (Food Corporation of India) steps up to ensure No shortage of food grains to poor. As centre allows the state to directly purchased the fixed quota of wheat and rice from FCI depots without participation in E-auction under open market sale scheme and this has been done to meet the requirement under NATIONAL FOOD SECURITY ACT (NFSA) and PM – GARIB KALYAN YOJNA (PMGKY) . Under this scheme PMGKY-5 KG food grains (rice or wheat) for three months was announced to 81.35 Crore Families and NFSA targeted populations gets 5 kg food grains for each month at the rate of Rs. 2 or 3 kg. Government approves plans to convert the FCI's surplus rice into Ethanol in which food grains stocks with FCI is 58.49 million tones and rice 30.57 million tonnes. NATIONAL BIOFUEL COORDINATION COMMITTEE (NBCC) approved available stock with FCI and converted to ethanol for utilization in Making alcohol based Sanitizer and in Blending for Ethanol Blended Petrol (EBP PROGRAMME)

One of the members of NITI – AAYOG quoted as saying 'the farm sector will grow up by 3% this year despite the adverse condition and add at least 0.5 % to India's GDP growth in 20-21. The third advanced estimate of production of food grain and oilseed for 2019-20 released by department of Agriculture cooperation and farmer's welfare and they are:



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India as an aid

- India exported around one lakh tones of wheat to Afghanistan and Lebanon under government to government agreement (G2G)
- NAFED exported 50,000 tons of wheat to Afghanistan and 40,000 tonnes to Lebanon through diplomatic route.
- Government has been exporting wheat to African and Asian countries on HUMANITRIAN ground under G2G agreement.
- To support the farmer and agriculture the Government of India has released various platforms, financial aid, schemes by which they should not get suppressed by the covid pandemic and lockdown. Online platform like KISAN RATH APP Launched by Ministry of Agriculture and Farmers welfare (17/04/2020) to facilitate the farmers and traders in identifying the right the Right mode of transportation for moment of produce (fruits ,vegetables ,spices ,oilseed).
- Another online trading platform ENAM (A pan India electronic trading program portal launched on 14th April, 2016)
  - There are 585 mandis in first phase
  - In second phase their wings integrate to 415 mandis with total of 1000 mandis across 18 States and 3 Union territories.

❖ Pradhan mantra kisan samman nidhi (PM –KISAN) is a central sector scheme in which 17,793 crores released for 8.89 crore farmer families during lockdown.

❖ Another additional working capital worth 30 thousand crores to farmers through NABARD (NATIONAL BANK OF AGRICULTURE AND RURAL DEVELOPMENT) And facility to help 3 crore farmers

1. 33 state cooperative banks
2. 351 district cooperative banks
3. 43 regional rural banks

❖ The finance minister also said that 63 lakh loans worth Rs. 86600 crores were approved in agriculture sector between 1 march to 30 march 2020 as LIQUIDTY SUPPORT MEASEURES.

Hence agriculture is the best sector to boost the economy and fulfils the demand of country in every term.

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Cultivation of cassava/Tapioca (*Manihot esculenta Crantz)* in India

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ARTICLE ID: 033

Cassava (*Manihot esculenta Crantz*), a popular industrial root crop, it is one of the main sources of calories for people in many tropical regions of the world. It is mostly cultivated in the tropics for its starchy roots. It is the fourth most important source of calories in human diet in tropical regions of the world. This crop has the potential to produce more food per unit area, capacity to stand with adverse biotic and abiotic stresses and adaptability to the conditions of drought and marginal lands. The crop has been cultivated in India for more than a century. Cassava was introduced into India by the Portuguese when they landed in the Malabar region, presently part of Kerala state during the 17th century, from Brazil. The crop is known by many different popular names **Cassava, Mandioc, Manioc, Manihot, Yuka, Kahoy** etc.in different countries.

Importance

Though cassava was primarily introduced as food crop in India, two centuries ago, recent efforts on post harvest utilisation technologies for converting them into value added products have changed the status of cassava from a food crop to that of a commercial crop. It is estimated that 40% of the total production in Kerala is used for human consumption whereas in Tamil Nadu and Andhra Pradesh only 10-12% is used for the same. Cassava is consumed in the form of baked/cooked tubers, fried chips, across the southern India. Cassava is also used as animal feed. Cassava is used as raw material for a number of processed products such as starch, sago, liquid glucose, chips, flour etc. Modified starch, carboxy methyl starch, cationic starch, oxidized starch and pregelatinized starch are being produced using cassava starch. Dextrins (yellow and white), liquid adhesives, ethanol and sweeteners are other products prepared from cassava starch.

Indian Production of TAPIOCA (2017-18)

Sr. no.	States	Production(000Tonnes)	Shares
1	Tamil Nadu	2,862.14	57.90
2	Kerela	1,725.98	34.92
3	Andhra Pradesh	192.15	3.89
4	Nagaland	79.32	1.60
5	Meghalaya	36.24	0.73
6	Assam	28.87	0.58
7	Karnataka	13.99	0.28
8	Madhya Pradesh	4.29	0.09
9	Arunachal Pradesh	0.08	0.00

Source:National Horticulture Board (NHB)

Area, production and productivity of cassava in India

Though cassava is grown in about 101 countries, it is encouraging that India ranks first in the world for productivity of cassava with 27.92 t/ha as against the world average 10.76 t/ha. However, India ranks fourth in Asia and 14th in the world for area and third in Asia and 7th in the world for the production of cassava roots. However, India accounts for just 1.30% of area. Although cassava is cultivated in India in 13 states, major production is from the southern states of Kerala, Tamil Nadu and Andhra Pradesh.

Cassava production technology-

Soil and Climate Cassava can be grown on many types of soil, but a friable fertile, well-drained sandy loam is considered better than heavier types. A hardpan layer below the surface layer is thought to be desirable because it tends to prevent the development of the tuberous roots at too great depths.

The cassava crop is grown between 30°N and 30°S with more than 750 mm rainfall and an annual mean temperature greater than 18-20°C. A small proportion of cassava is grown near the equator in South America and in Africa at altitudes up to 2000 mm. It requires a warm climate free from frost for at least 8 months.

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Varieties: Varieties like Co 2, Co 3, CO (TP) 4, MVD 1, H 165, H 226, Sree Vishakam (H.1687), Sree Sahaya (H.2304), Sree Prakash (S. 856), Sree Vijaya, Sree Jaya, Sree Pekha, Sree Prabha, Co (Tp) 5, H - 97, H - 165, H - 226 and Sree Harsha are the popular varieties of cassava.

Propagation: Cassava is propagated from stem cuttings as the tubers do not produce buds. Stem cuttings should only be taken from plants which are free from disease, are at least 10 months old and have borne tubers. The cuttings should be taken from hardened stems leaving at least 30 cm (11.8 in) of stem intact in the ground. The stem can be severed using a sharp knife, secateurs or saw and each cutting should have 1-2 nodes and be approximately 20 cm (7.9 in) long

Planting: Stem cuttings are planted in furrows and covered to the depth of 24 inches. Planting the cuttings vertically has been found to be better than slanting or horizontal methods. Dipping the basal end of the cuttings in Azotobacter gives higher yield. The ideal spacing for branched-type cassava is 90 × 90 cm and for the non branched type 75 × 75 cm. In both types, retaining only two shoots is best for increasing yield.

Manuring and Fertilization: Initially, cassava should be fertilized with about equal amounts of nitrogen, phosphorus and potassium. However, if the crop is grown continuously for many years, the N-P-K balance will need to be modified to compensate for the removal of nutrients, especially potassium, in the harvest. That can be done using compound fertilizers that are high in K, N and relatively low in P. It has been recommended to apply 12.5 tons of FYM, 120 kg of N, 60 kg of P and 180 kg of K/per hectare (12). The application of 100:100:100 kg NPK/ha was also found to be significant with respect to tuber number and weight.

Irrigation: In India, cassava is grown as a rainfed crop. First irrigation is given at the time of planting. Life irrigation is given on the 3rd day followed by once in 7–10 days up to 3rd month and once in 20 –30 days up to 8th month.

Diseases and Pests : Cassava is susceptible to bacterial blight, being attacked by Cercospora henningsii, Cercospora viscosae, Erwinia carotovora, and Phoma sp. Cassava mosaic virus disease, namely, Tottikappa and Kalikalan, were reported from India . A number of insect pests causing serious losses of cassava products such as Mites, White fly, **Spiralling whitefly.**

Harvesting and Handling: Irrespective of the variety grown, crop is harvested between 7th and 8th month of crop age because factories do not purchase tubers harvested after March. Due to early harvest of the tubers, starch content in the tubers is obviously at a lower range. Factory owners are of the opinion that tubers harvested after March have more fiber content and less starch. Plant is uprooted manually and tubers are removed and kept in gunny bags to transport to factories.

Cassava is cured at relatively high temperature and humidity. Then curing is done at 25-40°C and 80-85% relative humidity. Under these conditions, suberization occurs in cassava in 14 days and a new cork layer forms around wounds in 35 days. Curing of cassava roots delays the onset of primary deterioration and reduces both secondary deterioration and moisture loss.

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Economic Impact of Flood on Agriculture- A Case Analysis of Spice Crops in Kerala

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Agriculture is the key stone of the Indian economy and is heavily dependent on the rainfall, when prone to floods it has an adverse effect on our country's economy. The flood caused huge loss to Kerala's agriculture and dairy sector could impact the state's already deficient food production as well as the livelihood of lakhs of farmers. The back to back floods in 2018 and 2019 smashed the state's agriculture production in which the plantation and spice crops are the worst hit. The cultivated area of spices crops in Kerala is around 1,62,660 ha, which contributes to production of 140,000 tonnes per annum.

Wayanad and Idukki together account for nearly 60 per cent of the total area under spices in Kerala. The crop loss data collected and compiled by the agricultural department of the state was further firmed up by to taking into account the crop specific indirect damage due to biotic and abiotic factors to arrive at the production impact of the natural calamity.

Table 1 Summary of production loss in spices

Crop	Area affected (ha)	Production loss in 2018-19 (tonnes)	Value (Million INR)
Black pepper	26613	10700	4027
Cardamom	15655	6600	6795
Nutmeg	4400	2749	1018
Clove	160	13	9.3
Ginger	1030	4100	605
Turmeric	395	976	86.8
Total	**48,253**	**25138**	**12541.1**

The data revealed that a total cultivated area of 48,253 ha under major spice crops such as black pepper, cardamom, nutmeg, clove, ginger and turmeric got severely affected. The Production loss of black pepper is estimated to be 10,700 tonnes valued at 4,027 million INR at the prevailing average price for the period 2018-19. Cardamom contributed for highest loss with in terms of value, which is 54.18 per cent of the total losses among the spice crops. An area of 15,655 ha and production loss of 6,600 tonnes occurred to cardamom alone. Another major crop strike was happened to the perennial crops, nutmeg and clove. The loss in quantitative terms of Nutmeg is pegged at 2,749 tonnes, valued at 1,018 million INR and 13 tonnes of clove with a value of 9.3 million INR is also accounted under crop loss. The two biannual rhizomatous spice crops, ginger and turmeric have met with a production loss of 16.31 and 3.88 per cent, which is valued at 605 million INR and 86.5 million INR respectively.

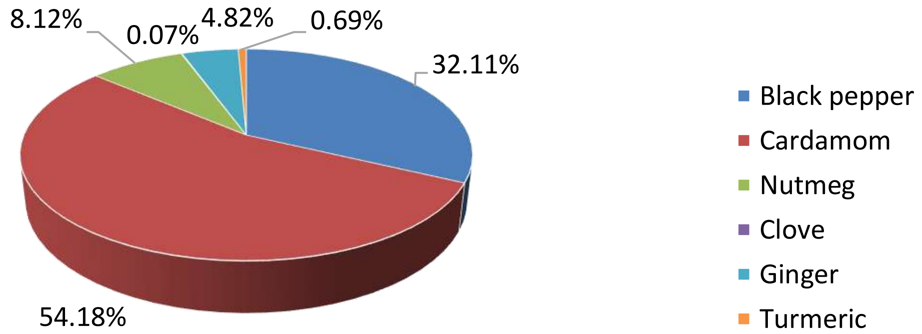

Fig. 1 The estimated crop loss of spice crops due to flood in Kerala (in terms of crop value)

Altogether, around 48,253 ha of cultivated area of spice crops has been affected, which led to a production loss of 25,138 MT of spices having a value of 12,541 million INR. Whereas, if the variable and fixed cost of inputs, the cost of re-establishing the crop, the long gestation period to attain full bearing etc. are taken into account., the loss would intensify as 39,012 million INR.

An analysis of soil and plant samples collected during the survey indicated widespread presence of Phytophthora in black pepper, cardamom and nutmeg samples, Pythium in cardamom and ginger and shot hole borers (*Xylosandrus* sp.) in nutmeg. The range of observed values for soil physico-chemical properties in flood affected areas were within the normal range usually observed in spice growing soils. Necessary measures for management of pests and diseases as well as soil amelioration need to be taken up in all flood affected gardens. The various Institutional stakeholders such as ICAR, State Agriculture Department, Kerala Agricultural University, KVKs, ATMA etc need to be seamlessly linked for effective technology dissemination. The research institutions in the country have an responsibility to undertake studies in the following areas for bringing up farmers from this distress caused by flood by suggesting and implementing policy measures such as

- Interest free credit support for sustenance of livelihood activity
- Flood zoning of the entire agricultural area in the state
- Implementing village level crop-weather forewarning systems
- A package for replanting of the affected areas with HYV & tolerant varieties

The focus should be on protecting the existing plants and launching a large-scale replanting programme with high-yielding varieties.

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FEMINISING AGRICULTURE: A step towards Women Empowerment

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ARTICLE ID: 035

Women are the key to the success of any human. This is because, if we consider any personality, there stands a woman as a pillar of support in their achievement, be it directly or indirectly.

It is rightly said that "if you educate a man, you educate an individual; if you educate a woman, you educate a nation".

Women from the very beginning of the civilisation were considered as dependents and were mistreated. In this patriarchal society, women are not given equal opportunities as men. But they are the real strugglers. They have crossed all the roadblocks and entered in every field. Be it in science, space or agriculture, you can find a women showing the zeal and leaving her footprints behind.

Agriculture, being the backbone of the Indian economy, employs about 70 % of the workforce. India's economy is majorly dominated by the farm sector, depicting a rise in the GDP for the past five consecutive quarters. Agriculture was the only sector that showed positive GDP growth of 3.4 % in Quarter-1, 2020-21 results. It has added Rs. 14,815 crores in the June quarter, showing a silver lining during this economic crunch (NSO).

Agriculture and allied sectors serve as the source of livelihood to the majority of the population. It ensures food security in a nation. Globally, Agriculture is in a transitional phase. It is broadening its scope rapidly. Modernisation in Agriculture with exceptional technology is grabbing the attention of people. Agribusiness activities like protected cultivation, value addition, high-tech agriculture, global marketing etc. is spreading extensively and organic farming is gaining the importance gradually.

India is the world's largest producer of milk and pulses, 2nd largest producer of rice, wheat, sugarcane, fruits and vegetables.

WOMEN IN AGRICULTURE

In ancient times, when men were engaged in hunting and gathering, women started growing crops. Evolution began there up on and agriculture came into existence. Now, the Indian economy is primarily dominated by agriculture and 63% of the workforce in agriculture is women. **15 October is celebrated as Women Farmer's day.**

Women play a crucial role in agriculture. About 80% of economically active women are engaged in agricultural work. According to the Economic Survey (2017-18), due to an increase in migrations among the male from rural to urban, there is a feminisation of agriculture.

Besides production, agriculture involves various activities. Women work in multiple roles from sowing to harvesting, post-harvest management, processing, poultry and dairy management, etc. 43% of the total agricultural labour force constitutes women. About 55-66% of women are employed in farm production, 94% of women are involved in dairy and 51% of women are engaged in Forest-based activities.

OPPORTUNITIES FOR WOMEN IN AGRICULTURE

India is an agrarian economy. Females are revolutionising the field of agriculture. 36 % of farmers are women. According to USDA, 56 % of farms account for females being the sole decision-maker.

Opportunities in agriculture and allied sectors prevail at different stages of the agriculture process like the input stage, farming stage, value chain, processing and marketing stage. For women, there are opportunities in numerous areas. This includes vegetable farming, cultivation of fruits, food grains, pulses and oilseeds etc.

- Most of the farm activities like sowing, transplanting, weeding, harvesting, winnowing and processing are predominately done by women.
- Rural women are mostly involved in dairy farms. They undergo different activities from cleaning the sheds, milking, feeding the cattle to make dung cakes.
- In villages, most of the households have poultry as an additional source of income and women play a major role in maintaining them.
- Women are largely employed in the preparation of various fruits and vegetable preserved items like chips, papad, Squashes, Jam, Jelly, Marmalade, pickles, Ketchup, etc.

- Beekeeping would be a better alternative for rural women as it is a growing venture and even an illiterate can start with no land requirement.
- There is immense scope for women entrepreneurs in developing the greenhouse concept, herbal plantation, dairy & poultry development, animal husbandry, grading and packaging of Agri products, sericulture, horticulture and many more. Besides the above-mentioned enterprises, women have better opportunities in Fish/prawn farming, Mushroom cultivation, gardening & landscaping and floriculture etc.

CHALLENGES FOR WOMEN IN AGRICULTURE

Though women are actively involved in agricultural activities, they are barred from making farm decisions and starting Agri-enterprises. This is due to social clichés prevalent in society. Obstacles faced by women are

- Lack of professional education
- No direct ownership of the property or farmland
- An improper balance between family and career obligations
- Poor financial support
- Lack of market knowledge
- The Complicated procedure of availing loan from banks
- Weak linkages between government and women entrepreneur

STRATEGIES TO ENHANCE WOMEN IN AGRICULTURE

Strategies must be formulated to empower women in the agriculture sector.

- The government should aid in strengthening education to women by providing scholarships, free education etc.
- Self-help groups (SHG) should be developed and women should get access to these groups. This helps in empowering women with similar socio-economic conditions
- The Loan Procedure should be simplified for starting enterprises by women.
- MSME sector should perform exceptionally to promote women empowerment. This will lead to the creation of new jobs.

CONCLUSION

Women are the superpower of any nation and have shown their charisma in all the fields including agriculture. A major category of the workforce in the Agriculture sector is women. From sowing to harvesting, feeding the cattle to taking care of poultry, women impart a major role in agriculture. Huge opportunities wait for women in this sector. There are many areas, viz. protected cultivation, hydroponics, vertical farming, dairy, poultry, beekeeping, mushroom cultivation, etc. where women can develop.

Though women play a key role in agriculture, their work is camouflaged. To owe justice to their hard work, they must be educated and skills should be imparted through training. Women agripreneurship should be encouraged to recognise their potential and uplift their socio-economic conditions. Equal opportunities, as of men should be given to women in land owning, starting a business or availing loans.

The government should further take a step to recognise the potential in the women and implement policies like Agri Udaan, Dairy Entrepreneurship Development Scheme to promote agripreneurship among women. This would help in feminising agriculture and contributing to women empowerment.

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Doubling Farmers Income through Livestock Based Intergrated Farming System

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Introduction:

All over the world, farmers work hard to earn their living. However, not all the farmers make money, especially small family farmers. There is very little leftover after they pay for all their inputs (seeds, livestock breeds, fertilizers, pesticides, energy, feed, labor, etc.). The emergence of integrated farming systems (IFS) has enabled farmers to develop a framework for an alternative development model to improve the feasibility of small sized farming operations. It refers to agricultural systems that integrate livestock and crop production or integrate fish be known as integrated bio systems. In this system, an inter-related set of enterprises is used so that the "waste" from one component becomes an input for another part of the system. This reduces costs and improves production and/or income. Since it utilizes waste as a resource, farmers not only eliminate waste but they also ensure an overall increase in productivity for the whole farming system. Adopting the integrated farming system approach will definitely help in the doubling of farmer's income.

Fish - livestock farming systems:

Fish- livestock farming systems are recognized as highly assured technology where predetermined quantum of livestock waste obtained by rearing the livestock in the pond area is applied in pond to raise the fish crop without any other additional supply of nutrients. The main potential linkages between livestock and fish production concern use of nutrients, particularly reuse of livestock manures for fish production. The term nutrients mainly refer to elements such as nitrogen (N) and phosphorus (P) which functions as fertilizers to stimulate natural food webs rather than conventional livestock nutrition usage such as feed ingredients. Both production and processing of livestock generate by-products that can be used for aquaculture. Direct use of livestock production wastes is the most widespread and conventionally recognized type of integrated farming. Production wastes include manure, urine and spilled feed; and they may be used as fresh inputs or be processed in some way before use.

Based on the type of livestock used for integration there are many combinations in livestock-fish systems. Some of the combination are listed and discussed below.

Cattle-Fish Culture:

Manuring of fish pond by using cow dung is one of the common practices all-over the world. A healthy cow excretes over 4,000-5,000 kg dung, 3,500-4,000 liter urine on an annual basis. Manuring with cow dung, which is rich in nutrients results in increase of natural food organism and bacteria in fishpond. A unit of 5-6 cows can provide adequate manure for 1 ha of pond. In addition to 9,000 kg of milk, about 3,000-4,000 kg fish/ha/year can also be harvested with such integration.

Pig-Fish system:

The waste produced by 30-40 pigs is equivalent to 1 ton of ammonium sulphate. Exotic breeds like White Yorkshire, Landrace and Hampshire are reared in pig-sty near the fish pond. Depending on the size of the fishponds and their manure requirements, such a system can either be built on the bund dividing two fishponds or on the dry-side of the bund. Pigsties, however, may also be constructed in a nearby place where the urine and dung of pigs are first allowed to the oxidation tanks (digestion chambers) of biogas plants for the production of methane for household use. The liquid manure (slurry) is then discharged into the fishponds through small ditches running through pond bunds.

Pig dung contains more than 70 percent digestible feed for fish. The undigested solids present in the pig dung also serve as direct food source to tilapia and common carp. A density of 40 pigs has been found to be enough to fertilize a fish pond of one hectare area. The optimum dose of pig manure per hectare has been estimated as five tones for a culture period of one year. Fish like grass carp, silver carp and common carp (1:2:1) are suitable for integration with pigs.

Pigs attain slaughter maturity size (60-70 kg) within 6 months and give 6-12 piglets in every litter. Their age at first maturity ranges from 6-8 months. Fish attain marketable size in a year. Final harvesting is done after 12 months of rearing. It is seen that a fish production of 3,000 kg/ha could be achieved under a stocking density of 6,000 fish fingerlings/ha in a culture period of six months.

Poultry-Fish Culture:

Poultry raising for meat (broilers) or eggs (layers) can be integrated with fish culture to reduce costs on fertilizers and feeds in fish culture and maximize benefits. Poultry can be raised over or adjacent to the ponds and the poultry excreta recycled to fertilize the fishponds. Poultry housing, when constructed above the water level using bamboo poles would fertilize fishponds directly. In fish poultry integration, birds housed under intensive system are considered best. Birds are kept in confinement with no access to outside. Deep litter is well suited for this type of farming. About 6-8 cm thick layer prepared from chopped straw, dry leaves, saw dust or groundnut shell is sufficient.

Poultry dung in the form of fully built up deep litter contains: 3% nitrogen, 2% phosphate and 2% potash, therefore it acts as a good fertilizer which helps in producing fish feed i.e. phytoplankton and zooplankton in fish pond. So application of extra fertilizer to fish pond for raising fish is not needed. This cuts the cost of fish production by 60%. In one year 25-30 birds can produce 1 ton dip litter and based on that it is found that 500-600 birds are enough to fertilize 1 ha water spread area for good fish production. Daily at the rate of 50 kg/ha water spread area poultry dung is applied to the fish pond.

Duck-Fish Culture:

A fish-pond being a semi-closed biological system with several aquatic animals and plants, provides excellent disease-free environment for ducks. In return ducks consume juvenile frogs, tadpoles and dragonfly, thus making a safe environment for fish. Duck dropping goes directly in pond, which in turn provides essential nutrients to stimulate growth of natural food. This has two advantages, there is no loss of energy and fertilization is homogeneous. This integrated farming has been followed in West Bengal, Assam, Kerala, Tamil Nadu, Andhra Pradesh, Bihar, Orissa, Tripura and Karnataka. Most commonly used breed for this system in India is the 'Indian runners'.

It is highly profitable as it greatly enhances the animal protein production in terms of fish and duck per unit area. Ducks are known as living manuring machines. The duck dropping contain 25 per cent organic and 20 percent inorganic substances with a number of elements such as carbon, phosphorus, potassium, nitrogen, calcium etc. Hence, it forms a very good source of fertilizer in fish ponds for the production of fish food organisms.

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For duck-fish culture, ducks may be periodically allowed to range freely, or may be put in screened resting places above the water. Floating pens or sheds made of bamboo splits may also be suspended in the pond to allow uniform manuring. The ducks may be stocked in these sheds at the rate of 15 to 20/m2. It is better if the ducks are left in ponds only until they reach marketable size. Depending on the growth rate of ducks, they may be replaced once in two to three months. About 15-20 days old ducklings are generally selected. The number of ducks may be between 100 and 3,000/ha depending on the duration of fish culture and the manure requirements.

Livestock-crop production system:

An "integrated crop-livestock system" is a form of mixed production that utilizes crops and livestock in a way that they can complement one another through space and time. The backbone of an integrated system is the herd of ruminants (animals like sheep, goats or cattle), which graze a pasture to build up the soil. Eventually, sufficient soil organic matter builds up to the point where crops can be supported. Animal can also be used for farm operations and transport. While crop residues provide fodder for livestock and grain provides supplementary feed for productive animals.

		
Azolla Unit (Green Fodder)	**Napier Bajra (Green Fodder)**	**Gunea Grass (Green Fodder)**

		
Solar based drip system	**Biogas Plant**	**Vermi compost units**

Animals play key and multiple roles in the functioning of the farm and not only because they provide livestock products (meat, milk, eggs, wool, and hides) or can be converted into prompt cash in times of need. Animals transform plant energy into useful work: animal power is used for ploughing, transport and in activities such as milling, logging, road construction, marketing, and water lifting for irrigation. Animals also provide manure and other types of animal waste.

Animal excreta have two crucial roles in the overall sustainability of the system:

Improving nutrient cycling: Excreta contain several nutrients (including nitrogen, phosphorus and potassium) and organic matter, which are important for maintaining soil structure and fertility. Through its use, production is increased while the risk of soil degradation is reduced.

Providing energy: Excreta are the basis for the production of biogas and energy for household use (e.g. cooking, lighting) or for rural industries (e.g. powering mills and water pumps). Fuel in the form of biogas or dung cakes can replace charcoal and wood.

One key advantage of crop-livestock production systems is that livestock can be fed on crop residues and other products that would otherwise pose a major waste disposal problem. For example, livestock can be fed on straw, damaged fruits, grains and household wastes. Integration of livestock and crop allows nutrients to be recycled more effectively on the farm. Manure itself is a valuable fertilizer containing 8 kg of nitrogen, 4kg of phosphorus and 16 kg of potassium per ton. Adding manure to the soil not only fertilizes it but also improves its structures and water retention capacity.

Advantages of Integrated Farming System:

Productivity: IFS provides an opportunity to increase economic yield per unit area per unit time by virtue of intensification of crop and allied enterprises especially for small and marginal farmers.

Profitability: Cost of feed for livestock is about 65-75% of total cost of production; however use of waste material and their byproduct reduces the cost of production, conversely it is same for the crop production as fertilizer requirement for crop is made available from animal excreta no extra fertilizer is required to purchase from outside farm as a result the benefit cost ratio increases and purchasing power of farmers improves thereby.

Sustainability: In IFS, subsystem of one waste material or byproduct works as an input for the other subsystem and their byproduct or inputs are organic in nature thus providing an opportunity to sustain the potentiality of production base for much longer periods as compare to monoculture farming system.

Balanced Food: All the nutrient requirements of human are not exclusively found in single food,to meet such requirement different food staffs have to be consumed by farmers. Such requirement can be fulfilled by adopting IFS at farmer level, enabling different sources of nutrition.

Environmental Safety: In IFS waste materials are effectively recycled by linking appropriate components, thus minimize environment pollution.

Recycling: Effective recycling of product, byproducts and waste material in IFS is the corner stone behind the sustainability of farming system under resource poor condition in rural area.

Income Round the year: Due to interaction of enterprises with crops, eggs, meat and milk, provides flow of money round the year amongst farming community.

Saving Energy: Cattle are being used as a medium of transportation in rural area. More over cow dung is used as such a burning material for cooking purpose or utilized to generate biogas thereby reducing the dependency on petrol/diesel and fossil fuel respectively, taping the available source within the farming system, to conserve energy.

Meeting Fodder crisis: Byproduct and waste material of crop are effectively utilized as a fodder for livestock (Ruminants) and product like grain, maize are used as feed for monogastric animal (pig and poultry).

Employment Generation: Combining crop with livestock enterprises would increase the labour requirement significantly and would help in reducing the problems of under employment to a great extent IFS provide enough scope to employ family labour round the year.

Conclusion:

It has been accepted by everyone across the globe that sustainable development is the only way to promote rational utilization of resources and environmental protection without hampering economic growth. Developing countries around the world are promoting sustainable development through sustainable agricultural practices which will help them in addressing socio-economic as well as environmental issues simultaneously. Within the broad concept of sustainable agriculture "Integrated Farming Systems" hold special position as in this system nothing is wasted, the byproduct of one system becomes the input for other. It refers to agricultural systems that integrate livestock and crop production. Moreover, the system help poor small farmers, who have very small land holding for crop production and a few heads of livestock to diversify farm production, increase cash income, improve quality and quantity of food produced and exploitation of unutilized resources.

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Zero Budget Natural Farming: A boon or a curse for our nation?

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Abstract

The growth and importance of zero budget natural farming (ZBNF) in our nation. It's journey from a single state (Karnataka) and that also led by some peasants, to gaining importance in the entire country is actually considered as a boon, keeping in context its importance to our farmers. There is a popular saying that nothing in this universe is perfect and the same goes with ZBNF

Introduction

Zero Budget Natural Farming, as the name implies, is a method of farming where the cost of growing and harvesting plants is zero. This means that farmers need not purchase fertilizers and pesticides in order to ensure the healthy growth of crops.

It is, basically, a natural farming technique that uses biological pesticides instead of chemical-based fertilizers. Farmers use earthworms, cow dung, urine, plants, human excreta and such biological fertilizers for crop protection. It reduces farmers' investment. It also protects the soil from degradation. It is a cultivating practice for the normal development of yields without including substance composts.

Start of Zero Budget Natural Farming:

When the Green revolution began to destroy lands and livelihoods, some farmers began their search for a return to alternative systems. One of them was Subhash Palekar of Vidarbha, who had practiced chemical farming but after several experiments he met Fukuoka when this Japanese philosopher visited India. They took the initiative together for that technique of natural farming. They promoted it widely across Karnataka under the official name as Zero Budget Natural Farming.

Subhash Palekar is an Indian agriculturist who practiced and wrote many books about Subhash Palekar Natural Farming (SPNF) formerly known as ZBNF (Zero Budget Natural Farming). Subhash Palekar was born in 1949 in a small village Belora in the Vidarbha region of Maharashtra in India, and he has an agricultural background. He practised Zero Budget Natural Farming without using pesticides to cultivate. He conducted many workshops all over India. **He was awarded India's fourth highest civilian award the Padma Shri in 2016.**

What makes Zero Budget Natural Farming a boon for our nation?

In this context let's discuss about the benefits of Zero Budget Natural Farming. As both a social and environmental programme, it aims to ensure that farming – particularly smallholder farming is economically viable by enhancing farm biodiversity and ecosystem services. It reduces farmers' costs through eliminating external inputs and using in-situ resources to rejuvenate soils, whilst simultaneously increasing incomes, and restoring ecosystem health through diverse, multi-layered cropping systems.

Cow dung from local cows has proven to be a miraculous cure to revive the fertility and nutrient value of soil. One gram of cow dung is believed to have anywhere between 300 to 500crore beneficial micro-organisms. These micro-organisms decompose the dried biomass on the soil and convert it into ready-to-use nutrients for plants. Resilient food systems are the need of the day given the variability of the monsoons due to global warming and declining groundwater in large parts of India. The drought-prone regions in India are reportedly seeing promising changes already in farms with the ZBNF.

Zero budget natural farming requires only 10 per cent water and 10 per cent electricity than what is required under chemical and organic farming. ZBNF may improve the potential of crops to adapt to and be produced for evolving climatic conditions. In ZBNF, yields of various cash and food crops have been found to be significantly higher. E.g. yields from ZBNF plots were found on average to be 11% higher for cotton than in non-ZBNF plots.

The yield for Guli ragi (ZBNF) was 40% higher than non-ZBNF. Input costs are near zero as no fertilizers and pesticides are used. Profits in most areas under ZBNF were from higher yield and lower inputs. Model ZBNF farms were able to withstand drought and flooding. Notably these are the serious emerging concerns with regard to climate change. Planting multiple crops and border crops on same field provides varied income and nutrient sources. Overall, there is Reduced use of water and electricity Improved health of farmers Flourishing of local ecosystems and biodiversity No toxic chemical residues in the environment Improvements in soil, biodiversity, livelihoods, water Climate resilience Women's empowerment and nutrition. These all points lead to a total conclusion that Zero Budget Natural Farming is a boon for our nation.

Initiative of government towards Zero Budget Natural Farming:

Nirmala Sitharaman in her budget speech said zero budget farming is already being practiced in some states of the country. Sitharaman said emphasis on zero budget farming will help double the farming income in days to come. Government of India has been promoting organic farming in the country through the dedicated schemes of Paramparagat Krishi Vikas Yojana (PKVY) since 2015-16 and also through Rashtriya Krishi Vikas Yojana (RKVY).

In the revised guidelines of PKVY scheme during the year 2018, various organic farming models like Natural Farming, Rishi Farming, Vedic Farming, Cow Farming, Homa Farming, Zero Budget Natural Farming (ZBNF) etc. have been included wherein flexibility is given to states to adopt any model of Organic Farming including ZBNF depending on farmer's choice. Under the RKVY scheme, organic farming/ natural farming project components are considered by the respective State Level Sanctioning Committee (SLSC) according to their priority/ choice.

Drawbacks of Zero Budget Natural Farming :

- Labour intensive pushes production price to higher.
- For fragmented land holdings, giving jeevamrutha is much more difficult.
- Desi cow maintenance is another burden.
- Finding consumer to sell at premium price is difficult. Assume you find them.
- Difficult to convince customer that their produce is nutritious and pesticide free in order to command premium price.
- Cannot sell to reputed organic brands in wholesale as they insist on organic certification.

Conclusion

Zero Budget Natural Farming has its own benefits and drawbacks, although if properly executed it will become a secure part of Indian agriculture. Government should take the initiative to build the bridge of knowledge between the farmers and his system of farming. First of all government should address the crisis like rising labour cost in this, and by providing better produce price to the farmers. This all if looked into a better way will help overcome the various drawbacks of ZBNF. It should be tested on a wider scale and on all soil types. Hence, implementing this at larger scale and in a better way will help the nation to progress towards achieving the Sustainable Development Goals.

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Genetics and Breeding for Biotic and abiotic stress resistance in Chilli

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Introduction:

Hot pepper (*Capsicum annuum* L.) is one of the major spices cum vegetable crop belongs to the Solanaceae family originated from Mexico, Central America. Nowadays, hot pepper is cultivated all around the world, widely used in many cuisines as a spice and in pharmacy for the extraction of bioactive compounds known as capsaicinoids and the fruit is also a good source of carbohydrates, minerals, proteins, amino acids, antioxidants, phytochemicals, and vitamins. Asia is the main producer and exporter of hot pepper. Among the Asian and of the world countries, India is the largest producer of green hot pepper with the production of 3592 thousand tonnes in an area of 309 thousand hectares.

In 21st century, climate change is the most serious threat to crops, causing a negative impact on the quantity and quality of crops. Increase of CO2 along with other greenhouse gases may cause an increase of more than 2° in mean global temperature by the end of this century. Climate change in future exacerbates a rise in temperature level, which causes an adverse impact on crop growth and development. An increase in mean annual temperatures and heat waves might destroy physiological processes in plants (Jiang and Huang, 2001). The production of hot peppers in early summer is limited by high temperature, blowing of hot wind and shortage of soil moisture and high temperature and excessive moisture during rainy summer. Such conditions induce the abscission of flower buds, flowers and young fruits which are the most important factors limiting the production of hot pepper. It is also observed that hot pepper is mainly produced in the open field, summer production will be impossible in many parts of the world without heat-tolerant cultivars. Exposure of hot pepper to high temperature after anthesis adversely affects fruit growth, seed yield and seed quality of chili pepper. Drought tolerance is one of the important characteristics of hot pepper under climate change. Hot pepper performs well in hot and dry environments of Afghanistan with comparably lower post-harvest losses than other vegetable crops

Breeding and QTLs mapping for biotic stress resistance in chilli

Capsicum species are commonly known as peppers, one of the most important vegetable crops cultivated worldwide. The genus capsicum includes more than include 30 species, but generally five species like *C. annuum*, *C. chinense* and *C. frutescent*, *C.chinensis* and *C.baccatum* are main cultivated species grown for fresh, dried and, processed food consumption. Recently the development of NGS technology opened new opportunities for genome sequencing, and the study of the pepper genome. The Sequencing of the pepper genome was initiated by using the BAC library and estimation done by the ethidium bromide flow cytometry method. Genome of some wild and cultivated species have been sequenced and estimation like *C.annuum* (*3090 mbp*), *C.frutescens (3325mbp)*, *C.chinense (3345mbp)*, *C.baccatum (3628mbp)*, *C.chacoense (3746mb)p C.eximum*(*3971mbp)* and the largest genome size in *C.parvifolium (5643mbp)* respectively. Genetic studies in pepper have been progressed to the identification of germplasm and genetic inheritance of various complex traits, identification of gene location, QTLs mapping and characterized molecular marker linked to various important traits for fasted pepper breeding program. Molecular mapping has been initiated in chilli for a various complex traits like fruit color, fruit size, fruit shape, pungency and other quality traits like capsaicin biosynthesize, flavor and many diseases resistance traits. QTLs have been identified for resistance to anthracnose, cucumber mosaic virus, phytophthora blight, powdery mildew, potyvirus, capsaicinoid content, fertility and number of pedicel per node etc. Recent advance has been progressed and identified some trait with linked marker like tobacco mosaic virus (L^1, L^2, L^3,L^4, L^+), CMV resistance (*cmr-1, cmr-2 locus*), potyvirus series resistance locus like *pvr-1, pvr-2,pvr-3,pvr-5, pvr-6, pvr-7, pvr-8* and bacterial leaf spot (Bs-1, Bs-2, Bs-3, Bs-4 and recent gene like Bs-5, Bs-6), anthracnose resistance (*Anr-1, Anr-2, Anr-3, Anr-4, Anr-5*) QTLs, powdery mildew *(lmr-1, lmr-2 , lmr-3*) QTLs, erect fruit habit (*up-1*, *up-2*) gene, carotenoid synthesis *(C-1 , C-2*) gene, purple fruit color (*im* gene), *pun locus* responsible for pungency, GMS inherited by *ms-1, ms-2,ms-12,ms-13,ms-14*, and fertility restorer gene *rf* gene for effective utilization CGMS in hybrid seed production, TSWV (*Tsw)* gene, and root knot nematode *(Me-1, Me-3, Me-4, Me-7, Mech-1*) genes mapped and linked to molecular marker for improvement of complex trait in chilli. Candidate gene approaches is hypothesis based method for new gene identification in chilli constructed with map-based cloning and position of gene on genomic region and validate gene by virus-induced gene silencing method. Candidate gene approaches used in *L* locus for tobamovirus, *pvr-1*, *pvr-2* locus for potyvirus, pun locus for pungency, and *cl* for fruit colour.

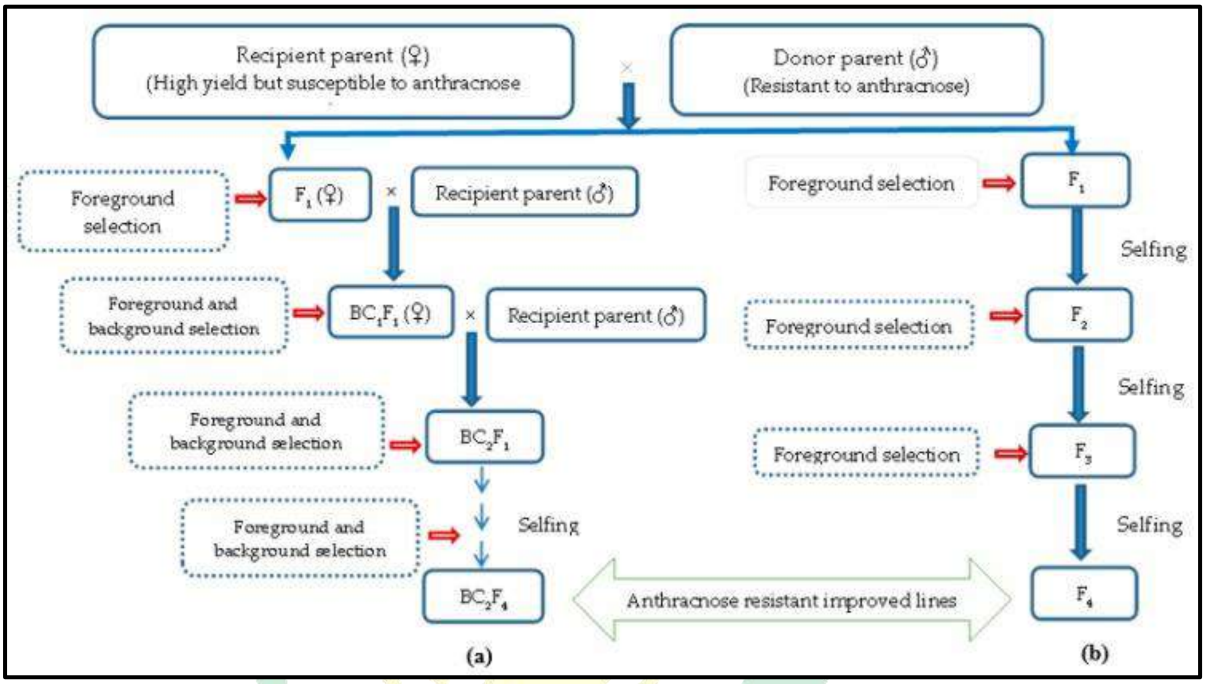

Fig 1: Diagram showing the development of anthracnose-resistant varieties through (**a**) marker-assisted backcrossing and (**b**) pedigree selection

QTLs mapping achievement for various traits in chilli:

Traits	Locus Name	Genetic inheritance	References
Putative Acyltransferase gene AT3 (Presence/Absence of Pungency)	*Pun1*	Gene, Dominant	(Lee *et al*. 2005; Stewart *et al*. 2005; Stewart et al. 2007)
Fasciculate	*fa*	Gene, Recessive	(Elitzur *et al*. 2009)
Male sterility (Genic)	*Camf1*	Gene, Dominant	Chen *et al*. 2012
Pungency	*Cap7.1*,	QTL	Ben Chaim *et al*. 2006

	Cap7.2		
Resistance to Cucumber mosaic virus (CMV)	*Cmr1*	Dominant	Kang *et al*. 2010
Resistance to potyvirus- tobacco etch virus (TEV), potato virus Y (PVY), potyvirus E (PVE)	*pvr1*	Recessive	(Murphy *et al*. 1998; Kang *et al*. 2005)
Resistance to tobamo-viruses	*L3*	Gene, Dominant	(Berzal-Herranz *et al*. 1995; Tomita et al. 2008)
Resistance to tobamo-viruses	*L4*	Gene, Dominant	(Yang *et al*. 2009)
Tomato spotted wilt virus (TSWV)	*Tsw*	Gene, Dominant	(Jahn *et al*. 2000; Moury *et al*. 2000)
Resistance to Xanthomonas campestris (Bacterial spot)	*Bs2*	Dominant	(Tai *et al*. 1999b; Mazourek *et al*. 2009)
Resistance to Xanthomonas campestris (Bacterial spot)	*Bs3*	Dominant	(Pierre *et al*. 2000; Jordan *et al*. 2006)
Resistance to Root-knot nematodes (Meloidogyne spp.)	*Me*	Dominant	(Djian-Caporalino *et al*. 2001; DjianCaporalino *et al*. 2007)
Resistance to Root-knot nematodes (*Meloidogyne chitwoodi*)	*Mech*	Multiple genes, Independent dominant	Djian-Caporalino *et al*. (2004)
Resistance to potyvirus—pepper veinal mottle virus (PVMV)	*pvr1*	Recessive	(Murphy *et al*. 1998; Kang *et al*. 2005)
Resistance to potyvirus—pepper veinal mottle virus (PVMV)	*Pvr 4*	Dominant	(Grube *et al*. 2010)

Fig 2: Wild species of chilli used for resistance breeding against various biotic and abiotic stress resistant breeding programme

Breeding and QTL mapping for cold and hot resistance in chilli

The cold resistance should be governed by a polygenic and the broad spectrum genetics of inheritance in poorly understand in hot pepper. Plants respond with changes in their pattern of gene expression and protein product when exposed to low temperature. Most appear to be involved tolerance to the cold stress and expression of some of these are regulated by C-repeat binding factor/dehydration-responsive element-binding (CBF/DERB-1). To struggle with abiotic challenges, plants are evolving with a complex mechanism of perception and reactions. Abiotic stresses are recognized by many signaling cascades which later activates ion channels, kinase cascades and sometimes producing reactive oxygen species and by some other means such as accumulation of hormones, i.e., salicylic acid (SA), ethylene (ET), Jasmonic acid (JA) and abscisic acid (ABA). The late embryogenesis abundant (*LEA*) gene from barley is effective in increasing cold tolerance when introduced to rice plants. Many structural and transcriptional factor-encoding genes that get induced by cold stress have been identified in Capsicum species including *EREBP (CaEREBPC1 to C4), WRKY (CaWRKY1*), and *bZIP (CaBZ1*) genes. EBR (2, 4-epibrassinolide) enhances salicylic acid & jasmonic acid cycle and suppresses the ethylene biosynthesis pathway in cold stress. RNA-seq analyses of peppers treated with heat, cold, salinity and osmotic stress at six different time points will provide useful information for basic studies of various stimuli to facilitate the development of stress-resistant pepper cultivars.

Mapping of Quantitative trait loci (QTLs) controlling cold resistance is a major breeding objective. QTLs controlling to sensitivity to chilling have been identified in maize (Hund et al 2005), Sorghum seedling (Knoll and Ejeta *et al*., 2008), and cultivated tomato (Goodstal *et al*., 2005). A *CBF* gene (*CFB-2*) also mapped as freezing tolerant QTL mapped in Arabidopsis and controlling gene (Alonso Blanco *et al*., 2005). Presently, hot pepper breeding is mainly focused on the development of cold-tolerant cultivars due to the continues rise in global mean temperature necessitating constant requirement of cold-tolerant sources and genomic information related to the cold that enhanced breeding for dissecting QTLs or gene for cold tolerance in chilli.

Heat tolerance appears to be polygenically controlled, because of which genetic basis of heat stress tolerance in plants is poorly understood (Wahid *et al.* 2007; Ainsworth and Ort 2010; Collins *et al.* 2008). Hence QTL mapping is found to be an effective way to identify the genes responsible for heat tolerance (Janick *et al*. 2011), many efforts have been made to identify quantitative trait loci (QTL) for heat stress in segregating mapping populations. Jha *et al.* (2014) showed QTLs associated with heat tolerance in various plants. Similarly heat shock proteins which are produced in plants under heat stress, play an important role in heat resistance in plants. They function as molecular chaperones and can bind partially denatured proteins, thereby prevent deleterious protein conformations and eliminate non-native aggregations formed during stress (Morimoto 1998; Boston *et al.* 1996; Vierling 1991). Zhu *et al.* (2011) indicated that the expression of *CaHSP24* small heat shock protein gene in hot pepper was induced by heat stress. Two SSR markers (Hsp70-u2 and AGi42) are tightly linked to the Hsp genes in pepper (Magaji *et al.* 2016; Ince *et al.* 2010). Sharma *et al.* (2017) observed that fine mapping using a recombinant inbred line population where many recombinant events as well as replicated phenotypic evaluation might give better resolution of the QTL region and candidate gene for heat tolerance as compared to the mapping which was based on F_2 populations. Wen *et al.* (2019) demonstrated that combination of conventional QTL mapping, QTL-seq analysis and RNA-seq can rapidly identify heat-tolerance QTLs and high-temperature stress-responsive genes. Transcriptome Analysis through RNA-Seq proved to be an effective approach for the identification of heat stress-related genes and also to investigate the underlying heat stress response mechanism in hot pepper genotypes (Li *et al.* 2015). Kang *et al.* (2020) also inferred RNA-seq analyses of peppers treated with heat, cold, salinity, and osmotic stress at six different time points will provide useful information for basic studies of various stimuli to facilitate the development of stress-resistant pepper cultivars.

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GLOBAL DEMAND FOR FOOD

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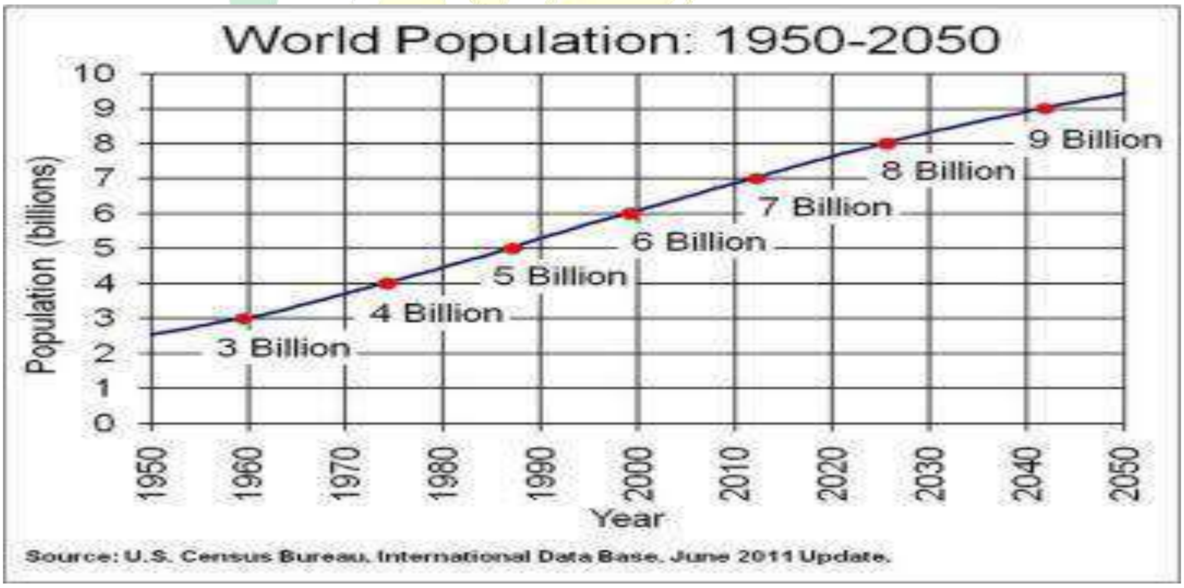
Food is one of the primary needs of human beings because it is the source of energy and nutrition. The population of our country and the world is increasing rapidly, however it is challenging to fulfill the demand of food. Arable land is decreasing due to population increase; cultivable fertile land has been used for construct houses, Buildings and factories etc. Continuous growth of population has raised the demand for food, which in-turn has brought a situation where crop production is not adequate as per the demand. According to the recent United Nations report the current world population is 7.8 billion in September 2020 however it will reach about to 10 billion in 2050, meanwhile the demand of food will also be double by 2050.



The graph showing increasing world population (1950-2050)

Agriculture in the 21st century faces multiple challenges. Current projections suggest that average daily energy availability could reach 3050 kcal per person by 2050, up from 2770 kcal in 2003/05. However, the same projections suggest that production increases alone would not be sufficient to ensure food security for everyone. Climatic changes happening due to various reasons like depletion of ozone layer, acid rain and global warming have led to a decrease in the production of food.

THERE ARE MANY PROBLEMS ON FRONT AGRICULTURE SCIENTIST AND FARMERS TO FEED THIS GROWING POPULATION?

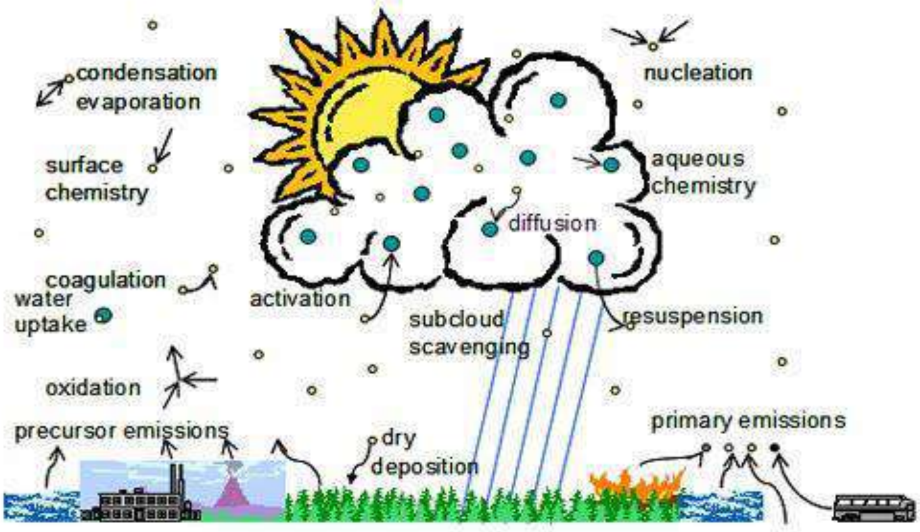
- Today 1 in 9 is undernourished.
- Every day world population is increasing by 180,000.
- But land available for farming is limited.
- Yield from small and marginal farmer is very low due to lack of resources and technical knowledge.
- By the year 2050 there will be about 9.7 billion people on earth.

PROBLEMS

1. **Population Growth:** This varies considerably across countries. Africa is expected to double its population from 1 to 2 billion by 2050. Populations in the developing world are also becoming increasingly, with 2.5 billion additional urban residents projected in Africa and Asia.

A view of population density in India

2. **Climate change:** Currently, 40% of the world's landmass is arid and rising temperatures will turn yet more of it into desert. At current rates, the amount of food we're growing today will feed only half of the population by 2050.



The image showing factors responsible for climate change

3. **Water scarcity:** this is another impending crisis: 28% of agriculture lies in water-stressed regions. It takes roughly 1,500 litres of water to produce a kilogram of wheat, and by 2050 water demand will be double.

The image showing water scarcity

4. Food waste:

One-third of food produced for human consumption yearly – approximately 1.3 billion tons – is lost, or wasted, which the UN's World Food Programme (WFP) estimates costs the global community $1 trillion. The UN's Food and Agriculture Organization (FAO) defines food waste as "the discarding or alternative (non-food) use of food that is safe and nutritious for human.

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The image showing mass food wastage

WHAT MAKES ENSURING FOOD SECURITY SO COMPLEX?

In INDIA Agriculture contribute 18% of the economy's output and 47% of its workforce. India is the second biggest producer of fruits and vegetables in the world. Yet according to the Food and Agriculture Organization (FAO) of the United Nations, some 19million Indians are undernourished, the largest number of hungry population in any single country. An estimated 15.2% of the population of India are too malnourished to lead a normal life. A third of the world's malnourished children live in India. Food demand is expected to increase between 59% to 98% by 2050.

HOW CAN WE MEET THE DEMAND FOR FOOD?

Farmers in world will need to increase crop production, either by increasing the amount of agricultural land to grow crops or by enhancing productivity on existing agricultural lands through fertilizer and irrigation and adopting new methods like precision farming. The agricultural sector also needs significant long-term private investment and public spending.

How can farmers increase production and income as well?

1. By adopting protected cultivation (Off season cultivation).
2. Hydroponics (Cultivation in water/ water pipes)
3. Inter cropping (Cultivation of one or two crops in between two rows of main crop)
4. Mix cropping (Cultivation of one or two crops with main crop)
5. Mix Farming (Crop production + poultry+ dairy+ bee keeping etc.)

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6. Vertical farming (cultivation of crops in vertically vacate space whether indoors or out door)



a). Protected cultivation b). Hydroponics c) Vertical farming


d). Inter cropping e). Mix Farming

Units Operations in Post Harvest Management of Fruits and Vegetables

- Pre-harvest treatment
- Harvesting at maturity
- Safe harvesting
- Pre-cooling and Washing
- Surface drying
- Cold storage
- Safe Transport
- Safe Handling

Other factors can boost the production, productivity and post harvest management

- The government should provide interest free loans to farmers and allocate land space for farming.

- Arrangements of trainings about modern and advanced farming methods and technologies.
- Rehabilitation of sodic and acidic soils.
- Prevention of erosion and increase in fertilizers use efficiency.
- Establishment of storages and processing industries.
- Food waste control.

Conclusion:-

Increasing population can be feed in quality and quantity both by adopting advanced agricultural technologies. Farmers can boost their production and also can raise their living standard by adopting: Mix farming, protected cultivation, controlling postharvest looses, adopting vertical farming. Also acrable area can be increase by rehabilitating sodic waste land and acidic soils. By adaptation of food processing and post harvest management we can meet the demand of food in coming days.

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Impact of COVID-19 Pandemic On Agriculture Sector

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IMPACT OF COVID-19 PANDEMIC ON AGRICULTURE SECTOR

The current health crisis of COVID-19 has affected countries all over the world. No sector has escaped from it. Its impact on the agriculture sector is complex and the sector has to face many problems during the crisis. Outbreak of COVID-19 virus not only taken the lives of people but also strongly affected our economy. As India moves to total lockdown the impact of the crisis on the economy was becoming more severe. As continuing of lockdown far from months its impact will be even more severe on the working sector and on Indian economy as a whole.

WHAT DOES LOCKDOWN MEAN?

It is a situation, in which there is a complete shutdown of all the economic activities and that people must stay where they are and may not enter or exit a building or rooms within it and the production and transportation of goods and services are disrupted. Goods and services are not supplied in adequate quantities to meet existing demand. Besides this, reduction of consumption takes place which also leads to a fall in demand for goods and services. But at the same time, economic activities are being shutdown many people lose there jobs and wages. With the shutdown of factories and workplaces due to lockdown, millions of migrant workers had to deal with the loss of income, food shortages, and uncertainty about their future. Thousands of them then began walking back home, with no means of transport due to the lockdown. More than 300 migrant workers died due to the lockdown, with reasons ranging from famine, suicides, road and rail accidents, and denial of timely medical care.

In response, the Central and State Governments took various measures to help them as they arranged transport facilities for them, making shelter homes, and make arrangments for food and other stuff.

While the government schemes the 'One Nation, One Ration Card' system ensured that the poor would get additional rations during the crisis days.

THE AGRICULTURE SECTOR IS THE BACKBONE OF OUR ECONOMY

India has always been an agricultural country, distinguish by smallholding farmers, small and marginal farmers, and many other peoples depending on farming, yet they feed 1.3 billion people. Agriculture employs about 55% of the population and contributes 17% to the GDP. India is second in agricultural production, next only to China. We produce 12 percent of the entire world's agricultural out. The savior of the nation which suffered recently due to uneven monsoon will face another hit due to disruptions from the corona virus. ⇒The World Food Programme (WEP) has observed that the COVID-19 crisis is threatening to affect millions of people by food security and malnutrition. World agricultural prices show signs of a rise from the 3rd week of March 2020 mainly for the rice and wheat crop.

⇒As foreign export has been stopped Vietnam, the world's 3rd largest rice exporter has stopped exports, which may reduce the global rice exports by 15%. If India and other countries also ban export world rice prices may rise sharply soon. As Kazakhstan, one of the world's biggest sources of wheat flour already banned its export. Similar things are observed in other crops export and import to.

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As we talk about the Indian agricultural sector, because of the COVID-19 pandemic and nation-wide lockdown the different sectors of agriculture has to face many problems as-

☞Wholesale prices of fruits, vegetables, wheat, rice, pulses, and sugar have fallen up to 75% since the start of the nationwide lockdown due to subdued demand, particularly from wholesalers in other states, restaurants, and institutions.

☞Prices of wheat, rice, and pulses have fallen about 15% since the lockdown began while sugar prices have dropped about 5% with demand from ice-cream and cold drink manufacturers shrinking greatly.

☞The price of flour has come down by 20% to Rs 20 a kg, maida by 12% to Rs 21 a kg, and suji by 18% to Rs 23 a kg in the wholesale market.

☞Prices of all types of pulses have declined by about 10% to 20% during the lockdown.

☞The meat and seafood industry in India are struggling from rumors about Covid-19 linking it with the consumption of meat and seafood, the prices of eggs have plunged to two rupees per egg and the resultant impact is chicken prices have crashed to 30 to 40 rupees/kg when the production cost for the farmer is 70/kg. Overall demand has come down by 70% and consumption has moved from chicken to mutton and seafood.

☞National Dairy Development Board (NDDB) from the dairy cooperatives shows a decline in daily liquid milk sales by dairy cooperatives by about 15% in the Covid-19 lockdown period, and a drop in the proportion of sales to procurement by about 8.8% during the same period. Milk consumption down 25% in one month as eateries remain shut.

This leads to worries among milk producer in the exporting countries and expectation are that global milk prices will also tend downwards. As news started trickling about supply chain disruptions, both central and some state governments started taking action towards the situation. These included making available low-cost working capital to producer-owned institutions to convert milk into skimmed milk powder (SMP) and milk fat, direct procurement of surplus milk for conversion, and direct distribution to needy people.

⇒The Corona virus lockdown will adversely affect the agriculture sector and farmers in India. The sector is facing a lot of trouble with labourers and movement of the farm

produced goods. Besides this, it is also affected by many other factors Cyclone Amphan, earthquakes and the locust attacks that have also disrupted the agricultural sector.

✧SPECIAL COVID-19 PACKAGE FOR AGRICULTURE SECTOR

The finance minister said the largest proportion of the Indian population is dependent on agriculture. Among all those dependent on agriculture, 85 percent are small and marginal farmers.

→The third allocation of the special Covid-19 package announced by Union Finance Minister NirmalaSitharaman focused on agriculture and allied activities. She announced the third allocation was to create a Rs 1 lakh crore agriculture infrastructure fund that will finance projects at farm-gate and aggregation point for efficient post-harvest management of crops.

→The Finance Minister said the government will provide Rs 1 lakh crore for the Agri infrastructure fund while a Rs 10,000 crore fund will support two lakh Micro Food Enterprises (MFEs) for promoting health and wellness, herbal, organic, and nutritional products.

→Fishermen received a huge bonus from this package, with Rs 20,000 crore allotted through the Pradhan MantriMatsyaSampadaYojana. The goal is to develop marine and inland fisheries, to employ over 55 lakh people, and to double exports to Rs 1 lakh crore.

→Also, aRs 15,000 crore Animal Husbandry Infrastructure Development Fund was set up. An outlay of Rs 4,000 crore was announced to promote herbal cultivation in about 10 lakh

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hectares of area with another Rs 500 crore earmarked for beekeeping initiatives that will help two lakh beekeepers.

→Also, the finance minister said the government will bring law to implement agriculture marketing reforms to provide marketing choices to farmers. The new law will provide adequate choices to the farmer to sell produce at an attractive price.

AGRICULTURE -The savior

As we learn to live with corona, we also realize the importance of the agriculture sector and farmers. We also must realize that agriculture may be a savior.

Because of lockdown, many migrant workers have moved back home and many, of course, will return to cities once the lockdown is over, yet a considerable number will stay back, most likely taking to agriculture. Therefore, agriculture may be profitable for them to make a good life.

The agriculture sector is the only bright spot at the time of crisis which eyewitnesses an impressive growth of 5.9 percent on the back of a better rabi harvest despite lockdown due to the COVID-19 crisis. The Indian economy grew only by 3.1 percent during the same period due to the contraction of core sectors. Also, the recent forecast shows agriculture will still depict positive growth of 2.5 percent, when GDP may register negative growth.

IN A NATIONWIDE LOCKDOWN OR PANDEMIC, A FARMER WORKS SO THAT THE WORLD CAN EAT

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Increasing Self-Immolation By Farmers In India: Statistics, Reasons and Solutions

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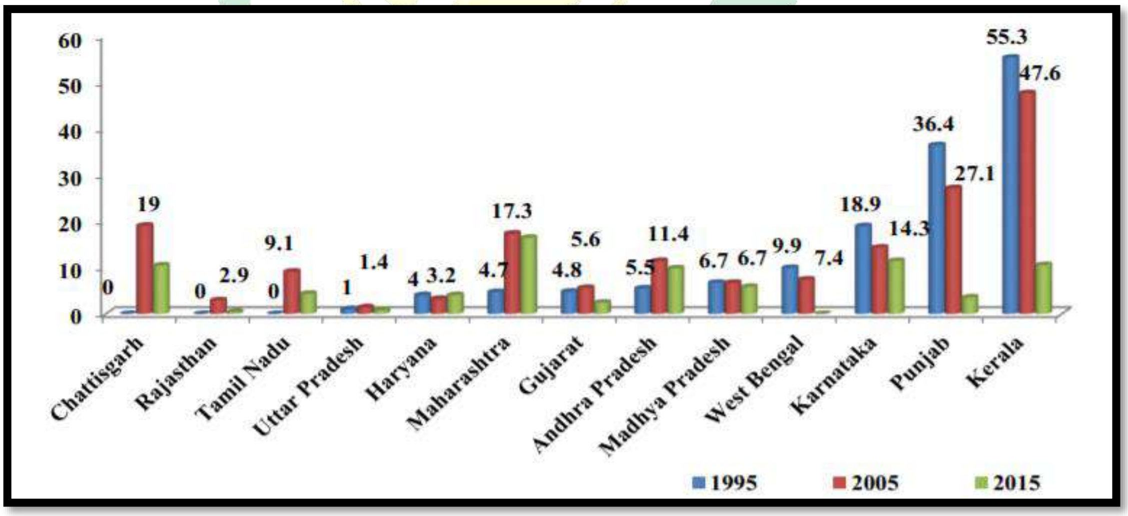
The ultimate sign of distress is suicide. Amid the ongoing rural distress, reports of farmer's suicides are often used to highlight the plight of rural India. However, new data and research suggest that farmer suicides may not have increased in recent years and may have more complex causes than falling incomes or rising indebtedness. As many as 42,480 farmers and daily wagers committed suicide in 2019, an increase of about 6 per cent from 2018, as the number of farmers committing suicide fell marginally while that of daily wagers increased 8 per cent. According to the National Crime Records Bureau (NCRB) data on accidental deaths and suicides, 10,281 farmers committed suicide in 2019, down from 10,357 in 2018, whereas the figure for daily wagers went up to 32,559 from 30,132.



Decadal variations in farmer suicide rates across major states: macro point of view Source Computed from NCRB and Census data for various years. As per statistics by Government of India, over 12,000 suicides were reported in the agricultural sector every year since 2013. The report states that "a total of 12,602 persons involved in farming sector - 8,007 farmers-cultivators and 4,595 agricultural labourers - committed suicide during 2015, accounting for 9.4% of total suicide victims (133,623) in the country." Maharashtra topped the list with 4,291 suicides, followed by Karnataka with 1,569, Telangana 1,400, Madhya Pradesh 1,290, Chhattisgarh 954, Andhra Pradesh 916 and Tamil Nadu 606. Together, these seven states accounted for 87.5% of total suicides in the farming sector in the country - 11,026 of 12,602. In 2014, 12,360 persons in the farming sector - 5,650 farmers-cultivators and 6,710 agricultural labourers -committed suicide, accounting for 9.4% of the total number of suicides (131,666) in the country. In 2013, the number was 11,772, accounting for 8.7% of the 134,799 suicides in the country.

The number of suicides by farm labourers, defined as those whose primary source of income is through farm (agriculture / horticulture) labour activities, has gone down to 4,324 in 2019, from 4,586 a year before. The numbers highlight another worrying trend. In 17 states, more farm labourers have committed suicides than farmers, while the reverse is true for seven states. Yet, only 58 per cent of the total suicides committed by people employed in the sector are farmers. West Bengal, Bihar, Odisha, Uttarakhand, Manipur, Chandigarh, Daman & Diu, Delhi, Lakshadweep and Puducherry reported zero suicides of farmers and agricultural labourers. The report suggests that with over 139,123 registered suicides, India recorded the highest suicide numbers in the past five years. The 2019 suicide numbers was 3.4 per cent higher than 2018. In other words, 10.4 people committed suicides per 1,00,000 population. In recent times, agriculture made headlines for all the wrong reasons: Farmers quitting cultivation; the sector turning into a perennial loss-making enterprise; and the country's official policy to downsize the dependence on agriculture to reduce overall economic hardship among the poorest of the population. Agriculture's fast-declining economic

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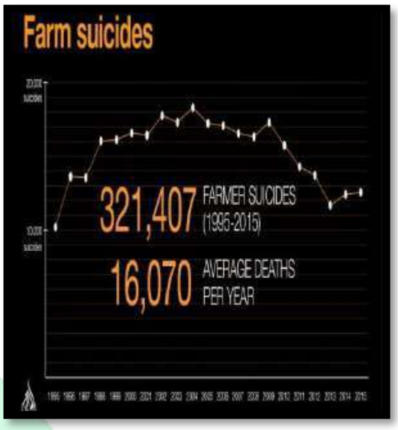
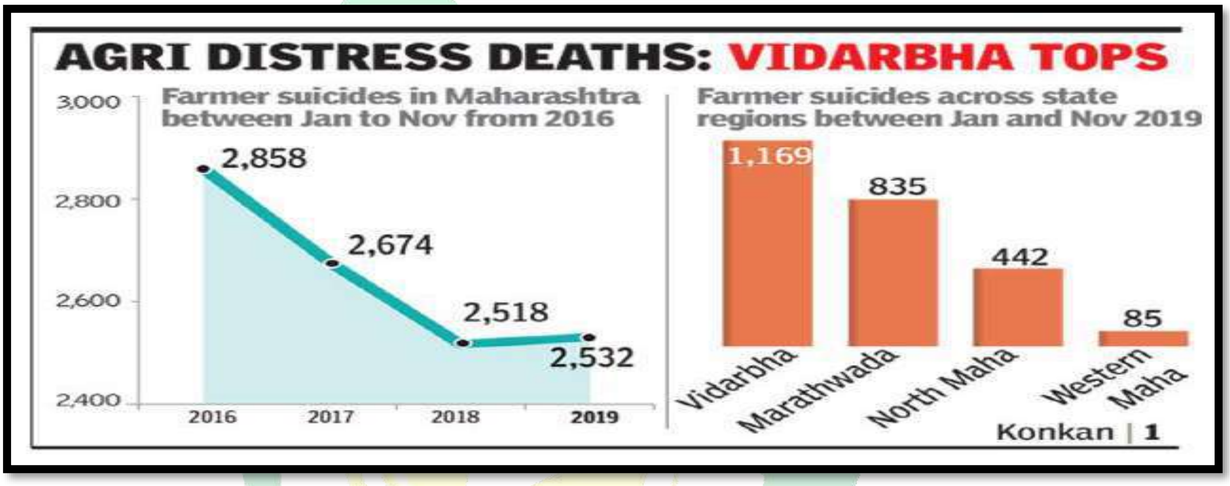
importance reached such an extent that economists suggested India had already turned into a non-agrarian economy and the more people quit farming, the better the fortune of remaining farmers would be. But two developments in the first half of September seem to be forcing us to revise these perceptions of Indian farming and farmers.

First, when India recorded 23.9 per cent contraction in the gross domestic product (GDP) in the first quarter (April-June, 2020), agriculture emerged as the unbelievable winner, growing at 3.4 per cent. This growth in the agriculture sector was based on the rabi or winter crop, that was anyway a bumper one. Second, the kharif or the monsoon crop is already an exceptional one in terms of acreage. It has broken a four-year record, with 109.5 million hectares (ha) under sowing. Farmers are not earning proportionately to their production or matching agricultural growth. As such, a farmer's share in consumers' expenditure on food items is very low; sometimes, it is less than 66 per cent and as low as 20 per cent in case of fruits and vegetables. Official data does point at an increase in the income from farming per cultivator in recent years.

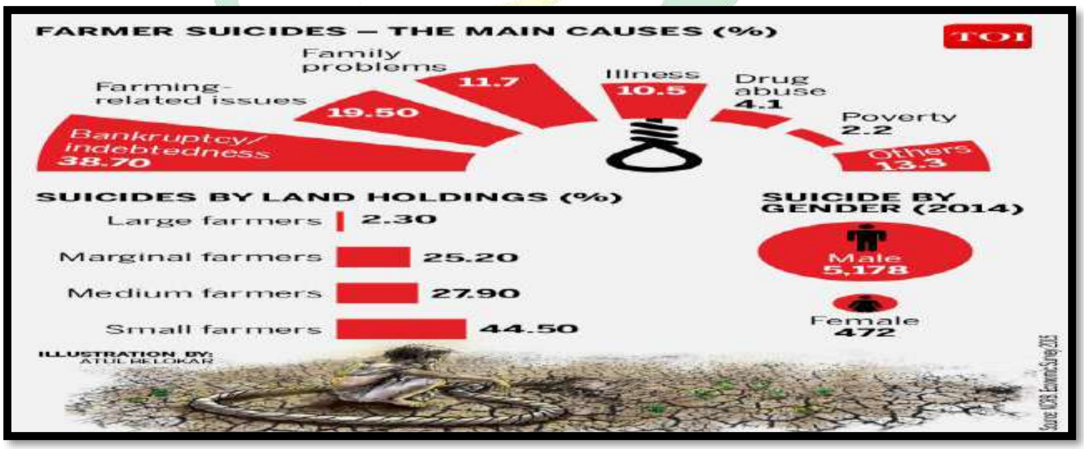
But that is due to another reason. The growth in farm income/ cultivator during 2004-05 to 2011-12 increased not due to a rise in real income but due to steep decline in the number of cultivators to 146 million in 2011-12, from 167 million in 2004-05. A potential loss in the kharif season is an ominous sign for farmers. They make the most from the kharif season, in comparison to the rabi. In the central and northern hilly areas of the country, farmers don't earn anything in the rabi season and depend entirely on the kharif seasons for survival.

Statistics regarding farmer's suicide:





Why do farmer actually commit suicide



Solution for Self-immolation by farmers:

Farmers need to be protected from falling into the trap of the spiraling debt, which is the primary risk factor for suicide. Small and marginal farmers should be encouraged to pool their farmland. Water supply for irrigation must be insulated from the vagaries of nature by better water management systems; attention must particularly be paid to rainwater harvesting and resolution of interstate river water sharing disputes. Farmers must necessarily be educated about modern farming techniques and practices. Younger professionals must be encouraged to participate in farming activities. Farm loans at soft interest rates need to be made available, and loan recovery procedures should be provided. Reasonable price for farm products must be ensured, and middlemen eliminated by creating a direct reach for the farmers to the market. The government-administered MSP should be taken into consideration the existing realities to cover the cost of production and to insulate farmers from fluctuating market conditions. Training needs to be provided for secondary rural investments other than agricultural practises like in dairy farming, poultry farming, animal husbandry, and other activities, with a clearly viable chain apparent from financing to marketing. The matters ranging from alcohol use to dowry gifts and large wedding spending should be discouraged. Storage and food processing units need to be established in rural areas. Comprehensive but affordable insurance schemes should be made available, covering farmers and crops from problems at every stage of the crop cycle. There should be a quick, simple, and corruption-free approach to crop damage assessment with disbursement of relief directly into the claimant's bank account. Pradhan Mantri Farmer Bima Yojana, an improved version of existing schemes such as the National Agricultural Insurance Scheme and the Modified National Agricultural Insurance Scheme (NAIS), is a step in the right direction although some voices have been raised against it. Organizations such as the Alliance for Sustainable and Holistic Agriculture call it another missed opportunity, citing drawbacks such as non inclusion of tenant farmers, limited coverage, non inclusion of crop damage by wild animals, improper damage assessment methods, and lack of clarity regarding where the claim amount will be deposited (to the farmers' savings account or to the loan account).

Attention should be focused on the development of an all-encompassing relief scheme after consulting farmers and farmer movements, and after considering the recommendations of government committees such as the PK Mishra Committee and others.

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GI tags and its contribution in Indian Agriculture

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Article ID: 042

Introduction

Geographical indications (GI) refer to a type of intellectual property (IP) protection which identifies goods with a geographical region. The GI tagging is attributed in such a manner that quality, reputation and other salient features of the commodity are linked to the location of origin. The GI tag for a product can be used only by legitimate users and the residents of the territory of origin. GI tags may be obtained for agricultural products, handicrafts, textiles, manufactured goods, foodstuffs etc. The given GI tag may be in the form of a geographical name or a figurative representation or a combination of these two. The tag assigned to a product should convey its geographical origin. GI plays an important role in promoting the conservation of biodiversity among the rural population.

Graphical indications

GI is defined in Article 22.1 of the Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement as "indications which identify a good as originating in the territory of a member, or a region or locality in that territory, where a given quality, reputation or other characteristic of the good is essentially attributable to its geographical origin". In general, a GI is recognized in the "country of origin" in which the area referred by the GI tag is located. The registered proprietors or authorized users of GI might include associations of persons or statutory authorities. The authorized users can prevent anybody from using the GI tag on products, which are not originating from the designated location. Thus GI helps to ensure comprehensive and effective protection to GI tagged goods. In India, the Geographical Indications (GI) of Goods (Regulation and Protection) Act was passed in the 1999 to facilitate registration and protection of intellectual property in relation to goods. The Act defined GI under Section 1(e) as, "Geographical Indication in relation to goods, means an indication which identifies such goods as agricultural goods, natural goods or manufactured goods as originating or manufactured in the territory of a country or a region or locality in that territory, where a given quality reputation or other characteristic of such good is essentially attributed to its geographical origin and in case where such goods are manufactured goods, one of the activities of either the production or of processing or preparation of the goods concerned takes place in such territory, region on locality as the case may be.

Agriculture items with GI tags

All GI tagged items are divided into 12 categories—Agriculture, Handicrafts, Manufactured, Foodstuff, Textile, Handmade Carpets, Natural Goods, Clothing, Natural, Spice, Forest Produce and Footwear. Here we are going to look into agricultural items, lets see how many are there and how many we were actually aware of. There are 96 GI tagged agricultural produce in total.

1) **Assam:** Assam (Orthodox) Logo, Assam Karbi Anglong Ginger, Tezpur Litchi, Joha Rice
2) **Andhra Pradesh:** Guntur Sannam Chilli, Banaganapalle Mangoes and Araku valley Arabica coffee
3) **Arunachal Pradesh:** Arunachal Orange
4) **Bihar:** Bhagalpuri Zardalu
4) **Gujarat:** Gir Kesar Mango and Bhalia Wheat
5) **Himachal Pradesh:** Kangra Tea
6) **Karnataka:** Coorg Orange, Mysore Betel leaf, Nanjanagud Banana, Mysore Malligae, Udupi Malligae, Hadagali Malligae, Coorg Green Cardamom, Monsooned Malabar Arabica Coffee, Monsooned Malabar Robusta Coffee, Bydagi Chilli, Devanahalli Pomello, Appemidi Mango, Kamalapur Red Banana, Udupi Mattu Gulla Brinjal, Bangalore Blue Grapes, Bangalore Rose Onion, Coorg arabica coffee, Chikmagalur Arabica coffee, Bababudangiri arabica coffee and Sirsi Supari.

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7) **Kerala:** Navara Rice, Palakkadan Matta Rice, Malabar Pepper, Alleppey Green Cardamom, Pokkali Rice, Vazhakkulam Pineapple, Central Travancore Jaggery, Wayanad Jeerakasala Rice, Wayanad Gandhakasala Rice, Kaipad Rice, Chengalikodan Nendran Banana, Marayoor jaggery and Wayanad Robusta coffee.

8) **Nagaland:** Naga Mircha and Naga Tree Tomato, Black pepper from Malabar region & Strawberries from Mahabaleshwar
9) **Manipur:** Kachai Lemon
10) **Meghalaya:** Memong Narang and Khasi Mandarin
11) **Mizoram:** Mizo Chilli
12) **Maharashtra:** Mahabaleshwar Strawberry, Nashik Grapes, Kolhapur Jaggery, Nagpur Orange, Karvath Kati Sarees & Fabrics, Ajara Ghansal Rice, Waigaon Turmeric, Mangalwedha Jowar, Bhiwapur Chilli, Sindhudurg & Ratnagiri Kokum, Waghya Ghevada, Navapur Tur Dal, Ambemohar Rice, Vengurla Cashew, Sangli Raisins, Lasalgaon Onion, Dahanu Gholvad Chikoo, Beed Custard Apple, Jalna Sweet Orange,

Jalgaon Banana, Marathwada Kesar Mango, Purandar Fig, Jalgaon Bharit Brinjal and Solapur Pomegranate.

13) Odisha: Ganjam Kewda Rooh and Ganjam Kewda Flower

14) Sikkim: Sikkim Large Cardamom

15) Tripura: Tripura Queen Pineapple

16)Tamil Nadu: Eathomozhy Tall Coconut, Nilgiri (Orthodox), Virupakshi Hill Banana, Sirumalai Hill Banana, Madurai Malli and Erode Turmeric

17) Uttar Pradesh: Allahabad Surkha Guava, Mango Malihabadi Dusseheri and Kalanamak Rice.

18) **West Bengal:** Darjeeling Tea (Word), Darjeeling Tea (Logo), Laxman Bhog Mango, Khirsapati Himsagar) Mango, Fazli Mango grown in the district of Malda, Tulaipanji

Rice: Gobindabhog and Basmati

Tea garden in Darjeeling, West Bengal

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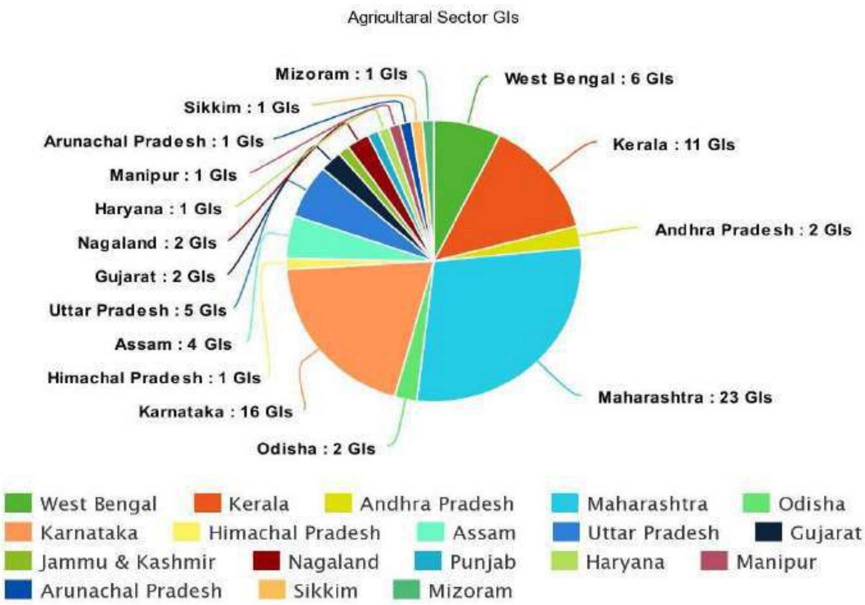

Registered GIs in India (2019)

Agriculture sector GIs

Under Manufactured goods there are very few states having registered GIs. Uttar Pradesh and Karnataka are the two both having 3 registered GIs. Kannauj Perfume, Kanpur Saddlery and Meerut Scissors are the old names in the list. There are also some foreign manufactured items which are registered as GI in India. Among them are mostly alcoholic beverages which include Peruvian Pisco, an alcoholic beverage belonging to a variety of grape aguardiente produced in Peru, Champagne and Cognac of France, Napa Valley of USA, Scotch Whisky of UK, Porto of Portugal , etc.

Geographical indication in agriculture

Seed or planting material is basic to all agricultural production. Seed costs minimum in total cost of crop production but has maximum impact. Having reaped the benefit through the seeds of green revolution varieties, farmers were quick to realize the importance of good seeds of new and better varieties of crops. For such superior seeds, farmers were even more willing to pay a higher price. Seed companies and technology developers saw this as an opportunity to convert plant varieties and important plant genes as profit – making products. Global strategy, pesticides and seed companies merged to consolidate capital and technology to dominate the market. In various countries the need to conserve biodiversity, farm level variation, giving credit to farmers for their traditional crop varieties, folk varieties, farmers varieties, access to benefit sharing, extending consumer assurance by way of geographic indications, appellation of origin, traditional knowledge etc were attempted to be protected. Global commodity trade is now dominated by several such new issues, which in India are now understood and applied. Other aspect of GI in agriculture is related the plant-based products or by-products. Plant-based products could be raw material for production or its processing or the preparation. After the GI became effective on 15th September 2003, Darjeeling Tea 12 became the first G tagged product in 2004 in India. After that landmark17, many GI-labelled agricultural products have been added (Table 1) in India.

Benefit of GI tags

The Geographical Indication registration confers the following benefits:

- Legal protection to the products
- Prevents unauthorised use of GI tag products by others
- It helps consumers to get quality products of desired traits and is assured of authenticity
- Promotes the economic prosperity of producers of GI tag goods by enhancing their demand in national and international markets.

Role of the GI in rural development

Some of the observed rural development impacts of GI are:

- The supply chain is structured around a common product reputation
- Increased and stabilised prices for the GI product
- Distributed through all the levels of the supply chain adds value
- Natural resources can be preserved on which the product is based
- Preservation of traditions and traditional expertise
- Tourism can be boosted.

Conclusion:

GI is an important tool for protecting the IP rights associated with agricultural products and foodstuffs originating in specific geographical regions. In recent times, there are considerable efforts made by various institutions and agencies in India for ensuring legal protection for Indian GI. Further, adequate promotional strategies are needed to popularize GI tagged products and to derive benefits from its commercial potential. The unique cultural aspects of rural communities associated with GI needs to be highlighted. GI tagging of foodstuffs should be restricted to those foodstuffs which are historically produced only in a specific region and are not the same when produced outside the region. Also, generic recipes for food stuffs should not be granted GI tags as they can be replicated anywhere in the world.

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Nanotechnology in agriculture, its role, favorable circumstances and pitfalls

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Introduction

The idea of applied science was born in 1959 once man of science Richard Phillips Feynman gave a lecture exploring the concept of building things at the atomic and molecular scale, and from that terribly day the Nano method is afoot in 1974, Prof. Norio Tanaguchi, projected the particular term '***nanotechnology'***.

Nanotechnology is science and engineering at the size of atoms and molecules. it's the manipulation and use of materials and devices therefore little that nothing may be designed any smaller. Nanotechnology is outlined because of the study and use of structures between 1nanometers (nm) and 100 nanometers (nm) in size. To present you a concept however tiny that's, it'd take eight hundred nm particles facet by facet to match the breadth of a personality's hair. At nano scales, the essential rules of chemistry and physics aren't applicable. Nanotechnology has gained intense attention in recent years thanks to its wide applications in many areas like drugs, medical medication, catalysis, energy and materials. Those nanoparticles with tiny size to massive expanse (1–100 nm) have many potential functions. The event of Nano chemicals has appeared as promising agents for the plant growth, fertilizers and pesticides. In recent years, the utilization of nanomaterials has been thought of as an alternate answer to manage plant pests together with insects, fungi and weeds. Many nanomaterials are used as antimicrobial agents in food packing within which many nanoparticles like silver nanomaterials are unit in nice interest. several nanoparticles (Ag, Fe, Cu, Si, Al, Zn, ZnO, TiO_2, CeO_2, Al_2O_3 and carbon nanotubes) are reportable to possess some adverse effects on plant growth except the antimicrobial properties. In food industries, nanoparticles are a unit leading in forming the food with top quality and smart nutrient price. Nanotechnology will increase agricultural production, and its applications include-

- Nanoformulations of agrochemicals for applying pesticides and fertilizers for crop improvement.
- The appliance of Nano sensors in crop protection for the identification of diseases and residues of agrochemicals
- Nano devices for the biotechnology of plants
- Disease diagnostics
- Animal health, animal breeding, poultry production
- Postharvest management.

Nanoparticles and their functions

Nanoparticles are created from Copper, Silver, Gold, oxide, silica, and noble metal additionally a great deal of beneath analysis. These particles are a billionth a part of each measurement. Those particles are smaller than viruses. They're principally oval and spherical forms. Once we convert any things in its nano particles then it shows its individual particles property.

Nanoparticles will function 'magic bullets', containing herbicides, chemicals, or genes that target explicit plant elements to unharness their content. Nano capsules will modify effective penetration of herbicides through cuticles and tissues, permitting slow and constant unharness of the active substances.

1. **Carbon Quantum Dots**

Generally, semiconductor QDs are high quantum yield and molar extinction coefficients, broad absorption spectra with narrow, symmetric fluorescence spectra spanning the ultraviolet to near-infrared, large effective excitation, high resistance to photo-bleaching and exceptional resistance to photochemical degradation. QDs have unique spectral properties compared with traditional organic dyes, thus recently, they have been applied as a new generation of fluorophores in bio imaging and bio sensing. QDs can be utilized for live imaging in plant root systems to verify known physiological processes.

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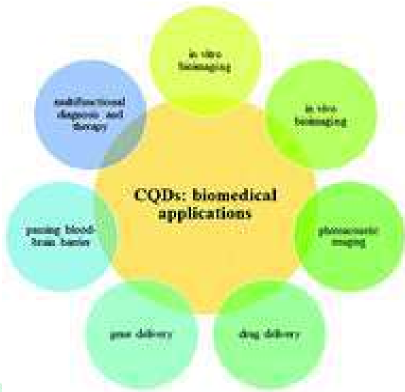
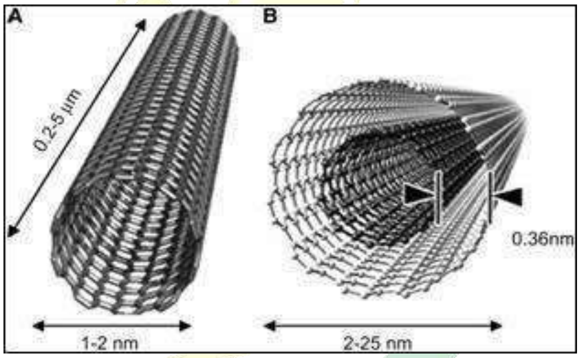


2. Carbon Nanotubes (CNTs)

It is a replacement sort of carbon, corresponding to two dimensional graphene sheets rolled into a tube. There are two main varieties of nanotubes: one is single-walled nanotubes and another is multi-walled nanotubes. It will conduct electricity higher than copper; one hundred times stronger than steel however just one sixth of its weight



3. Nanorods

Multifunctional plasmonic materials which may couple sensing phenomena well and size tunable energy regulation, are often including MEMS, and induce specific field responses.The gold nanorods considerably physiological changes occurred of watermelon plant and confirmed phytotoxicity toward plant notably at high concentration and conjointly ability to move plant hormone phytohormone 2,4-D, that resulted during a vital influence on the regulation of tobacco cell culture growth.

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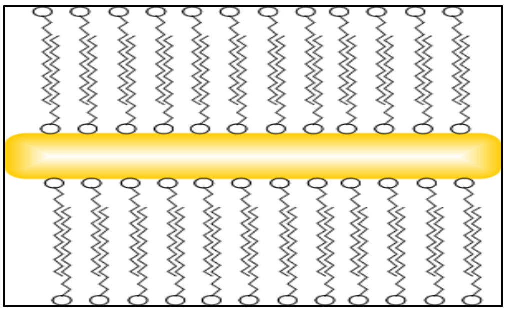
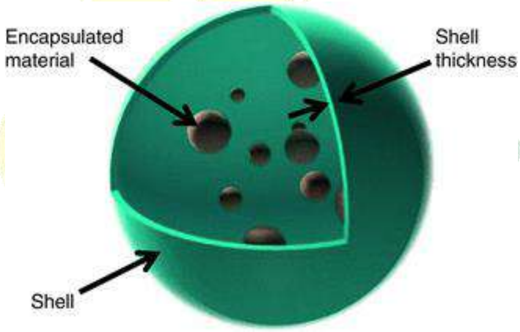


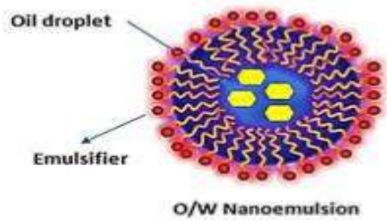
4. Micro/Nano Encapsulation:

Encapsulation is outlined as a method within which the given object is encircled by a coating or embedded in a homogenized or heterogeneous matrix. Nanocapsules are sac systems within which the substances are confined to a cavity consisting of associate degree inner liquid core boxed in by a compound membrane.Some medicines like peptides or anti-inflammatory compounds are successfully nanoencapsulated. Nanocapsules will doubtless be used as MRI-guided nano nanoencapsulated.



5. Nanoemulsions:

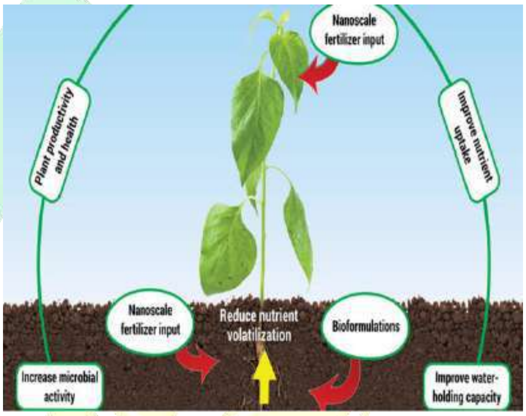
Nanoemulsions are fashioned by terribly tiny emulsion nanoscale droplets (oil/water system) exhibiting sizes below than 100nm.Due to the dimensions of droplets, the magnitude relation of expanse to volume, stargazer pressure and modulus of elasticity of nanoemulsions are considerably larger than that of standard emulsions.



6. Nano fertilizer:

A Nano fertilizer is any product that's created with nanoparticles or uses engineering to boost nutrient potency. There are three categories of Nano fertilizers are proposed:

- Nanoscale fertilizer (nanoparticles that contain nutrients),
- Nanoscale additives (traditional fertilizers with nanoscale additives), and
- Nanoscale coating (traditional fertilizers coated or loaded with nanoparticles)Nanoemulsions are formed by very small emulsion nanoscale droplets (oil/water system) exhibiting sizes lower than ∼100 nm.



7. Biosensor

A biosensor is often outlined as a sensing device or a measure system designed specifically for estimation of a cloth by exploiting the biological interactions and so assessing these interactions into a decipherable type with the assistance of a transduction and mechanical device interpretation.

Types of biosensors

1.Calorimetric Biosensors

2.Potentiometric Biosensors

3.Amperometric Biosensors

4.Conductometric Biosensors.

5.Optical Biosensors.

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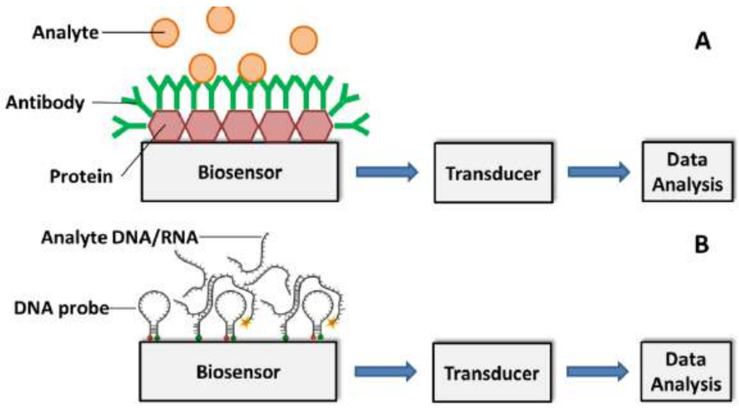
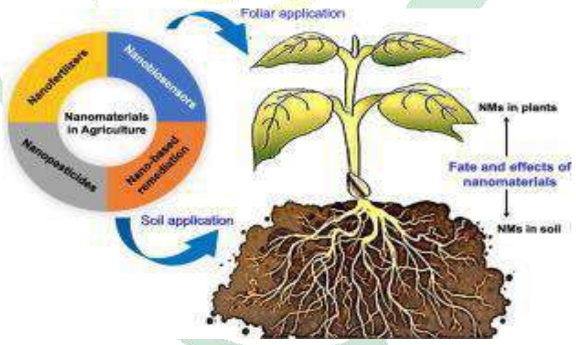


Why nanotechnology in agriculture?

In the current situation of agriculture wherever economic conditions and Hunger is increasing, there's an oversized demand for quick, reliable, low value systems for the detection, observance & identification for the biological host molecules in agricultural sectors. Chemically Synthesized Nanomaterials are thought-about to be nephrotoxic and thence Nanomaterials are synthesized from the plants and thus known as inexperienced engineering. The inexperienced engineering is:

- Safe method
- Reduces the waste created
- Lessens the emission of Greenhouse Gases.



Role of Nanotechnology in agriculture and environment:

- **Nanotechnology for Crop Biotechnology**

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Chemists have with success crafted three-dimensional molecular structures, a breakthrough that unites biotechnology and engineering. They created polymer crystals by manufacturing artificial polymer sequences that may self-assemble into a series of three-dimensional triangle-like patterns. The polymer crystals have “sticky-ends" or tiny cohesive sequences that may attach molecules in an organized fashion. Once multiple helices are connected through fiber sticky ends, there would be a lattice-like structure that extends in six totally different directions, forming a three-dimensional. This system can be applied in rising vital crops by organizing and linking carbohydrates, lipids, proteins and nucleic acids to those crystals.

Recycling of Agricultural Waste

Nanotechnology is additionally applied to stop waste in agriculture, notably within the cotton business. Once cotton is processed into material or garment, a number of the polysaccharide or the fibers are discarded as waste or used for low-value products like cotton balls, yarns and cotton batting. With the utilization of newly-developed solvents and a method known as electrospinning, scientists manufacture a hundred nanometer-diameter fibers that may be used as a fertilizer or chemical absorbent. These superior adsorbents permit targeted application at desired time and site.

Ethanol production from maize feedstock has enlarged the worldwide worth of maize within the past two years. Plastic feed stocks are currently considered a viable possibility for biofuels production and engineering can even enhance the performance of enzymes employed in the conversion of polysaccharide into fermentation alcohol.

Rice husk, a rice-milling byproduct, is often used as a supply of renewable energy. Once a rice husk is burned into thermal energy or biofuel, an oversized quantity of high-quality nanosilica is created which may be additionally utilized in creating different materials like glass and concrete.

Nanotechnology in food packaging

Food industries are a unit leading in forming the food with sensible nutritious worth. As an example, high impermeable packaging nanomaterials are used for cover of food from UV radiations and provide more strength to take care of the food shielded from the environment, increasing their shelf lives. Nanosensors units are used for the detection of chemicals, gases and pathogens in food. In trendy language, a word is given to such a sort of packaging as sensible packaging. Some studies have shown that individuals aren't accepting the direct involvement of nanoparticles in food because of some risk factors. Therefore, it's required to produce some safety measurements to cut back the danger and human safety.

Nanotechnology in Antimicrobialactivity

Several nanomaterials are used as antimicrobial agents in food packing within which silver nanoparticles are unit in nice interest. This is often attributable to its extended use. Other nanoparticles presently used are area unit titania (TiO_2), philosopher's wool (ZnO), silicon dioxide (SiO_2), mineral (MgO), gold and silver. All of them have different functions, forexample, Zn nanocrystal has antimicrobial and antifungal activity. Silver was a disinfectant and sterilizing agent employed by NASA and Russian space laboratories for water, silver mineral and silver. Gold has warm temperature stability and low volatility and sensible antifungal and antimicrobial effects against one hundred fifty totally different bacteria. AgNPs also are found to be effective against penicillin resistant staphylococcus aureus. Alternative nanoparticles besides silver also are found to own antimicrobial characteristics like titanic oxide (TiO_2). Zinc compound nanoparticles synthesized victimization dicot genus granatum peel binary compound extract have shown effectiveness as medicinal drug agents against commonplace strains of gram-positive *staphylococcus* and gram-negative *enterobacteria coli*.

Nanotechnology application as nano fungicides

Nano-silver has been studied recently against the phytopathogen *Colletotrichum gloeosporioides*. Alternative nanoparticles (Fe, Cu, Si, Al, Zn, ZnO, TiO_2, CeO_2, Al_2O_3 and carbon nanotubes) are reported to own some adverse effects on plant growth aside from the antimicrobial properties. Sometimes, nanoparticles even have an impact on the expansion of helpful soil bacterium, like Pseudomonas putida KT2440. Numerous analysis teams targeted their interest in the usage of eco-friendly pesticides. the same as chemical pesticides, nanoparticle-based pesticides and herbicides are being explored for the appliance of the antimicrobial agents to safeguard crops from various diseases. The antifungal properties of nanoparticles will facilitate the formulation of nanoparticle-based pesticides.

Nanotechnology for controlling plant virus

Plant virus significantly spherical virus is taken into account to be the natural nanomaterials. The littlest plant viruses known till date area unit satellite tobacco gangrene virus measurement solely 18nm in diameter. Plant viruses are units created from single or double stranded DNA/RNA as ordination that is encapsulated by a macromolecule coat. Their ability to infect, deliver macromolecule ordination to a particular web site within the host cell, replicate, package macromolecule and are available out of the host cell exactly in associate degree orderly manner have necessitated them to be employed in Nanotechnology.

Role of nanotechnology in agronomy

If things are through with exactitude the outcomes are increased and fewer time and economic resources are consumed. With the help of Nano sensors, we can, we are &we will be able to monitor agriculture i-e elements of the sphere are receiving less plant food, chemical or water. By knowing concerning the condition, we are able to allot our resources in such a way that every part of land gets optimum chemicals etc. within the same approach, we are able to perform physical manipulations as tillage by knowing these physical conditions of a field.

Role of nanotechnology in animal sciences

This technology finds its application in animal sciences in numerous aspects. Vaccines, probiotics and medicines once delivered at the nanoscale will be a lot of economical. At such a tiny low scale, they'll undergo numerous biological hurdles thus economical action at the targeted web site. Unleash of chemicals at a correct time and self-regulatory actions are some main necessary edges. Silver that could be a sensible antiseptic that work terribly expeditiously once delivered at nanoscale

Role of nanotechnology in environment

Nanotechnology is taking part in a subordinate role within the protection of the surroundings. The same subordinate as a result of the environmental engineering firms don't seem to be paying a lot of heed towards the utilization of this technology however still, it's a great deal of applications in utilization and saving raw materials, water and energy. It helps to mitigate the results of venturesome waste and endeavor greenhouse effects.

Advantages of nanotechnology

1. Nanotechnology helps to deliver agricultural chemicals like plant growth regulators, fertilizers, pesticides, herbicides etc.
2. It helps to monitor the environmental stresses and crop condition.

3. Nano sensors to find out the contamination in the food before packaging and distribution.
4. Nano engineered materials in the food industry involve nanocomposites, Nano encapsulation in food containers.
5. Resource management in agriculture.
6. It helps to maintain soil fertility.
7. It helps to enhance food packaging and food processing systems and also yield.
8. Risk assessment.
9. Aids in improving the efficiency of microorganisms in degradation of waste & toxic materials.
10. Monitoring of contamination in soil & water.
11. Biochemical sensors, electrochemical sensors, optical sensors for detection of heavy metals.

Disadvantages of nanotechnology

1. Nanoparticles can enter the body through lungs, skin, digestive system and create free radicals that can cause cell damage.
2. It can be able to cross the blood - brain barrier.
3. Loss of employment jobs.
4. Very expensive.

Conclusion

Nanotechnology can play a significant role within the development of the agricultural sector, because it is capable of getting used in agricultural products that shield plants and monitor plant growth and discover diseases. Scientists are working towards exploring new applications of nanotechnology in agriculture and therefore the food industry - if these discoveries are applied sensibly, the setting, the agricultural sector and therefore the food business can so see tremendous changes for the higher within the coming back years.In spite of being relative blessings in the agriculture method, still developing countries are plagued by an absence of high importance of food products. Despite heaps of knowledge regarding individual nanomaterials area unit obtainable, however the toxicity level of the many NPs continues to be indefinable, so the appliance of those materials is proscribed because of the dearth of information of risk assessments and effects on human health.

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Role and mechanism of botanicals in pest management

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ARTICLE ID: 044

Abstract

Pest management is one of the essential components in the agriculture. Conventional pesticides caused various environmental issues such as imbalances in the ecosystem, loss of soil fertility, and deterioration of marine life. Conventional pesticides also caused various harmful and serious issues on the humans and animal health leading to severe cancers, neurological disorders, hormonal disturbances, and reproductive issues. Botanical pesticides obtained naturally from plant-based chemicals were found to be an effective alternative to conventional pesticides. Neem based pesticides are one of the most important botanical pesticides used widely in India for agricultural pest management followed by pyrethrum, and Eucalyptus oil based pesticides. Various botanical pesticides are used in the conventional, sustainable and integrated pest management.

Introduction

Botanicals are derived from fresh or dried plants, plant parts, or plants' isolated or extracted in water, ethanol, or other organic solvents used for flavouring, fragrance, functional health benefits, medicine, or other biological and technical activities. These are naturally either occuring plant products or materials derived rather simply from plant materials. These may be crude preparations of plant parts ground to produce a dust or powder that may be used full-strength or diluted in carriers such as clay, talc or diatomaceous earth. Some worth mentioning are discovery of pesticidal properties of perthenin (from *Parthenium hysterophorus*) and related compounds, insect growth inhibition, antifeedent and antifungal activity of compounds isolated/derived from *Zingiber officinale* Rosae (Ginger) rhizomes, Antifungal activity of limonoids from Khaya ivorensis, Antifeedant/IGR activity of Aza-A and Tetrahydro Aza-A against *Helicoverpa armigera*.

All of the researches showed a general trend of getting specific, bioactive, and safe molecule with least environmental hazard and main emphasis is given on producing analogues of existing bioactive molecule and exploitation of the unexplored wealth of flora and fauna for plant protection, which will certainly be a distinct order of tomorrow. As they contain a virtually untapped reservoir of pesticides, they can be used directly or as templates for synthetic pesticides. Numerous factors have increased the interest of the pesticide industry and the pesticide market in this source of natural products as pesticides.

Why Botanicals?

Botanical pesticides are environmentally safer, unique with novel mode of action, rich source of biologically active compounds. There is still an unexplored area of study in the field of agrochemicals, chemically complex in nature and different stereoisomers are possible imparting less resistance, showed excellent activity in pharmaceuticals.

Botanical are now emerging as a viable component of integrated pest management (IPM) strategies for all crops due to their:

- Efficacy to managing pest,
- Environmental and public health safety,
- Eco-friendly nature, and cost effectiveness
- Rich source of biologically active compounds
- Very useful tools in organic agricultural system.

Recent Development in Botanical pesticides

Now a day's scientists are working to develop some new botanical pesticides, which are very safer for human beings. Some of these are discussed below:

1. Pyrethrins

Pyrethrins, which are esters with insecticidal properties, are obtained from pyrethrum (*T. cinerariaefolium*) flowers. The compounds obtained from this plant which have known insecticidal activity are six esters formed by the combination of the acids chrysanthemic and pyrethric and the alcohols piretrolone, cinerolone and jasmolone. These compounds act both on the central nervous system and in the peripheral nervous system causing repetitive discharges, followed by convulsions. Research has shown that these compounds block sodium ion influx resulting in the channels being affected by intermolecular forces which causes alterations in moving ion conductivity as a result of the changes in the channels. There is no doubt that the most important characteristic of these compounds is their irritating effect or "knock down" which causes the insect to stop feeding as soon as it encounters a treated surface. Pyrethrins are the best example of products copied in the laboratory since their modifications gave rise to the pyrethroid family of insecticides.

2. Azadiractin

This compound is a tetraterpenoid characteristic of the Meliaceae family but particularly from the Neem tree (*A. indica*), indigenous to India. The compound is found in bark, leaves and fruits of the tree but seeds have the highest concentration. This compound has not yet been synthesized in the laboratory, but when isolated and tested pure the results have been less than when extracts are used. In the extract 18 compounds have been identified among which salanine, meliantrol and azadiractin are most prominent, the latter being in the highest concentration. Azadirachtin shows antifeedant activity, is a growth regulator, inhibits oviposition and is also a sterilizing compound. Today, commercial formulations of neem may be found with names like Neem Gold, Neemazal, Econeem, Neemark, Neemcure and Azatin among others, in many countries including the United States, India, Germany and several Latin American countries. Nicotine is an alkaloid obtained from some plants in the Solanaceae family, particularly tobacco (*Nicotiana tabacum*).

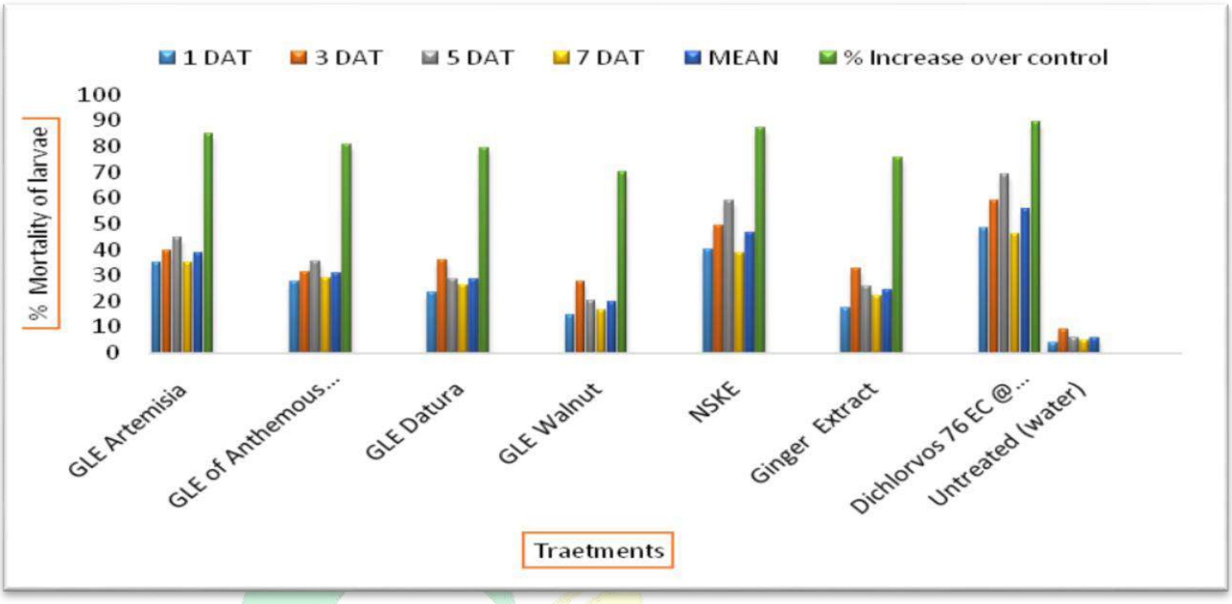

Fig: 2 Efficacy of various botanicals and DDVP against *Mythimna separata in Oats*

Among all plant extracts, 5% NSKE found effective against M. *Separata* with highest mean percent mortality of 46.65% and reaming extracts with decreasing order of efficacy treated with Neem seed extract as compared to the control where the lowest average yield of 6.52 was recorded.

3. Nicotine

The insecticidal properties of nicotine were recognized in the first half of the XVI century. This compound is not found free in the plant but in the form of maleates and citrates. Nicotine is essentially a non-persistent contact insecticide. Its mode of action consists in mimicking acetylcholine when it binds with its receptor in the post-synaptic membrane of the muscular union. The acetylcholinic receptor, is a site of action of the postsynaptic membrane which reacts with acetylcholine and alters the membrane permeability. Nicotine activity causes the production of new nerve impulses which cause convulsions, and death. An important new class of insecticides, commonly known as neo-nicotinoids, are synthetic copies or derivatives of the nicotine structure. These include imidacloprid, thiacloprid, nitempiram, acetamiprid and thiamethoxam, among others.

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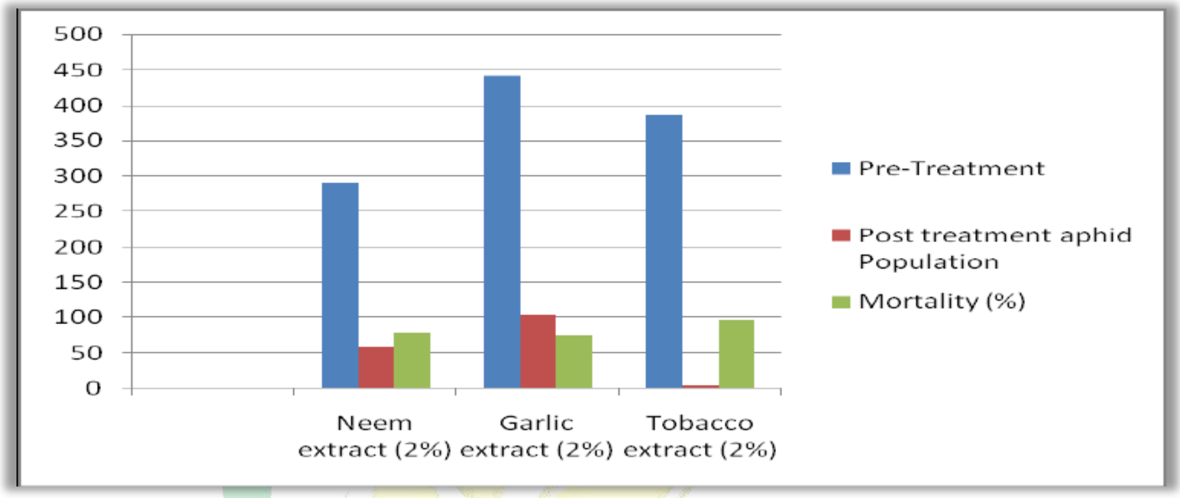


Fig: 1. Efficacy of various botanical pesticides after 24 hours spray interval presented in graph for comparison.

Fig. 1. indicated that the spraying tea cutting with tobacco extract (2%) caused highest mortality (98%) of aphid, where its population reduce to 5% treatment over pre-treatment population of 386. Neem extract (2%) ranked second in relation to efficacy against aphid with insect mortality 80%. Garlic extract (2%) was least effective against aphid with mortality of 75%.

4. Rotenone

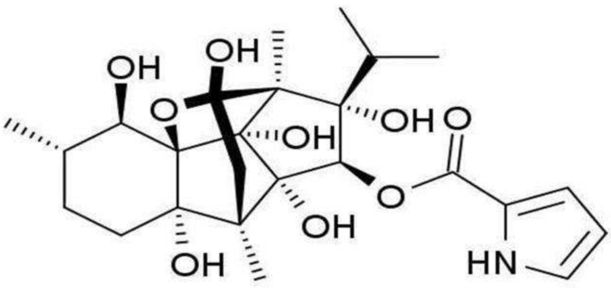
Rotenone is a flavonoid extracted from the roots of two plants: *Derris* spp. (Fabaceae) and *Lonchocarpus* spp. (Fabaceae). The first one gives up to 13% of rotenone while the second only about 5%. *Derris* spp. is a native to Eastern tropics, while *Lonchocarpus* spp. is native to western hemisphere. Rotenone is a contact and ingestion compound, which acts as a repellent too. Its mode of action involves the inhibition of the electron transport at the mitochondrial level, thus blocking phosphorylation of ADP to ATPthereby inhibiting insect metabolism. Insects poisoned with Rotenone show the following symptoms of intoxication: a drop in oxygen consumption, respiratory depression and ataxia leading to convulsions and finally to paralysis and death by respiratory arrest.

5. Sabadilla

This is a compound that can be obtained from seeds of a plant of South American origin known as *Schoenocaulon officinale* (Liliaceae). Seeds of this plant have been shown to have high concentrations of alkaloids which impart its toxic properties. The mode of action is disruption of neuron cell membranes causing reduction of nerve activity, paralysis and death. The ground seeds are one of the plant insecticides with the lowest mammal toxicity but that is not the case with their isolated alkaloids which are both highly toxic and skin irritants.

6. Ryania

This compound is obtained from the roots and stems of a plant native to South America known as *Ryania speciosa* (Flacourtiaceae). From this plant may be obtained a series of alkaloids, of which the most important is ryanodina. This alkaloid is effective as a contact or stomach poison and directly prevents muscles from contraction, causing paralysis.



Environmental impact of Botanical pesticides

They are environment friendly, biodegradable and very less residue problem, target specific and safe to beneficial organisms like pollinators, predators, parasites, growth of natural enemies of pests is not affected and thus reducing the pesticide application.

Effect on non-target organisms

The results of a number of studies have been revealed that botanical pesticides are relatively safe to non-target organisms, natural enemies, pollinators, fish, bird and fish, predators, parasitoids, pollinators, secondary insect pests, wild relatives of crops, and soil biota.

Scope of Botanical Pesticide in India

The use of botanical pesticide plays an important part of IPM program over the synthetic pesticides. Naturally occurring botanical pesticide exerts a wide range of behavioral and physiological effects on insects and it is difficult for insect to develop resistance to these pesticides. Village cooperatives can take up formulation of locally available plants and thus, farmer will be saved from spending large sums of money for the purchase of costly synthetic agrochemicals. There is a great demand in international market for residue free cotton, fruits, vegetables, and beverages.

Conclusion:

Botanical insecticides are natural chemicals extracted from plants with insecticidal properties and used as an excellent alternative to synthetic or chemical pesticides for crop protection to avoid negative or side effects of synthetic insecticides. Botanical pesticides (such as Pyrethrum, Neem, nicotine etc..) have various chemical properties and modes of action and effect on insects in different ways namely; repellents, feeding deterrents/antifeedants, toxicants, growth retardants, Chemosterilants, and attractants. So it is preferable to use the botanical insecticides instead of synthetic insecticide and these botanical insecticides are recognized by organic crop producers in industrialized countries. So, we recommended using botanical insecticidal and being promoted and research is being conducted to find new sources of botanical insecticides.

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Snail Farming: Boost to Agriculture Export

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Humans have been consuming snails for thousands of years. They are very high in proteins, iron and water but are low in Fat. Snail consumption is popular in various countries around the world. Presently, global snail farming or heliciculture industry achieves sales of greater than 12 billion US dollars annually.

History of snails as food

According to different archaeological surveys and evidences, it is known that ancient humans ate snails as piles of empty snail shells have been recovered from many pre-historic sites. A study revealed that snails used to be an extra food source for Palaeolithic humans in spain. For over 30,000 years, the Iberus aloneness snail has played a role in the gastronomy of Spain. The Benidorm area of Spain is believed to be the first recorded place where humans consumed snails. Around 10,000 years later, people along the Mediterranean coast of Northern Africa, Italy, France, Greece and the Middle East were eating snails.

Major snail consuming countries

The countries in which snail is used in food and various stuffs like, Abalone is a common feature of Chinese cuisine and are called Bao Yu in mandarin. There is other type of snails eaten in China, too and it's not just the Chinese. The Kiwis, Brits, Americans, and plenty of other people eat it. It is known as Paua in New Zealand and Ormer in the UK.

In the Bahamas, conch is eaten raw and is often viewed as an aphrodisiac. In Vietnam, snails are a common pastime food. There are stalls set up that feature a wide variety of snails and apple snails are commonly eaten. In Japan, Turbo snails, whelks and abalone are eaten as sashimi. The Romans popularized snail eating in Europe and it is now a feature of Spanish, Italian, Portuguese, Greek and of course French cuisine.

In Korea, whelks are eaten and there is also the dalseulgi (*Semisulcospira libertina*) and bladder moon snail which are commonly eaten. In Africa, the Giant African Land Snail (*Achatina fulica*) is eaten and it is a staple of Nigerian cuisine. In the USA, there are conch fritters, boiled periwinkles and a variety of water snails available on the seafood market. Conch were commonly eaten by the aboriginal Americans and in some places, the tribes have left their marks by leaving piles of shells.

Nutritional value and health benefits of Snails

A 3-ounce serving of cooked snails delivers 76 calories with No Cholestrol or sugar as well as 1/3rd of daily Vitamin-E requirement of an adult. It promotes the production of red blood cells that benefits muscle and tissue growth. Additionally, it can provide one half of daily recommended selenium intake. Selenium is an antioxidant mineral that helps in preventing heart diseases and thyroid. Snails also have high mineral content. A single serving of escargot provides 1/6th of daily requirement of iron, 10% of potassium, 1/3rd of phosphorous and 2/3rd of magnesium. Snails also contain a chemical named Tryptophan which is healthy for Brain and is also a good mood booster.

Climate and soil required for proper snail cultivation

Snails flourish in mild climate (55-77°F) and high humidity about 75% - 95%. Although most varieties of snails are tolerant to climate but for cultivation purpose high yield is necessary which can be obtained only by providing favourable conditions for their growth and production. If temperature falls below 7°C the snails hibernate. Below 12°C the snails are inactive and blow 10 growth stops. Temperature above 27°C or too much dry conditions result in snails to aestivate. Wind is bad for snails as it speeds up moisture loss and snails must retain moisture to survive.

Snails thrive in damp and waterlogged conditions and thus well-drained soil is required. Various researches indicated that 80% of humidity and 80% of water carrying capacity is the most favourable condition. Mist spraying devices and sprayers may be used to maintain the humidity and temperature. Also if the system contains alive vegetation the leaves should be wet. The soil composition should consist of neither too much clay nor too much sand as hard soil is difficult for them to dig and sand has very big pore spaces hence the water is drained excessively. The presence of 20-40% of organic matter stimulates higher growth and cation exchange capacity of calcium as well as magnesium increases. The pH must be around 7 neither acidic nor basic. There should be adequate amount of calcium in the soil so that the primary constituent of shell demand can be completed and growth is not retarded. Addition of limestone to the soil can greatly improvise the calcium content of the soil. Calcium may also be set in tough or feeding fish so that snails can feed into it. Moreover, addition of polyacrylamide to the soil also can improvise soil health.

Soil mix may contain peat, clay, compost and CaCo3

The soil may be provided with leaf mould at 7 pH.

Market value in India and export

There are different varieties of snails which are widely consumed by peoples in different parts of India.The north-east states such as ArunachalaPradesh, Mizoram, Nagaland, Sikkim are consumers of snails. Moreover, peoples from parts of west Bengal, Odisha and many restaurants prefer to serve their guests with delicious snail cuisine.Indian Economy is agricultural economy, countries 70% of the population is dependent on Agriculture.Export market is very big for snail in foreign markets. It can greatly contribute to the income of country. There is a great potential for export market in snail cultivation sector.

Conclusion

Snail cultivation does not require any special arrangement hence is cost-friendly, it also does not require any special care and feed though, it provides a good financial support to the farmer. It can be a good side business for the farmers. Snail has also wide range of nutritional value hence it is good optional supplement for people. It has great potential for export market as many Asian, African, American and European countries have huge number of snail consumers. Indian farmers can export their cultivated variety of snail and can get good amount of money and also it will contribute to the country's GDP.

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Silage Making Uses to Reduce the Feeding Expenditure

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Introduction

Dairy farming is one of the oldest and well established subsidiary occupation and most widely adopted by all over farming community of Punjab state. Every farmer, if wish to start any entrepreneurship along with agriculture—First Think upon Dairy Farming.The latest training, new techniques and research work help in making this business work better. The present number of cattle in Punjab is about 81.2 lakh, which has 62.4 lakh big animals. There is a need for substantial increase in the current yield of green fodder to provide complete and good quality feed to the animals. One animal gets 30.65 kg of fodder per day, which is very low. If 40 kg of green fodder is found in a large livestock daily, then there is an annual requirement of 911 million tonnes of green fodder. It is clear that the shortage of green fodder has been visible in the growth of dairy. For the sake of this shortage, the area under green fodder should be increased or the cultivation of green fodder with maximum yield and the excess quantity of green fodder should be conserve as silage, which is used during the lean period of time.

Excess of production of green fodder will be stored as silage. To make silage, non-legume crops such as maize, sorghum (jawar), bajra, napier bajra and Guineagrass are suitable for *kharif* fodder, because of these crops have low amounts of carbohydrate and the amount of protein is low. There is an extra availability of green fodder from July to September in the year. There is a severe shortage of green fodder during the months of October to November. At this time, additional green fodder from July to September can be used by making silage. Animals can be reared by mixing the fodder crops such as berseem/Lucernealong with non-leguminous crops like maize or sorghum.

Benefits of making silage:

- Used as feed/fodder when there is scarcity of green fodder.
- Costly grains and feed will be saved.

- Fodder crops are harvested at maximum nutrients stage, which is very beneficial to dairy animals.
- Every day the cost of wages on cutting/chopping of green fodder and time will be saved.

Optimum time to cut fodder for making silage:

Harvest the fodder crop to make silage when the crop is at their full nutrient stage and the amount of dry matter is high. The amount of dry matter in the fodder should be 30-35%. For preparation of silage, the appropriate time of harvesting various crops is as follows:

The right time to cutting for making silage:

Fooder crop	**Cutting stage**	**Sowing tocutting time (days after sowing)**
Maize	Flowering to milking stage	55-65 days
Sorghum	Booting to milking stage	65-85 days
Bajra	Booting stage	50-55 days
Oat	Booting to milking stage	110-120 days
Napier bajra and Guinea grass	One metre tall	After 60 days

The moisture content in fodder should be 65-70% for silage. If the moisture content is high, then dry the fodder for one day after cutting the fodder. Crop harvested at the above given stages usually have the desired dry matter content. However, napier bajra hybrid and guinea grass need one or two days for drying in the field before chaffing to reduce the moisture. We can see the quantity of moisture in the fodder by twisting the chops in the hands. If the hand does not feel lean, the fodder has enough amount of dry matter.

Appropriate place for silo-trench: To make silage, the silo-trench should be built in a high and sloping area near animal shed, where there is no rain or other water, otherwise the fear of spoiling the silage with water is maximum which spoil the silage as well as deteriorate the quality of silage.

Planning of the silo-trench to prepare forsilage making: Depending on the size of the silo-trench, the number of animals, the amount of green fodder and period for which to be conserved and the availability of green fodder. There are many types of silo-trenches, such as the trench-silo, tower silo, powerhouse-silo and silo pit. The silo-trench depends on the amount of additional green fodder. Generally, in one cubic metre space, 5-6 quintals of chaffed green fodder can be packed. In 10-metre-long, 3-metre-wide and 2-metre-deepsilo-trench about 325 to 360 quintalschopped green fodder can be packed, which is enough to feed 10 dairy animals for four months at 20-30 kg per head per dayduring the lean period. The length of the silo-trench can be much or lower as per their requirement according to the number of animals and their need. The depth of the silo-trench should always be 1.5-2.0 metres. The trench should be made at a high point near the animal shed. It must be made the pucca and plastered with cement from inner side.

Method of silage making:

- Chop the harvested fodder crop to the length of 5 to 8 cm and fill it in the silo-trench.
- The silo-trench should be filled in the shortest time (maximum 2 days). Silage should always be made in dry days.
- With the help of a tractor or a bull, press the chaffed fodder in the silo-trench and regularly press of each half metrethick layer of chaffed fodder. Keep it one meter above the surface of the ground.
- Cover the fodder with 10-15 cm thick of straw/residues. Then put soil on it and finallymud-plaster. Silo-trench should be completely air-tight.
- Cover the silo-trench well with polythene seats. After finishing the above, put 2-3-inchlayer of thick soil. The edges of thesilo-trench can also be closed with dung soil.
- Keep an occasional watch and if there is anycrack or hole, plug it immediately. Silage will be ready in 45 days.

Identification of accurate silage:

- The best silage color will be bright yellow. If any kind of negligence occurs, results in the change of color to brown. From the best silage comes the aroma of vinegar.
- A well prepared silage has pH (acidity) of 4.5 and is low in losses of nitrogen. A goodquality silage retains the nutritional value of original crop and has a high lactic acidand a low butyric acid content.

Method of opening the silo-trench:

- When using silage, open the silo-trench from the width side that air seems to be the least.
- Take out the daily requirement of the feed and covered the remaining silage. This way the silagestays good till used.

Use of silage in animal feed:

- Animals do not like silage for the first few days. For this, first 5-6 days, add 5-10 kg of silage green fodder to the animals. Later silage can be fed to every animal at 20-30 kg per day mixing with other green fodders.
- Do not fed up the silage during milking, otherwise the fragrance will come in milk.
- Silage must be fed after or before 5-6 hours milking.

Diet management: Different types of animals should be given different amount of silage, which is as follows:

Amount of silage for animals

Cattle	Amount of silage
Calves	10-12 kg
Milch cows	20-25 kg
Milch buffalos	25-30 kg
Pregnant dairy animal	15-20 kg
Bulls	20-25 kg

Summary

It is clear from the above facts that these aspects will help to meet the shortage of green fodder. Such tips are effective in reducing cost of milk production and increase the income from dairy unit. All these facts are helpful to the dairy industry to prepare cheap and balanced ration which is available in abundant and used during the lean period of fodder. The fodder is easily available in the farm field and not gives the good return, if sale as raw material in open markets. But if conserve as silage, results in very good feed to the dairy stock and improves the production and reproduction performance of dairy stock.

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Agronanotechnology

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Introduction :

Agriculture is the major source of income in developing countries, it provides food and fodder. Indian agriculture suffers from low productivity due to conventional farmers' practices. Indian population is increasing at alarming rate. Therefore, it is crucial time to use modern technology such as bio and nanotechnology to maintain the ever increasing demand of food crops.

Nanotechnology is defined as the branch of the science that deals with the understanding and control of matter at the dimensions of about 1-100 nm, and their implications for the welfare of humans .

Globally, a large proportion of people face daily food shortage due to changing agro-climatic conditions particularly in developing countries. The situation is even poor in developing countries. Thus, there is need to develop drought and pest resistant crops with increased minerals uptake to maximize production . Nanotechnology will increases the crop yield by withstanding environmental conditions, detection and control of crop diseases, improved crops with efficient capabilities for mineral uptake from the soil. Although the scientific studies on the applications of nanotechnology in the agriculture are less than a decade old yet the prospects of nanotechnology in this field are considerable. Nano-technology is making its way in agriculture throughout the world. Traditional farming techniques have attained saturation and are neither able to increase productivity nor able to restore ecosystems damaged by existing technologies. The global requirement of food is increasing gradually. Nanotechnology would prove a boon for modern agriculture farming by increasing the efficiency of nutrient uptake employing nano fertilizer.

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Areas of Nano-science Research in Agriculture And Food Science

Contribution of nanoscience research in agriculture will be in the following areas:

- Food safety and biosecurity.
- Material science.
- Food processing and product development.

Applications of Nanotechnology :

- **Detection and control of the plant diseases :**

  Nanoparticles may be useful in the treatment and monitoring of food crops diseases by targeting pathogens . Some of the nanoparticles are nano-forms of carbon, silver, silica and alumina silicates that are use in control of crops diseases. Nano silver is the most exploited nano particles in biological system. The capsulated nano silver removes unwanted microbes in planting soils and restricts several other plant diseases .

- **Nano-fertilizers :**

  The augmentation of fertilizers in soil is essential to supplement the soil fertility for better yield of food crops. However, the use of chemical fertilizers cause many adverse environmental effects and damaged the soil health. Thus, there is requirement a new cost effective ecofriendly technique for better crop production. In this context, the use of nano-fertilizers instead of using conventional fertilizers will assist in controlled release of nutrients in soil and prevent loss due to chemical fertilizers. In nano-fertilization, nutrients may be entraped using nano-materials coated with a thin film or delivered as emulsions. The slow release of nutrients from nanoparticles coated fertilizers increase the use efficiency of nutrient by crops.

- **Nano-pesticides :**

  In agriculture, pesticides or weedicides are used to control pests or weeds for increasing crop yield. However, they also damage the soil health. Nano-pesticide is an agro-chemical combination used to overcome the problems caused by conventional pesticides . Several types of materials viz., surfactants, organic polymers and mineral nanoparticles that fall in the nanometer size range are used in formulation of nano-pesticides. The new generation of nano-pesticides will be specific in action against insects and does not have any other harm to other important insects of soil.

- **Nano-sensors**

The crops growth depends on proper agro-climatic conditions. For effective protection of crops, the fast and sensitive sensors are required to detect plant pathogens. Nanosensors can be use all over the agricultural fields for monitoring the fertility of soil and other climatic conditions.

- **Nano-fibers**

Nanotechnology with use of biological, chemical and physical processes plays a role in recycling the residual materials of agricultural products to energy and industrial chemicals. For example when cotton is processed into fabric or garment, some of the cellulose or the fibers are discarded as waste or used for low-value products such as cotton balls, yarns and cotton batting. With the use of newly-developed solvents and a technique called electro spinning, scientists produce 100 nanometer-diameter fibers that can be used as a fertilizer or pesticide absorbent. These high-performance absorbents allow targeted application at desired time and location . Nano-fibers are also used for encapsulating chemical pesticides, to prevention of scattering of chemical pesticides in the environment and water and soil pollution. This technology increases the chemical pesticides durability and security applications. When the fibers are degraded through biological, chemical materials are released slowly in the soil. When hydrophobic organic pollutants are enters to the soil through water, easily absorbed by the water insoluble solids. Porous nano-polymers have a very similar to the pollutants molecules, and considered the most suitable means for separating organic pollutants of soil and water. Similar nano fiber-based fabrics are being used as a detection technology platform to capture and isolate pathogens. The nano fibers in this fabric are embedded with antibodies against specific pathogens. The fabric can be wiped across a surface and tested to determine whether the pathogens are present, perhaps indicating their presence by a change in colour.

- **Nano silver:**

  Nano silver is the most studied and utilized nano particle for bio-system. It has long been known to have strong inhibitory and bactericidal effects as well as a broad spectrum of antimicrobial activities. Silver nano-particles, which have high surface area and high fraction of surface atoms, have high antimicrobial effect as compared to the bulk silver. Antifungal effectiveness of colloidal nano silver (1.5 nm average diameter) solution, against rose powdery mildew caused by Sphaerotheca pannosa Var rosae. It is a very wide spread and common disease of both green house and outdoor grown roses. It causes leaf distortion, leaf curling, early defoliation and reduced flowering. Double capsulized nano silver was prepared by chemical reaction of silver ion with aid of physical method, reducing agent and stabilizers.

Nanoformulations For the Control of Plant Diseases

Nanotechnology provides new ways for improving and modifying existing crop management techniques. Plant nutrients and plant protecting chemicals are conventionally applied to crops either by spraying or broadcasting. Due to problems such as leaching of chemicals, degradation by photolysis, hydrolysis and microbial degradation, only a very low concentration of chemicals which is much below the required minimal effective concentration, reach the target site of crops.

Recent Developments

With nanotechnology gaining recognition in the agricultural and food sectors, scientists and experts in the scientific field have recently showcased their nanotechnology expertise to farmers in Africa.

Three significant innovations were demonstrated:

- The scientists have planned to develop a plastic storage bag lined with nanoparticles that are capable of reacting with oxygen and preventing cassava from rotting. In this way, the African farmers can prolong the shelf life of cassava and prevent wastage of this vegetable.

- A milk container was designed with a nano patterned, antimicrobial coating that helps the diary farmers in Africa to preserve milk for a prolonged time period as they take almost a whole day to reach

- The cooling centers. These nanotechnology-based milk containers replace the currently used plain plastic bags.

- The scientists have also planned to develop nanopatterned paper sensors to detect bovine pregnancy in order to enable the dairy farmers determine if their cows will run dry without milk due to udder infection or pregnancy.

- Plant mineral nutrition is important for obtaining higher agricultural productivity to meet the future demands of the increasing global human population. It is envisaged that nanotechnology can provide sustainable solutions by replacing traditional bulk fertilizers with their nanoparticulate counterparts possessing superior properties to overcome the current challenges of bioavailability and uptake of minerals, increasing crop yield, reducing fertilizer wastage, and protecting the environment. Recent studies have shown that nanoparticles of essential minerals and nonessential elements affect plant growth, physiology, and development, depending on their size, composition, concentration, and mode of application. The current review includes the recent findings on the positive as well as negative effects that nanofertilizers exert on plants when applied via foliar and soil routes, their effects on plant associated microorganisms, and potential for controlling agricultural pests. This review suggests future research needed for the development of sustained release nanofertilizers for enhancing food production and environmental protection.

Plant Pathogens in Biosynthesis of Nanoparticles

Fungi:

Fungi are relatively recent in their use in synthesis of nanoparticles. There has been a shift from bacteria to fungi to be used as natural 'nanofactories' owing to easy downstream processing, easy handling and their ability to secrete a large amount of enzymes. However, fungi being eukaryotes are less amenable to genetic manipulation compared to prokaryotes.

Bacteria:

Among microbes, prokaryotes have received the most attention for biosynthesis of nanoparticles. Bacteria have been used to biosynthesize mostly silver, gold, FeS and magnetite nanoparticles and quantum dots of cadmium sulphide (CdS), zinc sulphide (ZnS) and lead sulphide (PbS).

Plant virus:

Plant virus especially spherical/icosahedra viruses represent the examples of naturally occurring nano-materials or nano-particles. The smallest plant viruses known till date is satellite tobacco necrosis virus measuring only 18 nm in diameter. Plant viruses are made up of single or double stranded RNA/DNA as genome which is encapsulated by a protein coat.

Conclusion

Nanotechnology will play a vital role in the development of the agricultural sector, as it is capable of being used in agricultural products that protect plants and monitor plant growth and detect diseases. Scientists have been working towards exploring new applications of nanotechnology in agriculture and the food industry - if these discoveries are applied sensibly, the environment, the agricultural sector and the food industry will indeed see tremendous changes for the better in the coming years.

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Problem of Farmers in Himachal Pradesh

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Agriculture plays an important role for increasing the income and nutritional status of the people in the state. Agriculture is the main occupation of the peoples of Himachal Pradesh. The geographical area of Himachal Pradesh is 55.67 lakh hectare (55,673 sq. km) out of which the gross cropped area is about 9.51 lakh hectares, with a net area sown of approximately 5.38 lakh hectares. The demand for food is continuously increasing day by day that result in the significant increase in the prices of food grains, which has made farming profitable to the farmers and sellers. But farmers are facing lot of problems related to crop production, transportation and marketing etc.

Problems:

Production Problems – To increase the production, it is very important to maintain the productivity at a level. Following are the production problem faced by the farmers:

a. Land: For cultivation, land is the primary requirement. The size of cultivable land is small (58.12%), marginal (32.51%) and large (9.37%). The quality of soil is also poor in some areas. In maximum cases the land holding is small and lack of water management which results in low production and income to the farmers in Himachal Pradesh.

b. Skilled Labour: Skilled labour is also a serious problem in the state. Maximum farmers have failed to get the skilled labour on time. When the farmers get skilled labour then the problem of wages arises because the labourers used to charge high wage rate from them. In most of cases the wage rate charged by the labour is high that results in increase of cost of production

c. Availability of Seeds (High Yielding Variety Seeds): The good quality and High Yielding Varieties (HYVs) of seeds is one of the key inputs to enhance the crop yield. For the use of these types of seeds, price, availability of HYV's seed on time also plays an important role. If the price of seed is higher, then many farmers would be tempted to use any other available seed. Many farmers failed to get the HYV's seed on time which decreases the production.

d. Irrigation: In Himachal Pradesh, Irrigation is one of the major problems. About 81% of the total cultivated area in the state is rainfed. In Himachal Pradesh, rainfed farming is mostly followed i.e. farmers depend on rain water for irrigation. This is because approx 85% of farmers do not have any permanent source of irrigation. Remaining 15% of farmers have permanent source of irrigation (like wells, ponds, hand pumps etc). The dependence of farmers on rain water lowers the crop yield.

e. Fertilizers: The availability and price of fertilizers on time is also a major factor. Approximately 75% of farmers get fertilizers on time. About 70% of farmers reported that price of fertilizers is not reasonable. In most of the cases, farmers get fertilizers on time, yet the prices of these fertilizers were comparatively high. In this regard it can be suggested that the state department should ensure timely and adequate supply of fertilizers with reasonable prices to the farmers

f. Plant Protection Chemicals: Farmers need to use various chemical to control the diseases, and insect pests etc. that results in the increase the crop production. For the use of these chemicals, farmers must have the knowledge about their use, doses, timing of use etc. Many farmers are failed to identify the symptoms of disease and insect pests due to lack of knowledge. After that availability of chemicals at reasonable prices is the major factor. About 85% of farmers reported that the prices of these chemicals are very high. Due to the high prices of these chemicals and lack of knowledge the farmers hesitated to use them which lower the production and income.

2. Marketing Problems: Efficient marketing is very important for the farmers to fetch the remunerative prices for their produce. Lack of markets and improper marketing practices leads to a complicated nature of marketing of the agriculture produce in the hills and affects the income of the farmers. The problems regarding marketing faced by the farmers of Himachal Pradesh are as follows:

a. Grading: Grading is the basic and one of the most important marketing activities in post-harvest management to be done by the farmers to fetch the remunerative prices for their produce. Many farmers face the problem of non-availability of grading centre. About 85% of farmers reported that grading is done manually and grading centers are not near to their place. Grading is done by hands and they also feel that grading done by hand is costly and time consuming.

b. Packing: Packing is one of the most important marketing activities in post-harvest management to be done by the farmers to fetch the remunerative prices for their produce. Proper packaging is required especially in case of Horticultural crops like fruits and vegetables w.r.t. protect the produce for breakage during the transportation. Cost, quality and availability of packaging material on time is very important factor. 1/3rd of farmers reported that the packing material is costly.

c. Transportation: Transportation facility is utmost important factor for marketing and to fetch the desired amount of money from selling the agricultural produce. Most of the fruit production in temperate region and off-seasonal vegetable production are in hills with broken topography and difficult means of communication, located far away from the markets. Development of better road system including link roads, cableways, efficient and full proof communication system and creation of modern markets are some of the important requirement for advancement of the agricultural exports outside the state. Approx. 30% percent of farmers reported that they do not get transportation facilities due to the lack of road connectivity in some of the areas. Another problem regarding transportation is higher transportation charges approximately 80% of farmers are suffering from this problem. Government should make provision for the transportation, so that the farmers could easily reach the market well in time.

d. Marketing Intelligence: Efficient information about market network can greatly help the farmers in reading the pulse of the market. The lack of timely market information and market education is the main reason for improper working of the markets in the state. Some farmers also felt that the market information they got was not so reliable. To overcome this problem, efficiency of market information network can be improved by increasing the frequency of market news bulletin, magazines, newspaper and television programmes etc.

e. Weighing: Weighing of produce is an important factor to get the desired prices equal with respect to quantity of the produce. About 2/3rd of the farmers reported that the weighing of their products is not done accurately which decrease their income. Traders used improper scale in weighing the produce which is also a problem faced by the famers of the state.

f. Market Prices: Minimum Support Price provides the security against the discriminatory prices of the market which is fixed by the government, so that the farmer could be benefitted. About 80% of sample respondents reported that government did not fix Minimum Support Price for their crop and they do not get reasonable price for their crop during the peak season. Strict adherence of the market regulations may help the growers in getting the better prices, it is also suggested that the farmers should try to farm co-operatives for marketing of their produce in order to receive desirable income from the markets.

3. Financial Problems: Agriculture is labour as well as capital intensive and availability of capital is an important factor in cultivation. Huge amount of capital is required to purchase the farm inputs and machineries etc. to adopt the modern farming system. Financial problems pertaining to the availability of credit from financial institutions like banks, co-operative societies, RRB's etc. About 40% of farmers reported that financial institutions were not nearer to the farmer villages. About 60% of farmers reported that they did not get loans from the financial institutions easily. They have to face so many problems to get their loan pass. These include high rate of interest, too much of formalities, cumbersome procedure and demand for security, etc. About 75% of farmers reported that even the behaviour of the staff was not cooperative. So, it is clear that the farmers face a lot of financial problems in Himachal Pradesh. To overcome the financial problems special concession should be given for the farmers to purchase the required inputs and implements, more and more branches of cooperative society should be setup in the identified areas in the state. Poor farmers need financial help from banks and other financial institution, but because of complicated procedures and rules, they left the idea of loans, which adversely affecting production and yield per hectare. Lack of short-term loans for orchard management, marketing and poor government investment on horticulture is other problem faced by growers.

4. Institutional Problems: The role of institutions like State Agricultural Universities, Krishi Vigyan Kendras (KVKs) and Department of Agriculture is very important in the dissemination of technology among the farmers. Knowledge of improved technology and farming practices not only improves the productivity and efficiency of the farms but also the quality of produce. About 75% of farmers did not get any institutional help regarding the use of agriculture inputs. About 30% of farmers out of those who get institution help reported that they did not get any knowledge about latest techniques. Training is one of the most important factors to impart the knowledge about new implements, HYVs, plant protection chemicals and fertilizers etc. In 50% of cases government did not provide any kind of training to the farmers in the state. About 2/3rd of the respondents reported that they did not attend any kind of workshops and seminars to get latest knowledge about new techniques.

5. Technology: Technology plays an important role to increase the income of the farmers and maintains the time. Problems regarding technology faced by the farmers of the state.

a. Mismatch between technology developed at research station and technology needed at farmer's field.

b. Agricultural machinery utilization is very low.

c. Late adoption of new farm technology (market uncertainty, fear of crop failure, threat to food security etc.)

d. Lack of new varieties

e. Increasing susceptibility to insects, pests and diseases

f. Erratic weather conditions

g. Harmful effects on soil

h. Mountain perspective and specifics not well integrated into R&D policies.

6. Knowledge gaps:

a. Indigenous knowledge pertaining to managing scarce resources to improve soil fertility, soil moisture, irrigation, crop seeds, varieties and about mixed farming has not been incorporated in the mainstream agricultural system and practices

b. State of FYMs in different areas and promoting ways to improve it a better compost

c. Lack of knowledge about modern system of marketing

d. Need for development of nutrient management protocols with rotations, nutrient management strategies and on-farm input management with locally available resources

e. Understanding and incorporation of green growth as a policy and programme goal

f. Absence of systematic and quantified evidence of impacts of various policies and aspects on long term sustainability.

Policy Measures and Suggestions for Overcoming These Problems:

Appropriate Government Policy: A clear-cut public policy of the central and state government is a necessary pre-requisite for a purposeful planning and worthwhile action plan. It should lay down priorities, parameters of growth and investment, goals to be achieved, strategies and broad operational plans, etc. An integrated approach to research, production, post-harvest handling, marketing and processing is to be an essential part of the policy framework.

Production Support Measures: One of the important factors responsible for poor status of the industry and low productivity is the gross inadequacy. In this plan production support, knowledge should be given to farmers. Among the important services, the determination of exact nutrient requirements of the fruit crops keeping in view their productivity, plant protection including post surveillance and post-harvest technology for post-harvest quality control. The technology advice is incomplete without the support of these services. Leaf and fruit analysis has been accepted as more precise scientific method of determining nutrient status of perennial crops as all environmental factors including soil fertility are integrated with the system. There are already such laboratories in the State Universities and Directorates of Horticulture and Agriculture. But these are not enough to meet the requirement of the agricultural industry. There is need of a competent, efficient and well-equipped plant protection laboratory, which should identify and diagnosis of the pathogen related problems, pest surveillance, pest forecast and warning service. All these should be integrated part of the horticulture production system.

Marketing and Fruit Utilization: Marketing is a necessary adjunct to the fruit production programme. For taking care of marketable as well as unmarketable surplus and all post-harvest handling problems, the Horticulture Produce Marketing and Processing Corporation (HPMC) was established in the state in the year 1974. This corporation implemented an IDA project with an outlay of Rs.16.31 crores. Implementation of this project was initiated in the fifth five-year plan and the creation of infrastructural facilities was completed in the year 1982. In fact, this state has been pioneer in implementing such a project for the first time in the country under which modern marketing infrastructure like ten mechanical grading and packing centres in producing areas, one processing plant and a transit warehouse has been created. The total facilities for marketing of fruits so far created under the World Bank project in the state are capable of handling about 65000 tonnes of fresh fruits. In the utilization of the processing trade fruit, the state has already built-up a capacity to process about 30000 tonnes of fruit annually. However, this capacity requires proportionate strengthening corresponding to the ever-increasing fruit production in the state.

Water Harvesting Technology and Hill Slope Technology: Agriculture on hilly terrain of lower Himalayas greatly suffers due to lack of irrigation facilities. The run-off from heavy storms not only causes loss of water but top layer of fertile soil gets washed off causing denudation and degradation of fertile agricultural lands. The suitable answer to water scarcity problem in the hills can be the use of collection of run-off water in ponds, depending on the source of water and their location with respect to the land surface. This technique is highly beneficial to increase per hectare productivity and quality of produce.

Diversification of Agriculture: Besides exploitation of the regional potential for growing special tree crops for bringing diversification, farmers diversified towards off-seasonal vegetables and horticultural produce, efforts are also made to develop ancillary horticultural activities like floriculture, sericulture, apiculture and mushroom production, etc. Himachal Pradesh has been the first state to introduce the modern technology of bulk pasteurization for production of compost, which is the media for growing mushrooms. At present Himachal Pradesh is growing about 28000 tonnes of mushroom annually. Efforts are also underway for the introduction of most advanced technology in mushroom activities from Netherlands. Olive has been identified as another promising fruit crop which is being developed in the state for providing a sound base for the oil industry. A project for the development of olive cultivation with the assistance of Italian Government is under implementation in the state since 1985. Olive has got a wide range of adaptability to climatic conditions prevailing in some areas of Chamba, Kullu, Mandi, Sirmour and Solan districts. Kiwi is yet another newly introduced fruit crop from New Zealand which is finding favour for plantations especially with the mid-hill region farmers of the state, but because lack of marketing facilities farmers are not adopting its cultivation on large scale. Similarly, the diverse agro-climatic conditions of Himachal Pradesh are most congenial for growing off-season vegetables, seed of temperate vegetables and exotic vegetables. At present, the area under vegetables in the state is 36000 hectares and 4.80 lac tonnes of vegetables are annually produced. Himachal Pradesh also offers vast potentials for the development of floriculture. Himalayas are rich source of flora but unfortunately, no concerted efforts for the identification and commercial exploitation of this resource have been made so far. The vast floral wealth in the state provides sound base for apiculture industry. Besides developing apiculture as cottage industry for providing an additional income to farm families' bee keeping has vital importance in the orchards for effective pollination essential for obtaining good fruit yields. The state Department of Horticulture runs bee-keeping stations at various places, serving as nucleus for beekeeping development in the surrounding areas. However, there are about 370 private beekeepers in the state.

Infrastructural Support: Most of the temperate region fruit production is in hills with broken topography and difficult means of communication, located far away from the markets. Development of better road system including feeder roads, cable-ways, efficient and full proof communication system and creation of modern markets are some of the important requirements of the industry. With latest technology now available, one can monitor the minute-to-minute situation with regard to pricing and demand. In fact, with the introduction of these technologies, India can become single market without many variations, which is the rule now. Unfortunately, what is not emerging or happening is the coordination and cooperation of the farmers amongst themselves. But if growers of one state organize themselves, they will yield great influence on marketing operations and farmers will get a much better deal.

Incentives for Floriculture: The State Department of Horticulture has been providing several facilities/incentives for the development of floriculture. Department is providing free technical advisory services and training facilities in various aspects of floriculture, making arrangements for the supply of quality planting materials, organization of 2W farmers study tours, subsidies for setting-up of green houses, subsidies on production inputs, etc. The research and development support for floriculture is available from the State Universities, i.e. Dr. Yashwant Singh Parmar University of Horticulture and Forestry Nauni, Solan, Himachal Pradesh and Chaudhary Sarvan Kumar Krishi Vishvavidyalaya Palampur and the CSIR Complex, Palampur (Himachal Pradesh).

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Raisins from table grapes: The opportunities in the scenario of #Covid-19

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Abstract

Raisin making is very old practice of grape preservation. India is known as table grape producing country. Different type abiotic and biotic stresses are common in vineyards of India. Outbreak of #Covid19 affected almost all countries. The effects are observed in different ways and economy is badly affected by long lockdown in affected areas. Agricultural activities are also halted by lockdown. As agriculture is backbone of Indian economy so lockdown has direct effect. Lockdown affected grape harvesting and trade was halted. But, grape industry opt a different path and moved further. Activates of grape drying opened new era to encash opportunities.

Introduction

Grape growing n India is mainly confined in tropical belts of Maharashtra and Karnataka and these states produce about 95% of total grape production. In India grapes are mainly produced for table purpose. However, about 28% of total production is converted into raisins. During year 2018-19 110 thousand T grapes were exported to different countries and fetched 334.79 million USD (Anonymous, 2019). Due to heavy and excess rains during Oct-Nov, 2019, the fruit buds were converted in filage and incidences of downy mildews were observed and due to prevailing conditions about 20% crop was lost in Maharashtra. Harvesting season was started normally. But due to outbreak of #Covid19, export process was badly affected and same time internal grape supply and demand in various markets was also declined sharply. Grape trade was affected due to unavailability of labours for harvesting, unwillingness of traders, closing of fruit markets and little interest of consumers in grape purchasing as they felt fruit consumption is luxurious than taking breads or rice for survival. According to available data, about 85 thousand T of grapes were exported from India till first week of April 2020 and same time more than 12 lakhs T of grapes were in vineyards and waiting for harvesting. These grapes were mainly available in vineyards within

Nashik district where grapes are grown for table purpose only. However, some grape growers who produce grapes for export and domestic supply from other districts were also facing same situation.

Keywords: Drying, quality, utilization

Raisin making process: Sangli and Solapur districts of Maharashtra and adjoining Vijayapura and Bagalkot districts of Karnataka grow grapes mainly for raisin making. In India, Australian method of raisin making is well adopted where grape bunches are treated with solution of ethyl oleate and potassium carbonate before drying in racks inside sheds. However, many parts of world grapes are dried under natural conditions or follow Drying on Vine (DOV) and prepare quality raisins (Peacock and Swanson 2005). Methodology of DOV is widely followed in California for raisin making. Raisins prepared by DOV are processed before packing. Dried grapes prepared by natural drying or DOV are cleaned, washed, graded, packed and stored. For raisin processing activities online systems are used.

Raisin Making in Nashik: Nashik region is known for table grape production. For making berries attractive and bold, growers apply gibberellic acid and CPPU which results in thick skinned berries of berries become thick (Pires, 1998). So, these berries are not suitable for quality raisin production. But due to effect of Covid19 farmers couldn't sell their crop and some areas traders were exploiting the growers and offering very low rates. Considering very low market value of able grapes, ICAR-NRC for Grapes, Pune advised farmers to adopt processing of grapes into raisins. As Nashik district is not involved in raisin making so required infrastructure (grape drying shed) are not available in this district. Hence, DOV and grape drying within two rows of vines were advised. Growers were not aware on various activities of grape drying, so a video was prepared and uploaded on https://nrcgrapes.icar.gov.in/ and same was circulated among various WhatsApp groups also. For giving wider publicity, a PDF copy contained activities in the process of grape drying was also circulated among WhatsApp groups. Many grape growers adopted suggestions of ICAR-NRC for Grapes and raisin making was started. According to an estimate about 4 lakh T of grapes have converted into raisins and about 80 thousands T of raisins are produced.

Raisin trading: Trade of the produce affected by various factors e.g. supply and demand, domestic availability, market price of raw produce, domestic market price, demand of exporters, quality of the produce, weather conditions etc. The drivers of domestic trade are

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based in Sangli. Supply and market price is controlled by theses traders only. Other than supply to domestic market, few groups are exporting also. Much variation is found in price realization which is directly related with quality of raisins and further use of raisins for various purposes. In international trade our position is not good and India is importing higher quantity than export. India ranks mostly at 10th rank in the list of major exporting countries. But we can identify potential markets from where we can get good market value of our product. This year about 80 thousand T raisins are produced additionally which are over and above normal size of product from the country. Same time India has very big domestic market but we have to improve infrastructure and supply chain for domestic market. E-NAM can serve as reliable platform for getting better return of raisins from domestic market. Govt. agencies like NHB can support grape growers and processors and other stake holders for marketing of raisins within county. Amendment in APMC rules by cabinet will ease norms in trading. Farmers will now not be taxed for any sale outside the APMC markets. The government is supporting farming sector by concept of one country one market, while also allowing farm produce to be sold across markets in India.

Utilization in food industry: Worldwide raisins are produced in preparing different food products like dairy products, bakery products, confectionary, salad, etc., while in India it mainly consumed as snacks and very small quantity is utilized for other purposes. It is time to concentrate on utilization of raisins for value addition of food products by the related food industries. Dairy and bakery industries are natural choice.

Other Opportunities:

Pekmez: Pekmez is a traditional Turkish food made by using different fruits such as grape, mulberry, fig, apple, and sugar beet. It is a kind of fruit juice concentrate produced from different fruits, such as grape, mulberry, fig, raisin, apple, and sugar beet, and is named after the fruit from which it is obtained i.e., grape pekmez, mulberry pekmez (Karababaand Isikli 2005). It is a healthful food due to its nutritional content and is used as a main source of energy based on its chemical composition. The carbohydrates in pekmez are generally in the form of natural sugars like glucose and fructose, which is nutritionally important for babies, children, sportsmen, and active workers (Simsek et al. 2005). Raisin concentrate (pekmez) is mostly manufactured in industrial conditions although traditionally, farmers produce small amounts of raisin concentrate in order to supply their own requirements and the market[5].

Some industries can start production of pekmez. It will open new era of raisin consumption and utilization in making new healthy product.

Raisin juice concentrate/paste: Raisins can also be utilized for preparation of raisin juice and raisin paste. Raisins are collected and soaked with water several times to produce raisin juice, making it a pure extract of raisins. The extracted liquid is evaporated in a vacuum pan to produce a self-preserving concentrate, which contains a minimum of 70% natural fruit soluble solids. Raisin juice is added to a variety of foods, including dairy, confectionery, and bakery items. Raisin paste is made completely from raisins, produced by extruding raisins through a fine mesh screen. Raisin paste can be used to add visual appeal and flavor. It is a stable ingredient that naturally sweetens fine confectionery fillings and soft-center candies (Papadakis, 2006). Raisin paste is also used in bakery items, such as bread, cookies, and pastries to inhibit mold growth, extend shelf life, and enhance flavor.

Raisin wine: Raisin wine has an ancient history as an alcoholic beverage. Indeed, dried grapes contain all the ingredients except for water, which are required to make wine (Anonymous2017). Since the skins contain the yeasts that naturally convert sugar into alcohol. About 2/3 of raisin weight is natural sugar and prepared raisin juice can be fermented and wine can be prepared. Production of raisin wine involves soaking the chopped raisins in water and addition of desired yeast. Acid can be added to maintain acidity level in the wines. After fermentation prepared wines are aged. Some used natural yeast for fermentation, however, few add identified yeast to obtain wine as per own requirements.

Table 1. Status of raisin production and trade

Particulars	Quantity
Raisin Production (2019)	230, 000 MT
Grapes converted into raisins (2019)	920,000 MT
Export during (2018-19)	17,820 MT
Import during (2018)	21,515 MT
Estimated raisin production (2020)	310,000 MT

Table 2: Raisin import in India (Source: AgriXchange. APEDA)

Year	Quantity (MT)	Value (thousand USD)	Share (%)	Rank
2015	15153	53189	3.21	7

2016	15155	55375	3.36	7
2017	17847	76362	4.96	5
2018	21515	94872	5.54	5

Table 3: Raisin export from India (Source: AgriXchange. APEDA)

Year	Quantity (MT)	Value (thousand USD)	Share (%)	Rank
2015	18179	21840	1.38	11
2016	33030	42980	2.60	10
2017	21453	29757	1.93	10
2018	17820	29347	1.71	10

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Maturity indices of fruit crops

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In postharvest physiology we consider "mature" as "that stage at which a commodity has reached a sufficient stage of development that after harvesting and postharvest handling to be done, its quality will be at least the minimum acceptable to the ultimate consumer". Maturation is the stage of development leading to the physiological maturity (when a plant or plant parts will continue ontogeny even if detached) or horticultural maturity (when a plant or plant parts possesses the pre-requisites for utilization by the consumer for a particular purpose). Maturity indices help in deciding that when a given commodity should be harvested to provide some marketing and to ensure the attainment of acceptable eating quality to the consumer. Fruits are picked at wrong stage of maturity may develop physiological disorders in storage and may exhibit poor dessert quality. For selecting the harvest maturity of fruits or vegetables it should be kept in mind that harvested commodity should have its peak acceptable quality (nontoxic, size, appearance and flavour with adequate shelf life). Quality indices consist of a combination of visual appearance, texture & flavour. The principles dictating at which stage of maturity a fruit should be harvested are crucial to its subsequent storage and marketable life and quality. Post-harvest physiologists distinguish three stages in the life span of fruits and vegetables: **maturation, ripening, and senescence.** Maturation is indicative of the fruit being ready for harvest. At this point, the edible part of the fruit is fully developed in size, although it may not be ready for immediate consumption. Ripening follows or overlaps maturation, rendering the produce edible, as indicated by taste. Senescence is the last stage, characterized by natural degradation of the fruit, as in loss of texture, flavour etc. Some typical maturity indexes are described in following sections. The maturity has been divided into four categories:

1. **Physiological maturity:** It is the stage when a fruit is capable of further development or ripening when it is harvested i.e. ready for eating or processing.

2. **Horticultural maturity:** It refers to the stage of development when plant and plant part possesses the pre-requisites for use by consumers for a particular purpose i.e. ready for harvest.
3. **Commercial maturity**

   It is the state of plant organ required by a market. It commonly bears little relation to physiological maturity and may occur at any stage during development stage.
4. **Harvest Maturity: It** may be defined in terms of Physiological maturity and horticultural maturity, it is a stage, which allows fruits at its peak condition when it reaches to the consumers and develop acceptable flavour or appearance and having adequate shelf life.

Principle of harvest maturity:

- **a)** Harvested commodity should have its peak acceptable quality when it reaches the consumer.
- **b)** Produce should develop an acceptable flavour or appearance.
- **c)** Produce should have optimum size and shape required by the market.
- **d)** It should not be toxic or unacceptable.
- **e)** Harvest maturity should have adequate shelf life.

Maturity indices of different fruit crops

S.No	**Fruits**	**Maturity Indices**
1.	Mango	a) Tapka stage b) Specific gravity (1.0-1.02 for Alphonso & less than 1.0 for dashehari). c) White powdery like appearance on skin of mature mango. d) Change in fruit shape (fullness of the cheeks) e) Days to fruit set (110-125 days for Alphonso and Totapuri). f) Change in skin color from dark-green to light-green to yellow (in some cultivars). g) TSS 12-15 % (Measured by hand refractometer) h) Change in flesh color from greenish-yellow to yellow to orange.
2.	Banana	a) Degree of fullness of the fingers i.e., disappearance of angularity in a

		cross section. b) Skin and pulp ratio (1.20:1.40 for Dwarf Cavendish). c) Drying of plant parts. d) Acid content 0.25% e) Days to fruit set (90 days for Dwarf Cavendish). f) Bananas are harvested mature-green and ripened upon arrival at destination markets.
3.	Citrus	a) All citrus are non-climacteric fruits, they ripe gradually over weeks or months and are slow to abscise from the tree. b) External color changes during ripening, but is a function of climate more than ripeness and a poor indicator of maturity. c) TSS 12-14% for mandarin and for sweet orange 10-12% d) By acidity (mandarin 0.4%, sweet orange 0.3%) e) The best indices of maturity for citrus are internal: ^{o}Brix (sugar), acid content and the ^{o}Brix/acid ratio (mandarin 12-14 ^{o}Brix, sweet orange 12 ^{o}Brix).
4.	Papaya	a) Change of skin color from dark-green to light-green with some yellow at the blossom end (color break). b) TSS 7-11% c) A minimum soluble solids of 11.5% is required d) Uniformity of size and color, firmness, freedom from defects such as sunburn, skin abrasions, pitting, insect injury and blotchy coloration, freedom from decay.
5.	Guava	a) Guava fruits are picked at the mature-green stage (color change from dark- to light-green), TSS 12-14 % b) Color is a good indicator of ripeness stage c) Size and shape may be important in some markets d) Freedom from defects, insects and decay e) Firmness and extent of gritty texture due to the presence of stone cells (sclereids) f) Flesh color depends on cultivar, it can be white, yellow, pink, or red

6.	Sapota	a) Skin color change from light-brown with a tinge of green to light-brown to dark-brown. b) Weight of fruit 65-70 gms c) Flesh yellow streak when scratched with finger nail d) **Appearance:** Size, shape (oval), color, freedom from defects and freedom from decay. e) Firmness (firm-ripe sapotes are preferred). f) Flavour is related to soluble solids content (13-26%) and acidity (0.2-0.3%).
7.	Jackfruit	a) Jackfruits can reach very large size (as much as 90 cm long, 50 cm wide, and 25 kg in weight), depending on the cultivar, production area, and the fruit load on the tree. b) Color change from green to yellow to brown is used as an indication of maturity and ripeness stages. c) Optimum harvest for long-distance transport is when the fruit changes color from green to yellowish-green. d) Freedom from defects (sunburn, cracks, bruises) and decay e) Jackfruits contain 25-30% carbohydrates (fresh weight basis) including about 15-20% starch in unripe fruits that is converted to sugars (sucrose + glucose + fructose) in ripe fruits. f) The unripe fruit is used as a starchy vegetable, either boiled or roasted, and when ripe it is used as a dessert fruit. Average acidity is 0.25% citric acid. g) Jackfruit fruit lets are commonly sold in producing countries as a fresh-cut product.
8.	Aonla	a) There are number of factors affect the maturity of fruits such as location, variety, climate, season, nutrition, soil type and moisture etc. b) The maturity indices of aonla fruits are change of seed color from creamy white to brown black.
9.	Pomegranate	a) External red color (depending on cultivar) b) Red color of juice

		c) Acidity of juice below 1.85%
10.	Ber	a) Ber mature 150-1 75 days after flowering. b) Green to golden yellow color c) Seed/stone ratio: 12 to 18 d) TSS 15-18%
11.	Apple	a) T-Shape b) Color c) Size d) Firmness as measured by pressure tester e) Days after full bloom (DAFB) f) Percent soluble solids (or sugar levels)

Conclusion:

It is important to deliver high quality fruits to the consumers and reducing post-harvest losses and thus it can be achieved by picking them at optimum maturity along with other measures. Much information is available about growth, maturity and respiration; however, more research is needed to develop indices based on them which are economic, easy to learn and apply at the field.

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A Review on Pre-Disaster Planning and Preparedness for Earthquakes in India

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"Earthquakes don't kill people; it is the structures built by man that kill people". Frequent reminders of moderate earthquakes makes our country India amidst of crossroads of earthquake preparedness. The one and only option is to prepare now because we do not want to repent and pay later. India being a country with relatively challenging economic conditions and with a very dense demographic distribution there is no other way out apart from a very strong and strategically planned earthquake preparedness. Late nineteenth and early twentieth century's earthquakes initiated a number of researches in science and engineering related to earthquakes which include the making of early codes and earthquake-proof housing and advancement of techniques enforced after the earthquake in Andaman Islands in 1941. Inspite of these early advances towards seismic safety, earthquakes result in a number of deaths in India. The Bhuj earthquake of Gujarat in 2001 marked a striking negligence for structural design principles and construction quality. This earthquake of Bhuj resulted in collapse of modern multi-storey structures in India, and initiated awareness amongst academics, professionals, scholars and the public which was seen never before. The earthquake was followed by the making of the National Information Centre of Earthquake Engineering and the development of a comprehensive 4-year National Programme on Earthquake Engineering Education which was initiated by the seven IITs and the IISc. Earthquake engineering is a highly context-specific stream of engineering and there are many engineering problems which require adequate solutions locally. "Confined Masonry Construction" is one such building typology. Construction of the students' hostels and faculty housing on the new 400-acre campus of the IIT Gandhinagar has given an opportunity to follow this construction typology on a large scale. The danger of the disaster in India is also evident from the occasional news of collapses of buildings under construction or during rains (without any earthquake shaking). Addressing the safety of built environment in our country is the need of the hour.

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Introduction

The Disaster Management Act, 2005 defined disaster as a "catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the recovering capacity of the community of the area affected".

In simple words it is an event or a series of events, which give rise to life threatening circumstances and acute damage or loss of property, environment and most importantly means of livelihood on a scale which is beyond comprehension and far beyond the recovering capacity of the community affected. These unfortunate events disturb the balance and progress of infrastructure development activities pushing nations back by several years in terms of GDP. Therefore, efficient disaster management has received great attention.

Disaster Management can be described briefly by the integration the following:

- Planning and implementation of disaster specific measures which are mandatory
- Mitigation of consequences
- Capacity building
- Pre-planned and prepared response
- Assessment of the severity
- Evacuation, Rescue and Relief
- Rehabilitation and Reconstruction

Largely due to its geo-climatic conditions combined with high population density and other socio economic factors, India is one of the most disaster prone countries in the world. The risk of damage of lives and property during and even after the occurrence of such an event is high due to the population spread and tendency of people to rehabilitate the areas prone to natural disasters such as earthquakes, Bhuj in Gujarat being a perfect example of such an occurrence. Increased vulnerability to the effects of disaster can be related to country specific problems such as population expansion, urbanization and industrialization, infrastructure development within high-risk zones and global problems such as environmental degradation and climatic changes. The current scenario of preparedness of our country in case of an earthquake has been discussed very categorically further.

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Literature Review

Ministry of Earth Sciences (MoES) (India Meteorological Department (IMD)) is the nodal Ministry for the management and mitigation of earthquakes in the country. In terms of National Disaster Management Guidelines on Management of Earthquakes issued in April 2007, MoES was to prepare the Earthquake Management Plan covering all aspects including earthquake preparedness, mitigation, public awareness, capacity building, training, education, research and development, documentation, earthquake response, rehabilitation and recovery. MoES did not prepare any disaster management plan for earthquakes. However, in reply to a query of the Committee regarding status of disaster management and mitigation plan for earthquake, the MHA informed as under:

"ESSO-IMD is only responsible for monitoring seismic activity in and around the country and disseminates the information to all the user agencies including the concerned State and Central Government agencies responsible for carrying out emergency response, relief and rehabilitation measures. It is to mention that the institutions of MoES/ESSO only deal with monitoring, detection and warning of cyclones and tsunamis and only carry out aspects of monitoring and detection in respect of earthquakes and hence have no experience of developing and monitoring the associated components of disaster management cycle viz., preparedness, mitigation, risk reduction, response and relief, etc., that are all along being dealt with by different Central and State Government authorities. Moreover, the implementation of disaster mitigation plans also has a significant component of techno-legal, and regulatory components that are operated by various competent authorities at different levels of governance in the country".

A project on "Optimum Seismological Network Program" was sanctioned in May 2009 by the IMD at an estimated cost of ₹ 48 crore, which was reduced to ₹ 25.17 crore. The project implementation was proposed to be carried out in two phases spread over a period of three years from 2009-10 to 2011-12. The objective of the project was to strengthen and modernize the National Seismological Network for improving the detection and location capability for earthquakes of magnitude greater than or equal to 3.0, occurring anywhere in the mainland of the country. The project was found by audit as still in the preliminary stages of implementation even after expiry of three years. The MHA in their submission about the status of OSNP stated as under:

"Earlier plan of "Optimum Seismological Network Program" was reviewed in the light of recent networks established in the country by various R & D groups. Under this approach, already 65-stations (40-seismic stations and 25-GPS stations) are operational and very soon the network would have 90-stations (50-seismic stations and 40-GPS stations) by which already medium and low seismic intensity is successfully getting monitored and analysed in real-time. Accordingly a new scheme was taken up for deploying a total of 78 additional state- of art broadband systems to the national seismological network in October, 2012. Global tenders have been floated and technical evaluation of bids received has been completed. Further action is in process for placement of order is under progress".

MOES/IMD had set up the Earthquake Risk Evaluation Centre at Delhi, in February 2004 [4]. During 2007-12, IMD proposed to carry out three projects:

(a) Seismic micro-zonation of Mumbai, Guwahati, Ahmedabad and Dehradun on 1:10000 scale;

(b) Creation of national database for seismic hazard and regional risk appraisal; and

(c) Impact assessment of utilization of database in planning and mitigation

An allocation of ₹ 298.38 crores was made for these projects. MoES stated (September 2012) that the micro-zonation of Guwahati, Bangalore, Ahmedabad, Dehradun and Delhi was completed. IMD initiated a project titled "Archival digitization of seismic analogue chart" in May 2008 at an estimated cost of ₹ 13.50 crores for two years. The duration of the project was extended from time to time and finally till June 2012. In their submission, the MHA furnished as under:

"Seismic data base comprises scanning and digitization of analog seismic charts for the period 1927-1996, on-line archival of digital wave form seismic data since 1996 in real time. The scanning of about 89,000 analog charts and out of which digitization of about 5000 earthquake events are taken up since 2008. As things stand today, the scanning of all the charts is completed and digitization of events is in its final stage. Archival-digitization of seismic analogue charts is pursued till December 2013 to complete the activity. The National NDMA had undertaken the task of preparing the upgraded hazard maps and atlas of Indian land Mass. In this connection the MHA informed that as per the recommendations of the

Working Committee of Experts (Geophysical-Hazards), NDMA has undertaken a project through Building Materials Technology Promotion Council (BMTPC) for upgradation of Earthquake Hazards Maps for the country at a cost of ₹ 76.83 lakh. Project which started in June, 2011 is yet to be completed. It is getting delayed due to non-availability of district boundaries data from the Census of India. NDMA has also taken up National Earthquake Risk Mitigation project. This Project was still in preparatory phase after a lapse of five years. The Ministry while furnishing the status of project stated as under:

"The Centrally Sponsored Scheme for National Earthquake Risk Mitigation (Preparatory Phase) has been approved in April, 2013 at an outlay of ₹ 24.87 crore, to be implemented within a period of two years *viz.* 2013-2015. The aim of the project is to demonstrate the effectiveness of strategies proposed for implementation of activities under four components namely,

(i) Techno-legal Regime,

(ii) Institutional Strengthening,

(iii) Capacity Building and

(iv) Public Awareness. The scheme will be implemented in 21 States/UTs that lie in seismic Zones V & IV in the country.

Present Status

1. NDMA has initiated preliminary steps for implementing the scheme

2. A Project Steering Committee has been constituted under chairmanship of Member(Earthquake), NDMA and Secretary, NDMA, JS(DM), Financial Advisor, Town & Country Planner, Technical experts, representatives from BMTPC, CPWD, NIDM etc. as members."

The Committee has noted that considering the vulnerability of the country's landmass to the risks of earthquake, various efforts are underway to prepare for such eventualities. It includes archival-digitisation of seismic /analogue charts since 1996, preparation of hazards map and atlas of India etc. Also following the Optimum Seismological Network Programme sanctioned in 2009 by the IMD, 65 stations are now operational and the capacity is being further enhanced. However the Project for up gradation of Earthquake Hazards Maps for the Country costing ₹ 76.83 lakh, which started in June 2011, is yet to be completed due to non-availability of district boundaries data from the Census of India. Another project 'National Earthquake Risk Mitigation', approved in April, 2013 is under implementation during 2013-15. Considering the increased seismic activity in the Himalayan region, which has been witnessed recently, the Committee emphasise upon an early completion of the earthquake preparedness activities at all levels. They desire that the MHA must take up the matter urgently with the Census Commissioner for supply of requisite boundaries data so that the hazard atlas/map could be completed early. The Committee hope that the preparatory phase of the Earthquake Mitigation project would be completed this year as stipulated and final phase would start on time. Meanwhile the MHA must strive to create maximum public awareness on earthquakes in the Country as an essential part of disaster preparedness.

Conclusion

India, one of the fastest growing GDPs of the world estimates unprecedented growth over the next decade, a situation both exciting and challenging. The growth prospects for all those in the construction industry are huge, yet with the possibility of repeating many of the potentially fatal mistakes discussed above. The most important among the unfinished agenda to improve this construction process are:

(a) Competence-based licensing for engineers in general and structural engineers in particular

(b) Enforcement of building codes by the municipal authorities, and

(c) Development and propagation of building typologies that are inherently earthquake-resistant.

The emphasis, with particular urgency, should be on new construction of all kinds, from the millions of housing for the masses that the central government has identified as a priority, to the expensive apartment buildings for the affluent. Clearly, India has come a long way on the road to earthquake safety and yet, much remains to be done before this journey is completed. Creating a system and culture for building safe houses in 21st century India is something not only possible but an absolute necessity. This is the least that the general masses of our country expect from technically qualified engineers and management professionals and others associated with the construction industry. Provisions for such safe housing are both our challenge and obligation.

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Agricultural Sensors: A Step towards Smart Agriculture

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Introduction:

As the worldwide population has risen, farming operations have grown increasingly complex, vast and optimized. Technological revolutions have leaded farming operations to be more productive than ever, harvesting more crops per area and yielding higher quality products. Smart agriculture, also known as precision agriculture, allows farmers to maximize yields using minimal resources such as water, fertilizers and seeds. In this context, agricultural sensors have been proven beneficial. The sensors used in smart farming are known as agricultural sensors. These sensors provide data which assist farmers to monitor and optimize crops by adapting to changes in the environmental conditions. These are installed on weather stations, drones and robots used in the agriculture industry. They can be controlled using mobile apps specifically developed for the purpose. Based on wireless connectivity, either they can be controlled directly using wi-fi or through cellular towers with cellular frequencies with the help of mobile phone apps.

In this article, we will explore how these sensing technologies have been woven into modern large agribusiness and discuss how progression of the technology can increase our capacity to feed the world along with advantages and limitations of this technology.

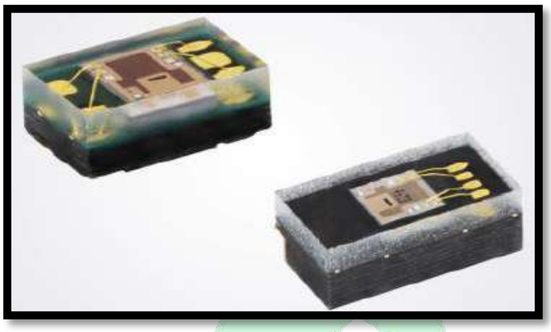
Types of Agricultural Sensors:

A number of sensing technologies are used in precision agriculture, providing data that helps farmers monitor and optimize crops, as well as adapt to changing environmental factors. These are:

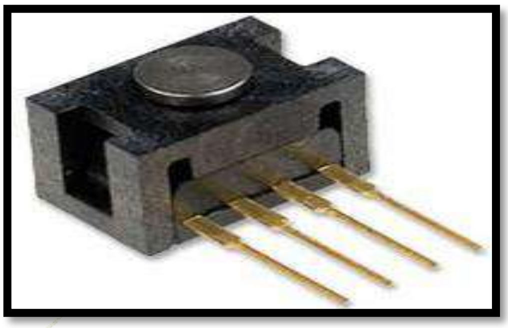
1. **Location Sensors:** Use signals from GPS satellites to determine latitude, longitude, and altitude to within feet. Minimum 3 satellites are required to triangulate a position. Precise positioning is the cornerstone of precision agriculture. GPS integrated circuits like the NJR NJG1157PCD-TE1 are a good example of location sensors.

2. **Optical Sensors:** They use light to measure soil properties. The sensors measure different frequencies of light reflectance in near-infrared, mid-infrared, and polarized light spectrums. Sensors can be placed on vehicles or aerial platforms such as drones or even satellites. Soil reflectance and plant color data are just two variables from optical sensors that can be aggregated and processed. Optical sensors have been developed to determine clay, organic matter, and moisture content of the soil. For example, Vishay offers hundreds of photo detectors and photodiodes, a basic building block for optical sensors.
3. **Electrochemical Sensors:** These sensors provide key information required in precision agriculture like pH and soil nutrient levels. Sensor electrodes work by detecting specific ions in the soil. Currently, sensors are mounted to specially designed “sleds” which help gather, process, and map soil chemical data.
4. **Mechanical Sensors:** These sensors measure soil compaction or “mechanical resistance.” These sensors use a probe that penetrates the soil and records resistive forces through the use of load cells or strain gauges. A similar form of this technology is used on large tractors to predict pulling requirements for ground engaging equipment. Tensiometers, like Honeywell FSG15N1A, detect the force used by the roots in water absorption and are very useful for irrigation interventions.
5. **Dielectric Soil Moisture Sensors:** These sensors assess moisture levels by measuring the dielectric constant (an electrical property that changes depending on the amount of moisture present) in the soil.
6. **Airflow Sensors:** They measure soil air permeability. Measurements can be made at singular locations or dynamically while in motion. The desired output is the pressure required to push a predetermined amount of air into the ground at a prescribed depth. Various types of soil properties, including compaction, structure, soil type, and moisture level, produce unique identifying signatures.
7. **Agricultural Weather Stations:** These are self-contained units that are placed at various locations throughout growing fields. These stations have a combination of sensors appropriate for the local crops and climate. Information such as air temperature, soil temperature at a various depths, rainfall, leaf wetness, chlorophyll, wind speed, dew point temperature, wind direction, relative humidity, solar radiation,

and atmospheric pressure are measured and recorded at predetermined intervals. This data is compiled and sent wirelessly to a central data logger at programmed intervals. Their portability and decreasing prices make weather stations attractive for farms of all sizes.



Vishay Photo IC Sensor



Honeywell Force Sensor

Sensor Output Applied:

Sensing technologies provide actionable data to be processed and implemented as and when needed to optimize crop yield while minimizing environmental effects. Here are a few of the ways that precision farming takes advantage of this data:

- Yield Monitoring systems are placed on crop harvesting vehicles such as combines and corn harvesters which provide a crop weight yield by time, distance, or GPS location measured and recorded within 30cm.
- Yield Mapping uses spatial coordinate data from GPS sensors mounted on harvesting equipments. Yield monitoring data is combined with the coordinates to create yield maps.
- Variable Rate Fertilizer application tools use yield maps and perhaps optical surveys of plant health determined by coloration to control granular, liquid, and gaseous fertilizer materials.
- Weed Mapping currently uses operator interpretation and input to generate maps by quickly marking the location with a GPS receiver and data logger. The weed occurrences can then be overlapped with yield maps, fertilizer maps, and spray maps.
- Topography and Boundaries can be recorded using high-precision GPS, which allows for a very precise topographic representation to be made of any field. These precision maps are useful when interpreting yield maps and weed maps. Field boundaries, existing roads, and wetlands can be accurately located to aid in farm planning.

- Salinity Mapping is done with a salinity meter on a sled towed across fields affected by salinity. Salinity mapping interprets emergent issues as well as change in salinity over time.
- Guidance Systems can accurately position a moving vehicle within 30cm or less using GPS. Guidance systems replace conventional equipment for spraying or seeding. Autonomous vehicles are currently under development and will likely be put into use in the very near future.

Scaling to "Small" Agriculture:

Smartphone sensors and apps, as well as small-scale machinery, allow smaller farms to take advantage of smart agriculture technologies.

Smartphone Tools:

The smartphone alone has several tools that can be adapted to farming applications. For instance, crop and soil observations can be logged in the form of snapped pictures, pinpoint locations, soil colors, water, plant leaves, and light properties. Table 1 lists some in-phone tools that are useful for gathering data:

Table 1: Agricultural uses of existing smartphone tools

Smartphone Tool	Smart Farming Applications
Camera	Provides pictures of leaf health, lighting brightness, chlorophyll measurement, and ripeness level. Also used for measuring Leaf Area Index (LAI) and measuring soil organic and carbon makeup.
GPS	Provides location for crop mapping, disease/pest location alerts, solar radiation predictions, and fertilizing.
Microphone	Helps with predictive maintenance of machinery.
Accelerometer	Helps determine Leaf Angle Index. Also used as an equipment rollover alarm.
Gyroscope	Detects equipment rollover.

Smartphone Apps:

Many smartphone applications have begun to incorporate Internet of Things (IoT) ideals, data aggregation, and speedy processing to bring up-to-date, actionable information to small farmers regarding seeding, weeding, fertilizing, and watering. These applications gather data from handheld sensors, remote sensors, and weather stations, creating in-depth analyses and valuable recommendations. Several applications have been developed specifically targeting the small-scale farmer:

- **Disease Detection and Diagnosis:** Photos taken of suspect plants can be forwarded to experts for analysis.
- **Fertilizer Calculator:** Soil sensors and leaf color can determine what nutrients are needed.
- **Soil Study:** Capturing soil images, as well as pH and chemical data from sensors, allows farmers to monitor and adjust to changing soil conditions.
- **Water Study:** Determining Leaf Area Index from photos and brightness logging can help farmers determine water needs.
- **Crop Harvest Readiness:** Camera photos with UV and white lights accurately predict ripeness.

Global Implications:

Solving problems for farms both large and small and helping farmers meet ever-increasing food demands aren't the only solutions smart, precision agriculture can provide. Smart farming offers a number of other benefits, such as:

- Lowering fuel and energy consumption thus reducing carbon dioxide emissions.
- Reducing nitrous oxide released from soil by optimizing nitrogen fertilizer use.
- Reducing chemical use by pinpointing fertilizer and pest control needs.
- Eliminating nutrient depletion through monitoring and managing soil health.
- Controlling soil compaction by minimizing equipment traffic.
- Maximizing water use efficiency.

Advantages:

- They are simple to use and easy to install.
- They are cheaper.
- In addition to agricultural use, they can also be used for pollution and global warming.
- They are equipped with wireless chip so that they can be remotely controlled.

Limitations:

- Smart farming and IoT technology require continuous internet connectivity. This is not available in developing countries such as INDIA and other part of the world.

- There is presumption in the market that consumers are not always ready to adopt latest IoT devices equipped with agriculture sensors.
- The basic infrastructure requirements such as smart grids, traffic systems and cellular towers are not available everywhere. This further hinders the growth of its use.

Conclusion:

Agricultural sensors are contributing solutions to problems that extend beyond farms, including pollution, global warming, and conservation. Future developments in precision agriculture will likely include increased autonomous farm vehicle use, as well as improved wireless data transmission and acquisition from smarter, smaller Unmanned Aerial and Unmanned Ground Vehicles (UAVs and UGVs, respectively). In addition to monitoring crop and soil conditions, these smaller vehicles can also monitor the status of farm equipment, allowing farmers to improve machine servicing and maintenance. In general, process improvements learned in the industrial manufacturing arena will continue to find their way into agriculture.

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Sustainable Agriculture and Smart Technologies

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Introduction:

Sustainability is a complex idea with many aspects which includes the economics (a sustainable farm should be a profitable), social (deals fairly with its workers and should have beneficial relationship with community) and environmental (proper use of natural resources). It involves the maintaining of soil healthy, reduce water lose, air, water, and climate pollution, Promoting biodiversity. The living organisms are dependent on the nature of biodiversity. This has been emitted on daily basis by emitting wastes, use of fertilizers and pesticides etc. Emission of greenhouse gases actually effect the plants, animals, and as well as human beings. So, it is very important to sustain and make a better environment for plants and human beings. Thus the smart farming is the primary key to meet better agriculture systems and make better sustainable agriculture for the future.

Is Sustainable = Organic farming?

Organic is not equal to sustainability. In sustainability there is no need for certification as a organic farming. There are no strict rules set up to ensure that the organic farmers or organic food production operations follow eco-minded practices. For the organic industries members, it's important to be realistic about the limits of organic certification.

Sustainable agriculture practices:

Rotating crops and embracing diversity, Planting cover crops, Reducing tillage, Applying integrated pest management (IPM), Integrating livestock and crops, Adopting agroforestry practices.

Today we all seen that there is demand for food is increase day by day which become a challenge to agriculture sector (farmers). There is need for a resource efficient global food system that help to maintain sustainability. With the increase demand and need for sustainable agriculture it is necessary for farmers and stakeholders to invest lot in knowledge & more sophisticated machines and devices. As we all know that in today there is lot of advanced technologies introduced in agriculture sector. There is a term Smart farming, it is a modern farming concept in which we use technology to improve agricultural production and lowering the inputs. Smart farming is information driven farming approach. This approach applies measuring that are economically and ecologically meaningful to achieve improved output in production. It runs on the principle of precision farming in which we use GPS guidance in the application of measure that are site specific. Precision farming not only focus on spatial precision but to smartest treatment by adopting certain technologies of farming , implementation of auto piloted harvesters & tractors , among other devices and farm machinery ,shifts the approach to an holistic . Smart farming targeting to solve the problems related to farm like fertilizers need in crop, time of application, specific area to be applied, which resources are needed for plant protection etc. Complex or a proper information needed for better results where smart farming is used.

Is smart farming promote sustainable agriculture?

Both smart farming and sustainable agriculture are rely on availability of data. Smart farming is bone of sustainability as well as cost effective agriculture with combination satellite and observations make it easy for farmers to take decision when doing farming. Smart farming is a farming management theory using modern technologies to increase the quality and quantity of agriculture products. Example, use of sensors helps the farmers to make decision on how, where and when to allocate certain resources to improved ecological and economic inputs. Smart farming involves the use of networked technology to achieve certain production goals. A smart farming technologies represent the function of modern Information and Communication technologies (ICT) into agriculture & leading a new green revolution i.e (3rd green revolution) in which innovative farming techniques and tools use to make agriculture more sustainable. Sustainability in agriculture can be achieved through proper use of data in decision making. Unlike in past, nowdays farmers can use smart farming techniques to collect data and make informed decision from it. For example , through smart technologies farmers can know the fertility of their land through analysis and comparison of satellite images and at end by using data know the yield potential of given land. With Smart farming

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techniques farmers can improve monitor the needs of individual animals and adjust their nutrition correspondingly ,thereby preventing diseases and enhancing head health.

Benefits of smart farming:

Crop management and waste decrease ,mitigate the risk of losing yield, Increase business efficiency through development automation, automate multiple processes , improve product quality and quantity, high crop productivity, decrease in use of pesticide & fertilizers, reduce strain on environment .

Smart farming technologies:

Smart farming involves use of technologies are:

- Sensors - for soil scanning ,water, light, humidity, and temperature
- GPS - Site specific information ,geographic area information
- Robotics and Automation -
- Data analytical tools for decision making and predications -
- Satellites and drones -

Opportunities of smart farming:

Smart farming aim is to reduce the ecological footprints. Use of site specific inputs, help to reduce the leaching problems, reduce the release of greenhouse harmful gases and reduce the use of pesticide and fertilizers.

Achieve profitable agriculture: By using techniques reduce resource inputs and reduce cost of labour. Smart farming techniques encouraging the use of techniques in site specific weather forecast, measuring of disaster and diseases and yield projection. Smart farming has a potential to making the agriculture profitable and sustainable and reducing resource inputs and costs.

Challenges of smart farming:

- In India farmers have Small land holdings.
- Installation of these sensors and tying sensor data to analytical driving automation.
- Expensive networking.
- Connectivity in rural areas.
- No proper knowledge about technologies.
- Loss of manual employment.

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Understanding Hydroponics and Its Scope in India

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Abstract:

Every plant needs different type of soil for its growth. Some heavy water requiring plants need clay soil, some need sandy soil where standing water can get easily drained out. This demand automatically restricts the diversification of cultivation i.e. only limited amount and limited type of crop can be produced in an area. So, the situation where this varietal need of soil type can be eliminated even without compromising on the crop's need of nutrients, minerals water etc. can be described as Hydroponics. There are 6 basic types of hydroponic systems; Wick, Water Culture, Ebb and Flow (Flood & Drain), Drip (recovery or non-recovery), N.F.T. (Nutrient Film Technique) and Aeroponic. Hydroponics farming in India is in its rising stage. Now-a-days, in India, the progressively thinking farmers are adopting this innovative and inventive farming technique. Here the plants are totally depended upon the artificially created system. Some success stories of hydroponics farming can be considered as the confidence booster of any grower who is willing to set up this innovative hydroponic system.

Introduction:

From the ancient time plants are been grown in soil where the plants happen to get all the necessary nutrients, minerals and water from the soil. Every plat needs different type of soil for its growth. Some heavy water requiring plants need clay soil, some need sandy soil where standing water can get easily drained out. Even some plants want loamy soil which is neither water holding nor water draining. Therefore, this demand automatically restricts the diversification of cultivation i.e. only limited amount and limited type of crop can be produced in an area. So, the situation where this varietal need of soil type can be eliminated

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even without compromising on the crop's need of nutrients, minerals water etc. can be described as Hydroponics.

Hydroponics is a type of Horticulture and a part of hydroculture, which implies growing plants without soil where mineral nutrient solutions in a water solvent are used. Hydroponics is a Greek term, made from two words - *Hydro* means water and *Ponos* means labor. Thus "working water" is the true meaning.

Hydroponics operates on the premise that if you can provide with what they need; plants will grow well. In this sense, Hydroponics is invented to rule out the influence of Mother Nature - It can be placed in a controlled growing environment. Hydroponics replaces the soil with water and the growing media

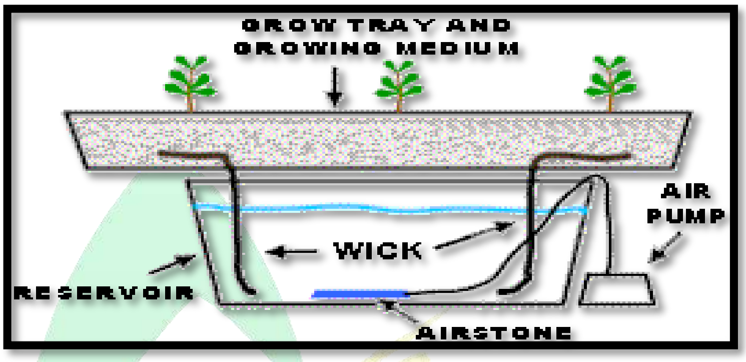
Hydroponics operates on the premise that if you can provide with what they need; plants will grow well. In this sense, Hydroponics is invented to rule out the influence of Mother Nature - It can be placed in a controlled growing environment. Hydroponics replaces the soil with water and the growing media. The growing media can be Perlite, sand, Rockwool, etc. Their main role is to transfer the nutrients in the water and keep the roots oxygenated. Nutrients are added to the water and are moved to the growing media and through the plant roots usually by a water pump. The interval of each action is often set by a timer.

Hydroponics is usually grown indoors or in a greenhouse. This means growers will take full management of the environment - climate, temperature, lights, ventilation, and so on.

Types of Hydroponic Systems:

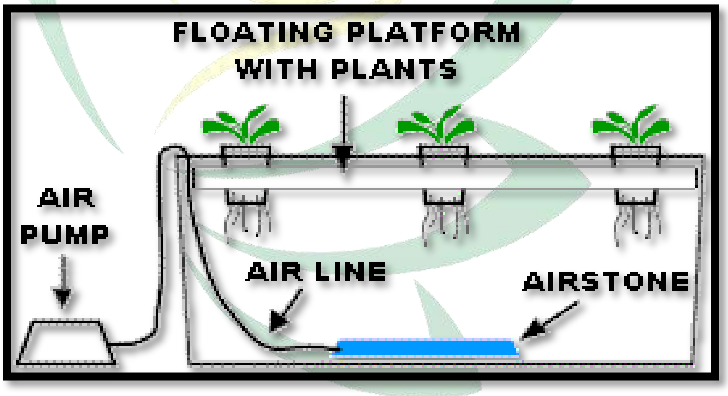
WICK SYSTEM:

The Wick system is a simple type of system. There are no moving parts in this passive system. The wick is used to draw the nutrient from the reservoir solution into the growing medium. Perlite, Vermiculite, Pro-Mix and Coconut Fiber are the most popular growing mediums which are used in this system.



WATER CULTURE:

The water culture system is the simplest of all active systems. A floating platform is used to hold the plants directly on the nutrient solution. This platform is usually made of Styrofoam. Oxygen is supplied to the roots of the plants. Here an air pump is used to pump air to the air stone so that bubbles are formed in the nutrient solution. This system is used for fast growing water loving plants like lettuce.



EBB & FLOW – (FLOOD AND DRAIN):

In this system the growing tray is flooded with the nutrient solution and then drained back into the reservoir. A submerged pump with timer is used for this action. The timer is used to turn the pump on so that the nutrient solution reaches to the grow tray. When the timer shuts the pump down, the solution comes back into the reservoir. It depends on the type and size of

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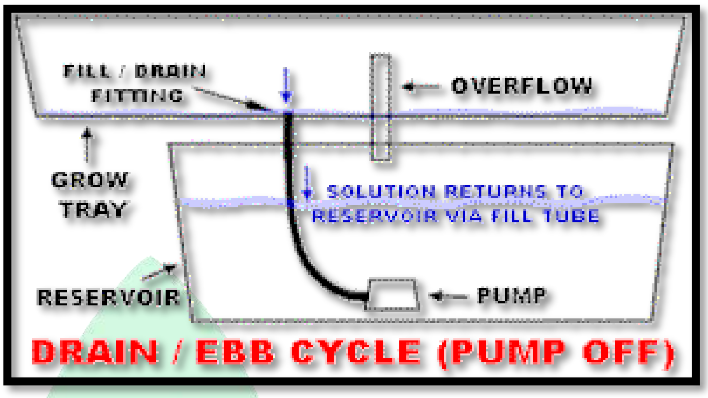
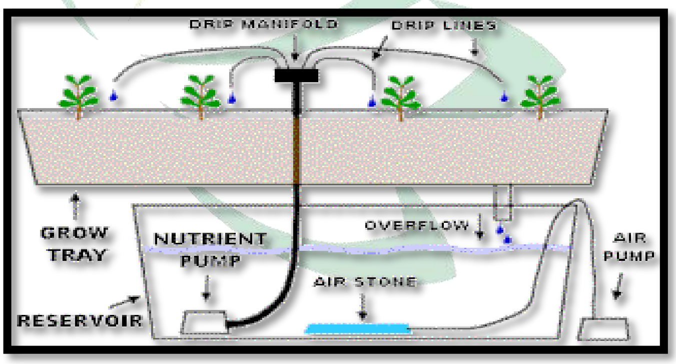
plants that how many times the timer will come in a day. Temperature and humidity and the type of growing medium are other factors too.



DRIP SYSTEMS - RECOVERY / NON-RECOVERY:

Drip system is widely used system in the world. A submersed pump is controlled by a timer. The nutrient solution is dripped onto the base of each plant by a small drip line when the timer puts the pump on. In a Recovery Drip System, if there is excess solution then the runs off comes back in the reservoir for using again.

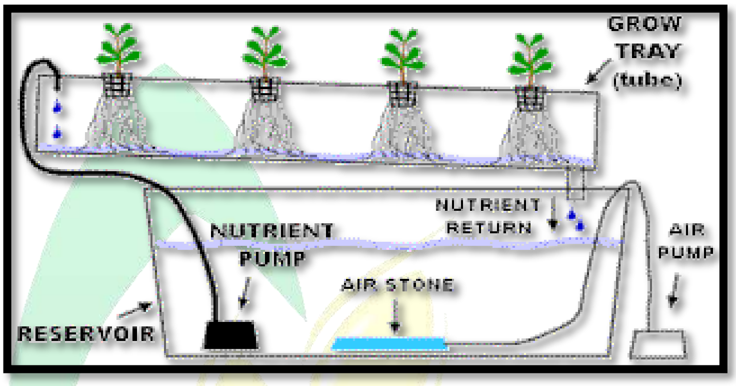
As excess solution is reused, a more inexpensive timer can be used because a recovery system can avoid precise control of the watering cycles. But the non-recovery system needs proper timer because watering cycles should be adjusted to give the plants enough nutrient solution and the runoff is minimum.



N.F.T.(NUTRIENT FILM TECHNIQUE):

N.F.T. systems ensure constant flow of nutrient solution, so the submersible pump is not connected with any timer. The growing tray (usually a tube) is filled with the nutrient solution through the pump and the solution flows over the plant roots. Then collected back into the reservoir.

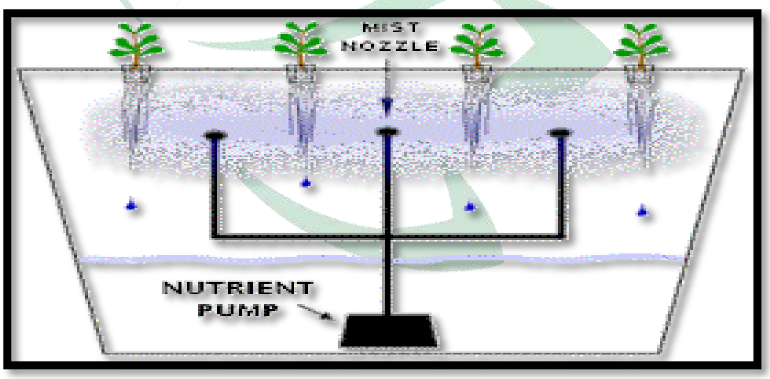
Air is normally used as growing medium to save the extra cost of replacing the medium after every crop. Normally a small plastic basket is used to support where the roots dangle into the nutrient solution.



AEROPONIC:

The aeroponic system is a high-tech type hydroponic system. Air is used as growing medium primarily like N.F.T. The plant roots hang in the air and are misted with nutrient solution. If the misting cycles are interrupted the roots would dry up because they are exposed in the air.

The nutrient pump is controlled by a timer here like other systems, but in this system a short cycle timer is required where the pump is run every couple of minutes for few seconds.



Advantage:

- Plants do not have to search for food in the soil rather the directly get all nutrient from the solution. All these energies will be instead consumed in its growth, and in producing fruits and flowers.

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- Hydroponics saves water. This soilless growing method uses only 10% water in comparison to soil agriculture because of its efficient recirculated system.
- There is no need for soil here. The main benefits are:
    a. Crops can be grown anywhere even in arable or heavily contaminated places. Crops are grown in all convenient locations like large scale green houses, apartments, terraces etc. So, a large portion of land can be saved.
    b. In this system all kinds of soil related pests and diseases can be avoided.No need to worry about weed problems here.
- Effective use of nutrients. All nutrients are added to the solution, and you are 100% controlling giving the specific amounts of foods (nutrients) that plants need.


Potential Downsides of Hydroponics:

- The initial expenses are little too high because whole set up of a hydroponics system requires a greenhouse or any place like that, hydroponic air pump, timer, lights, air filters, fans, containers, growing media, nutrients etc.
- The grower needs to have enough knowledge and experience to run the system successfully depending upon the size of the system. Specific knowledge helps the grower to set up the system, maintain and monitor.
- Sometimes whole set up gets destroyed due to power outage. Here the plants are totally depended upon the artificially created system.

Scope of Hydroponics in India:

Hydroponics farming in India is in its rising stage. Farming system of India is largely traditional. So, the current market for this type of farming is narrow in metropolitan and cosmopolitan towns. Now-a-days, in India, the progressively thinking farmers are adopting this innovative and inventive farming technique.

- In India, the scope of hydroponics is very high because population size is increasing indiscriminately, so the size of the arable land reducing in availability. For this reason, it is difficult to produce staple crops for the growing population. By using hydroponics methods, the farmers can solve the problem of arable land availability in near future. This may be a start of new green revolution.
- Besides this, another significant benefit of this farming system evolution in India will mitigate the heavy load on farmers. As hydroponics farms needs less space and water and the growth rate of the crops is very quick than the traditional one. With excess food availability, there will be no struggle for hunger by farming in hydroponics system.
- The hydroponics farming will reduce pest and disease attack and the weed production. So, the use of pesticide, herbicide will be reduced. As a result, the environmental pollution and the cost of cultivation will be low.
- In Indian weather condition, agriculture is being affected by climate change like unseasonal rain, hailstorm. But in hydroponics farming system, plants can grow under controlled condition by creating the artificial atmosphere.

Which type of plants we can grow?

- Vining plants- Tomatoes, Cucumbers, Peas etc.
- Root plants- Potatoes, Carrots, Radish etc.
- Fruits- Raspberries, Strawberries, Small papaya, Pepper, Blue berries etc.
- Greens- Spinach, Cabbage, Lettuce, Celery, Mint etc.
- Herbs- Basil, Rosemary, Parsley, Watercress etc.

Some success stories of hydroponics farming:

1. Aqua Farms, Chennai: Rahul Dhoka, the founder of Green Rusk Organics and Hydroponics Farming Consultancy Aqua Farms grows everything like Italian basil, mint, spinach, lettuce by using planter made of PVC pipes.
2. Letcetra Agritech, Goa: Ajay Naik, software engineer-turned- hydroponics farmer, grows chemical-free vegetables like lettuce, salad greens, cherry tomato, bell peppers etc.

3. Urban Kissan, Hyderabad: Vihari Kanukollu, Dr. Sairam and Srinivas Chaganti establish Urban Kissan jointly, where they produce lettuce, herbs, greens, exotic vegetables throughout the year.
4. Future Farms, Chennai: Sriram Gopal, who earlier ran an IT firm, establishes the Future Farm to develop hydroponics farming, which spread over 10 states growing leafy vegetables.

Conclusion:

The main concern of any crop cultivation practice should include not only the profit point of view but also the environmental safety. The grower should consider that if he wants to increase the production and productivity, there would always be some consequences to compensate. Thus, he has to maintain the balance. Hydroponics is one of those underrated techniques where all these concerns can be maintained if the farmer is willing to take some initial risks and investment. So, it is clear that this is the time when our farming community should switch to modern terms and techniques from the conventional without thinking that the new is always unacceptable. It is time that the farmers should be encouraged to adopt Hydroponic system in every part of our country so that they get the exposure to explore.

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The Future : Why Using Hydroponics For Farming?

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Introduction

Hydroponics is the method of growing plants without soil. Hydroponics is a Greek word. Hydro means 'water' and Ponos means 'labor'. Plants are grown on soilless medium and nutrients are provided through water for their growth. Hydroponics is invented to rule out the influence of mother nature. Hydroponics replaces the soil with water and growing media. The growing media can be perlite, sand, rockwool etc. The main role is to transfer the nutrients in water and keep the roots oxygenated. As long as we are able of providing what they need, plants will grow.

History

You all may have seen some soilless plants growing on walls, books etc however the practice has been used for thousands of years. The famous hanging gardens of Babylon in around 600 B.C. are the earliest records of Hyrdroponics. Other records of Hydroponics in the ancient times were found with the floating farms around the island city of Tenochtitlan by the Aztecs in Mexico in the 10th and 11th century. And in the late 13th century, the explorer, Marco Polo noted in his writing that he saw similar floating gardens during his traveling to China

John Woodward followed to study the growth of plants using water culture in 1699.1860 & 1861 marked the end of a long search for the nutrient source essential for plants' growing when two German botanists, Julius von Sachs, and Wilhelm Knop delivered the first standard formula for the nutrient solutions dissolved in water, in which plants could be grown. This is the origin of 'Nutriculture'. Today, it is called Water Culture. By this method, plants roots were totally immersed in a water solution that contained minerals of elements like nitrogen (N), phosphorus (P), potassium (K), magnesium (Mg), sulfur (S) and calcium (Ca). They are now seen as the macro elements or macronutrients (elements required in relatively large amounts).

The term Hydroponics was first coined in 1937 by Dr. William Frederick Gericke of University of California, aptly known as the "Father of hydroponics" he was able to grow tomato vines more than 7-meters long just by using mineral-nutrients solutions, right in his backyard.

Why Hydroponics?

With the great advantages of Hydroponics such as growth rate which is higher than normal, saving the space, water efficiency and better control of pests & disease, it's no wonder that Hydroponics has been applied widely around the world.

Advantages

- It saves water.
- No soil needed.
- Effective use of nutrients.

There are limitless growing media around us. Even the air can be a great material as long as it can provide plant roots with oxygen, moisture, and nutrients. When choosing a growing medium for your Hydroponic system, one should keep some traits in view:

- Good aeration and drainage - Does your medium hold the moisture and oxygen well?
- Lightweight enough to work with and carry around.
- Reusable.
- pH neutral.
- Cheaper.
- Organic and environmental friendly.

Hydroponics : The Future of Farming

The population of world is continuously increasing, the challenge is to produce more food while being more sustainable. However, such a population increase comes hand in hand with the need to produce more food to feed them. FAO suggest that 70% more food will be needed in 2050. But with 80% of cultivated land is already in use and the rapid urbanization of countries set to continue, the challenge of producing more food in a sustainable way will become ever more pressing.

Human beings have to achieve this despite the lack of lands, the increasing demand for fresh water from which agriculture consumes 70% , the expecting climate change which can lead to the alteration in temperature, lights as well as the plants and animals life cycle. Hydroponics is undoubtedly considered as an approach to the future of agriculture. Using no soil, it is a valuable culture method to grow fresh vegetables in countries or any place with little arable land and those whose area size is small yet contains a huge population. Hydroponics can help the Distant places and tourist sites like hotels, resorts can grow their own fresh food. Some successful examples that have adapted Hydroponics are the West Indies and Hawaii. People have served large tourists with their own vegetable production. We'll surely see more sites like these in the coming time.

For the scarcity of water, while desalination technology is being used, people will be able to extract fresh water from the sea to supply for the hydroponic garden as well as agriculture in general. A big disadvantage of the soilless planting method is that its expense. For large scale hydroponic farm, lights used to grow plants are a big part of the total cost. Therefore the prices of Hydroponic gardens grown indoor and those in the northern latitudes with limited sunlight are much higher. We are expecting that with the use of new technology in artificial lights, growing plants will become much more economically reduced.

In the space science industry, NASA has considered the hydroponic growing method for feeding and nourishment to astronauts on the space station and on Mars. In a world where scientists are working day by day to solve the matters of food and natural resources in a sustainable and ecological way, Hydroponics still plays a major part in human beings cope to the future survival.

Conclusion :

While we don’t know what the future holds exactly, we can make a couple of calculated predictions as a society. Statistics and reports already indicate that hydroponics will have a special place in the coming years. As the concept of space travel becomes closer to reality with each passing day, hydroponics will find a place in long flights across space, where agriculture is restricted due to area and soil-weight limits.

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Plant Defence Mechanism

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Introduction

Adjustment is probably, one of the most important virtue of a system that ensures it survival, be it host or parasite. On planet earth, the green plants (autotrophs) constitute the only biological system capable of converting solar energy (electro-magnetic radiations) into chemical energy. Plants as a biological system resist this exploitation, at all levels and by all means. The co evolution, forced by co-existence with pathogen, has led to development of defence mechanism in plants.

Thus, resistance against any 'deleterious act' has become a natural and universal response of plant system. The resistance against parasites/pathogen is the heritable trait of plants by virtue of which they resist attack by parasites/pathogens or their activities. The defence mechanism(s) has ensured the survival of plants in spite of living amongst some of the potentiality devastating pathogens in addition to abiotic stresses. Plants have also developed ability to resist/tolerate various abiotic stresses.

Plants represent a rich source of nutrients for many organisms including bacteria, fungi, protozoa, insects, and vertebrates. Although lacking an immune system comparable to animals, plants have developed a stunning array of structural, chemical, and protein-based defences designed to detect invading organisms and stop them before they are able to cause extensive damage. Humans depend almost exclusively on plants for food, and plants provide many important non-food products including wood, dyes, textiles, medicines, cosmetics, soaps, rubber, plastics, inks, and industrial chemicals. Understanding how plants defend themselves from pathogens and herbivores is essential in order to protect our food supply and develop highly disease-resistant plant species.

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Types of Defence Mechanism;

Plant defence mechanisms can be divided into two types: structural and chemical. A structural defence mechanism is simply part of the plant's form. Chemical defence mechanisms are more complex adaptations and include the production of chemical compounds and toxins. Chemicals may just make the plant taste foul to the animal, or even better from the plant's perspective, it may make digestion difficult, alter animal behaviour and activity, or even cause death.

Defence Mechanisms:

A- Pre-existing or Passive

The first line of defence in plants is present in its surface. Several characters of the plants surface function as barriers to penetration which pathogen must breach to enter the host. The pathogens enter the plant host by penetrating the epidermis along with cuticle and cuticular wax and number of natural openings existing before the onset of the pathogenesis can obstruct penetration. If the pathogen succeeds in penetration; it encounters pre-existing internal structural barriers. The external and internal structural barriers existing before pathogen attack are also called Pre-existing defence structures or passive/static or anit-infection structures.

Wax and cuticle

The cuticle covers the epidermal cells of plants and consists of pectin layer, a cutinized layer and a wax layer. Cutin is composed of fatty acids. Waxes are mixture of long chain aliphatic compounds which prevent the retention of water on plant surface essential for spore germination. A negative charge usually develops on leaf surfaces due to fatty acids. This condition repels air-bone spore / propogules. Only few pathogens are known to dissolve cutin enzymatically. Examples: *Monilinia fructicola* penetrates cuticle of cherry leaves but not of Gingko biloba leaves; the latter contains abundant cutin than the former. *F. solani f sp. Pis*i produces the enzyme cutinase production by specific antibodies and inhibitors.

Epidermal layer

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Epidermis is the first layer of living host cells that comes in contact with attacking microbes. The toughness of epidermis is due to the polymers of cellulose, hemicelluloses, lignin mineral substances, polymerized organic compounds, suberin etc. Potato tubers resistant to Pythium debaryanum contain higher fibre. Silicon accumulation in epidermal walls provides resistance against fungal attack. Suberization of epidermis confers protection against plant Xanthomonas axonopodis pv. Citri because of broad cuticulat lips covering the stomata. A functional defence mechanism has been observed in some varities (cv-Hope) in which stomato open late in the day when moisture on leaf surface has dried and the infection tunes have become non fuctional.

- **Hydathodes** are natural openings on the edges of leaves and serve to excrete excess water from the interior. They are easy entry pints of bacterial pathogens such as X.capestris pv. capestis (black rot of cabbage), Similar to hydathodes are the nectarthodes in inflorescence of many plants. They secrete sugary nectar and this serves as barrier to those organisms that cannot tolerate this condition and thus, can enter through nectarines.
- **Leaf hairs** on leaves and on nectarines also resist entry of pathogens. High hairlines of leaves and pods in chickpea are resistant character against Ascpchyta rabei. Groundnut varieties showing resistance to Cercospora leaf spots have thick epidemis-cum cuticle and compact paslisade layer, few and smaller stomata and high frequency or trochomes on the abaxial surface of leaf.
- **Lenticles** are opening in outer walls involved in gaseous exchange. They are weak points in defence unless the cork cells within them are suberized. After suberizatoin and periderm formation, lenticels are more resistant to invasion by pathogens.

Pre-existing biochemical defence;

Plants liberate different chemicals, which interfere with activities of the pathogen and pathogenesis, thereby preventing or reduce infection. These chemicals and the biochemical conditions that develop may act either directly through toxic or lytic effect on the invader or indirectly through stimulating antagonistic plant surface microflora. The compounds pre-existing in plants as constitutive antibiotics and those, which are formed in response to wounds as wounds antibiotics.

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Release of anti-microbial compounds

Plants while growing and developing release gases as well as organic substances, from leaves and roots (leaf and root exudates), containing sugars, amino acid, organic acids, enzymes, glycoside etc. These materials have profound effect on the nature of surrounding environment, particularly the phyllosphere, rhiizosphere microflora and fauna. Although these substances are ideal nutrients for microbes and help in germination and growth of several saprophytes and parasites number of inhibitory substances is also present in these exudates. Theses inhibitory substances directly affect the microorganism, or encourage certain groups to dominate the environment and function as antagonists of the pathogen.

Inhibitors present in the plant cells

In many host-parasite interactions, pre-existing toxic substances in the cells form the basis of resistance. In resistant variety these substances life in abundance while in susceptible variety they may be less or completely absent. Several phenollic compounds, tannins and some fatty acid like compounds such as dienes pre-exisitg in high concentrations in cells have been implicated for the resistance or young tissues to parasitic fungi such as Botrytis. Many such compounds are potent inhibitors of many hydrolytic enzymes. Several other types of preformed compounds such as saponins (glycosylaled steroidal or triterpenoid compound) tomatine in tomato and avenacin in oats, have antifungal membranolytic activity. The fungal pathogens which lack enzymes (saponinases) that breakdown the saponins are prevented from infecting the host. Several preformed plant proteins have been reported to act as inhibitors of pathogen proteinases or of hydrolytic enzymes. Similarly lactins (proteins that bind to certain sugars) cause lyses and growth inhibition of many fungi. Plants surface cells also contain variable amounts of hydrolytic enzymes such as glucanases and chattiness, which may cause breakdown of pathogen cell wall components.

Lack of essential factors:

Recognition factors

The first step in infection process is the cell-to-cell communication between host and pathogens. Plants of species or varieties may not be infected by pathogen if their surface cells

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lack specific recognition factors. If the pathogen does not recognize the plant as one of its hosts it may not adhere to the host surface or it may not produce infection substances such as enzymes, or structures (aspersoria, haustoria). These recognition molecules are of various types of oligosaccharides and polysaccharides and glycoprotein's.

Host receptors and sites for toxins;

In many host parasite interactions the pathogen produces host specific toxins, which are responsible for symptoms and disease development. The molecules of toxin are supposed to attach to specific sensitive sites or receptors in the cell. Only the plants that have such sensitive sites become diseased.

Essential nutrients and growth factors

The fact that many facultative saprophytes and most of the obligate parasites are host specific and sometimes are so specialized that they can grow and reproduce only on certain varieties of those species suggests that for these pathogens the essential nutrients and growth factors are available only in these hosts. Absence of these nutrients and stimulus make the other varieties and species unsuitable hosts.

Defence mechanism: Induced or active

Plants have to face the wide variety of pathogens (enemies) standing at a place. Thus a strategically designed pre-existing (structural and biochemical) defence mechanism in plants exists. The real value of this system has not been critically examined. It appears that these pre-existing defence mechanisms help plants in warding-off most of microbes as non-pathogens. But it does not seems t be sufficient. The induced/active defence mechanism in plants may operate at different levels

- Biochemical defence
- Defence at cellular level
- Defences at tissue level

The activation or induction of defence mechanism may be both specific and non-specific type. Several structural changes are known to be induced by a range of biotic or abiotic elicitors. These dynamic defence mechanisms prevent further colonization or spread of pathogen. Active defence in plants involves cellular defences that rely upon preformed surveillance systems are encoded by resistance genes. The receptor-proteins are strategically located in cell membrane to detect the pathogen or factor translocated by pathogens. The ability of plant to mount an active defence response is again under genomic control.

Disease occurs when

1. Pre-existing defence mechanism are not enough to check the entry of pathogen
2. A pathogen avoids timely eliciting active defence system in plant tissue or habits active

Defence response by secreting metabolic toxins.

Induced Structural Defence

Induced histological defence

Even after the establishment of infection in plant cells, the host defence system tries to create barriers for further colonization of tissues. This may be at various levels.

Lignifications

Lignified cell wall provide effective barrier to hyphal penetration. They also act as impermeable barrier for free movement of nutrient causing starvation of pathogen. Following are examples.

Radish: *Peronospora parasitica, Alternaria japonica*

Potato: *Phytophtora infestans*

Wheat: *Septoria nodorum*

Cucumber: *Cladosporium cucumerium, Colletorichum lagenarium*

Carrot: *Botrytis cineria*

Suberization

In several plants the infected cells are surrounded by suberized cells. Thus, isolating them from healthy tissue. Corky layer formation is a part of natural healing system of plants. eg. common scab of potato and rot of sweet potato are good examples.

Abscission layers

It is a gap between host cell layers and devices for dropping –off older leaves and mature fruits. Plant may use this for defence mechanism also. I.e. To drop-off infected or invaded plant tissue or parts, along with pathogen. Shot holes in leaves of fruit trees is a common feature.

Tyloses

The tyloses are formed by protrusion of xylem parachymatous cell walls, through pits, into xylem vessels. The size and number of tyloses physically block the vessel. The tyloses are inductively formed much ahead of infection, thus blocking the spread of pathogen. It suggests biochemical elicitors and movement of tyloses inducing facto (TIF) up the stem. eg. Sweet potato: Fusarium oxysporum f. sp. Batatas.

Gum deposition;

The gums and vascular gels quickly accumulate and fill the intercellular spacis or within the cell surroundings the infection thread and haustoria, which may starve or die.

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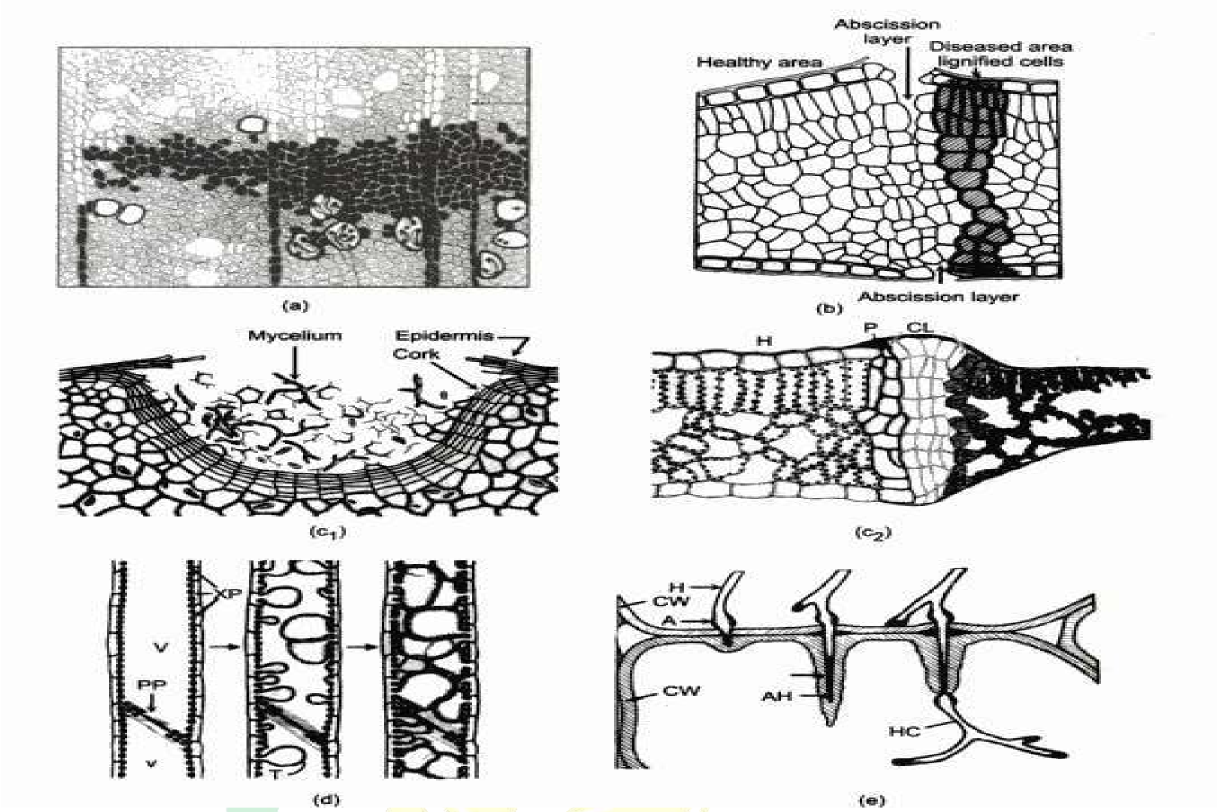

Mechanism of host resistance;

- Lignification
- Abscission layer formation.
- C_1 & C_2 Cork layer formation
- Tyloses formation
- Sheathing of infection threads

Induced cellular defence

The cellular defence structures, i.e. Changes in cell walls, have only a limited role in defence. Following types are commonly observed.

1. Carbohydrate apposition (synthesis of secondary wall and papillae formation)
2. Callulose deposition (hyphal sheathing just outside plasma lemma around the haustorium which delays contact of pathogen (Phytophythora infestans) with host cells.

3. Structural proteins
4. Induced cytoplasmic defence that present last line of host defence and may effective against slow growing pathogens, weak parasites or some symbiotic relationship.

Induced biochemical changes

The induced biochemical changes in host plants are the last line of host defence. This may condition a plant or plant tissue from susceptible to resistant to immune status as per their genetic potential. The role of bio chemical factor in host defence is based on the following four attributes.

1. The substance is associated with protection against disease at the site where protection occurs.
2. The substance can be isolated from the host showing protection against the disease.
3. Introduction of isolated substance to the appropriate susceptible host confers protection.
4. The nature of protection so induced resembles that of the natural agents of a resistant plant.

Toxic substances produced

Rapid production/suitable modifications and/or/ accumulation of chemicals toxic to pathogen up to effective concentrations is an important component of overall active defence strategy of plants. Slow production or accumulation or low levels of similar chemicals have reported in susceptible host plants also.

Role of phenolic compounds

The phenolic compounds, viz., chlorogenic acid caffeic acid and ixidation products of floretin, hydroquinone hydroxyquionones and phytoalexins are main toxi chemical produced to inhibit pathogen or its activities. Some of these are performed toxic chemicals while others may be de novo synthesized or modified to more toxic forms. The enzymes involved in chemical pathways are present in host cell (pre-existing).

Role of phytoalexins

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Most common response of plants to stress, biotic (phytoalexins/insects) or abiotic (wounding), is the production and accumulation of substrates that can inhibit the growth and activities of the biotic factors or may help in healing process. Muller and Borger proposed the concept of phytoalexins in their study on hypersensitive reaction of potato to avirulent P.infestans strains. Phytoalexins are antibiotics produced in plant pathogens interactions or as result reposnse to injury or other psychological simulation.

Role of new protein synthesized

Post-infectional changes in host cells involve production and modification of large number of proteins (structural and enzymatic), which have important role in defence mechanism. The enzymes are required for various synthetic pathways (normal or modified) for production of resistance related substances. In addition, phenol-oxidizing enzymes have vital role. The influence of these changes may be confined to infection site or nearby cells. Increased synthesis and activity of phenyl ammonia lyase (PAL) has been reported in several bacterial and vital pathogens in resistant reaction. PAL plays key role in syntheses of phenols, phytoalexins and lignin. The effectiveness of resistance depends on speed and amount of synthesized products and their movements to neighboring healthy tissues to create defensive barriers.

In-activation of enzymes and toxins

The role played by chemical weapons (toxin and enzymes) of pathogens during pathogenesis is well established. The necrotrophs and hemihiotrophs employ more of these substances fro causing those tissue damage as compared to speacialized obligate parasites. The defence strategy of resistant plants, through activity of phenols, tannins and protein as enzymes inhibitors, the phenolics are not anti-fungal but make pathogen ineffective by neutralizing their enzymes. In immature grape fruits catechol-tannin is known to inhibit enzymes produced by Botrytis cinerea.

Toxins are known to be involved in pathogenesis to various edtents (pathotoxins/vivotoxins). The resistance to toxins, in host, will be resistance to pathogens. This can be achieved by detoxification or lack of receptor sites for these toxins.

Role of altered biosynthetic pathway

The pose inflectional metabolism of host tissue is altered (stress physiology) to cope with the advancing activities of pathogen. New enzymes (proteins) are produced in an effort to synthesize defence related substances. Most of these compounds are formed through Shikmic acid pathway and modified acetate pathway. Respiration in diseased tissue is invariably increased; a part of glycolysis is replaced by pentose pathway, which yields four carbon compounds are formed through Shikmic acid pathway and modified acetate pathway. Respiration in diseased tissue is invariably increased; a part of glycolysis is replaced by pentose pathway, which yields four carbon compounds. It is possible that in early stages of infection the gene regulation of host cell is influenced and some specific genes.

Active defence to pathogens

Induction of host resistance, structural or biochemical seems to be universal I plants. Active defines responses have been reported against all classes of pathogens (fungi, bacteria, viruses, and nematodes). Active defence response may lead to incompatible host-pathogen interaction.

Summary of induced biochemical defines reactions

1. On entry of the pathogen, a temporary increase in cellular metabolic activities occurs in the host. Due to stress caused by increased metabolic activity cells die rapidly showing hypersensitive reaction. Rapid death of cells in correlated with increased degree of resistance in most diseased systems.
2. When the infected tissues are reaching the nectotic stage, metabolism of neighboring tissues is also increased and phenolics and other compounds are accumulated. In this process, the synthesized compounds move from healthy to diseased tissues.
3. The reactions expressed by hypersensitivity form common phenols, phytoalexins, and other abnormal substances. The oxidized products of phenolics may detoxify the toxins or inactivate other weapons of the pathogen.
4. When spread of the pathogen is checked, the neighboring healthy tissues with accelerated metabolic activities try to isolate the damaged parts by forming new tissues and eliminate the disease/pathogen.

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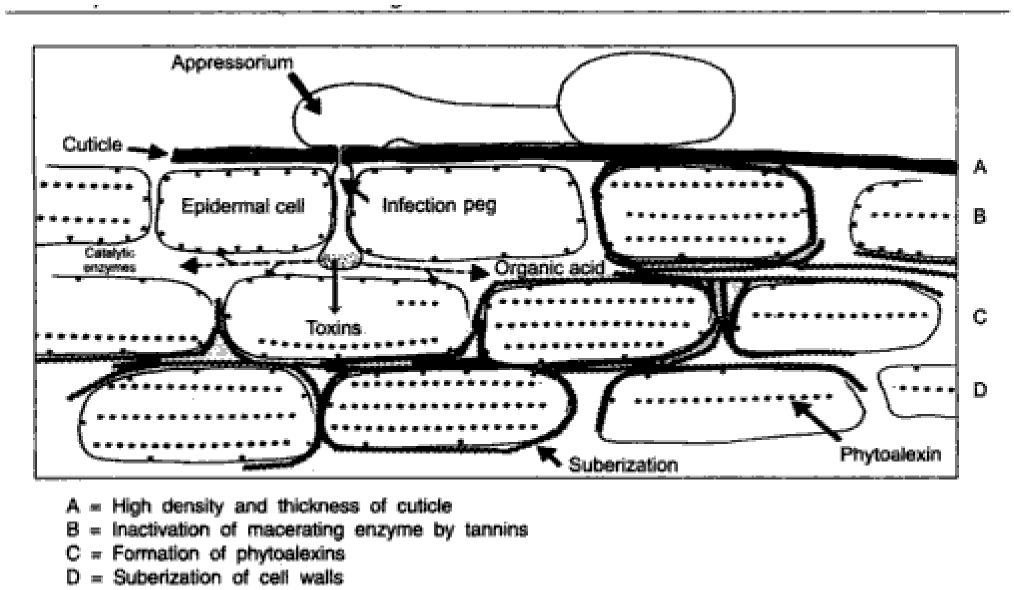
Host defence, pre-existing or induced, is a multi-component strategy where several factors work together to fashion the final outcome. Figure below represents a case where more than on factors are responsible to condition resistance in immature grapes berries against Botrytis cinerea.



Multi component defence mechanism in young grapevine berries against Botrytis cincerea.

Systemic acquired resistance;

Induced resistance (cross protection) in plants is a phenomenon of significance, which has not been properly exploited for plant disease management, probably because of our poor understanding. Induced resistance,, localized or systemic, may be specific. The signal molecule, that propagates the resistance to distant places are vital in systemic induced resistance. The resistance is induced in manner comparable to immunization in mammals but the mechanism differs.

The resistance may be induced due to any of the following:

- Accumulation of PR proteins
- Activation of lignin synthesis
- Enhanced peroxidise actitivity
- Suitable changes in plant metabolism

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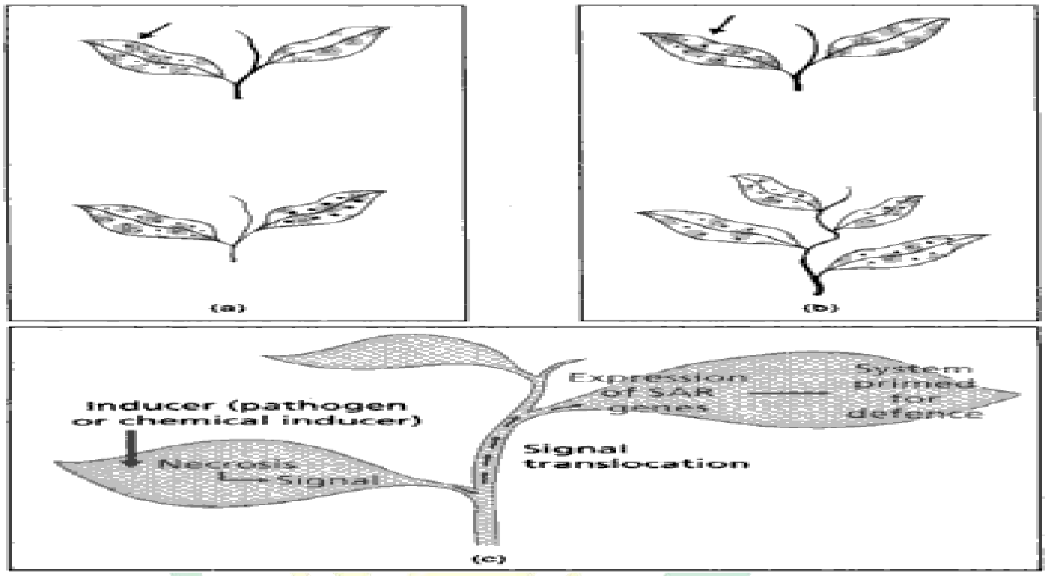
Principle of induced resistance;

Induced resistance is a phenomena where a lead treated with certain chemicals or inoculated with pathogen's virulent strain produce a signal compounds that is transported systemically throughout the plant and activities its defence mechanism (making the entire plant resistant to subsequent infection) without its own physical presence at the site. The picture below explains a hypothetical mode to explain induction of SAR.



Representation of acquired resistance a) Local b) Systemic c) SAR

Integrated Agro met advisory services (IAAS) and its economic impact on Farmers

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ARTICLE ID: 057

Introduction

Governments are investing huge budget for making weather forecast most reliable and best suitable for everyone and especially for farmers. Weather forecast system meant to operate to cope with adverse weather in particular relation with agriculture. Agriculture is one amongst the vulnerable area which is generally stricken by the climate and weather. Weather is one amongst the foremost factors affecting the agriculture production and crop productivity. Among the various weather parameter rainfall and its distribution determines failure or success of any crop in a season. The quality and quantity of the crop produce in a season is largely dependent on variability in the rainfall, delay/advancement in onset of monsoon, excessive rainfall and prolonged dry spells. Based on weather forecast, crop loss can be minimized by adopting the real time contingencies plan in crop management. Weather forecast is normally issued at three levels by Indian Meteorological Department (IMD), Ministry of Earth Sciences viz., short range (valid for 36 hours- 2 days), medium range (3-10 days) and long range (more than 10 days). IMD has started weather services for farmers in the year 1945. Selection of crops for a particular season is determined by Long range weather forecast while day to day farming practices/operations such as sowing, time of application of fertilizer and pesticides, irrigation scheduling, weed management etc. are determined by short and medium range weather and weather forecast helps to advice the farmers on the actual and expected weather to make decision on day to day crop management operations.

Based on the weather pattern and its relations with crop, farmers need integrated farm advice consist of advice on crop production and protection for improvement of crop productivity. The success of agricultural production depends on the degree of overcoming the ill-effects of crop production factors. Predicting the weather and rainfall pattern can help farmers to take suitable measures to reduce the risk and improve the productivity of crop.

In India Integrated Agromet Advisory Services report are being prepared and disseminated at the same time to the farmers on a regular basis (two days in a week) based on medium range weather forecast by National Centre for Medium Range Weather Forecast (NCMRWF) IMD, Ministry of Earth Sciences.

Dissemination of agro met advisories and extension activities

Agro met advisories are being disseminated with the farmers through various multi-channel system such as All India Radio (AIR) and Doordarshan, private TV, newspaper, internet and SMS. Also under Public Private Partnership (PPP) mode, Reliance Foundation, Reuter Market Light, IFFCO Kisan Sanchar Limited (IKSL), NOKIA-HCL, Handygo, Mahindra Samriddhi, Kisan Sanchar, National Bank for Agricultural and Rural Development (NABARD) are disseminating agro met advisories in SMS format to the farming community. A portal (http://farmer.gov.in/advs/login.aspx) launched by the Ministry of Agriculture, Government of India for the same purpose. India Meteorological Department (IMD) in co-operation with Agro meteorological Field Units (AMFUs) and State Agriculture Universities (SAU) publishes weather forecast and communicate it with farming community at same time in both regional and English languages. To avail this service, farmers are required to register their name and mobile number along with the crops.

Impact of Agro met Advisory Services on Farmers

Various studies suggests that farmers not only getting benefit on output of the crop but they can also reduce the cost which were incurred between crop management practices. Judicious use of fertilizers, best suited time for sowing, irrigation scheduling according with rainfall pattern etc. helps farmers to increase their farm productivity and helps in enhancing their income also.

Case study 1:-A field study was conducted in Kerala and it shows that on an average Paddy yield was increased for those farmers which are using agro met advisory services by 7.6 % and 12.4% in *Kharif* and *Rabi* season respectively as compare to non- AAS farmers.

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Table 1 Percentage increase in yield and economic gain due to AAS

Yield (q ha^{-1})				
Year	AAS farmers	Non- AAS farmers	% increase in yield	Economic gain
Kharif- Paddy				
2004	28.0	26.0	7.1	2290.0
2005	27.0	25.3	6.3	1776.0
2006	27.8	25.3	9.0	2125.0
Average	27.6	25.3	7.6	2064.0
Rabi- Paddy				
2003-04	36.5	29.5	19.2	2932.0
2004-05	30.0	27.8	7.3	2987.0
2005-06	33.0	28.5	13.6	3581.0
2006-07	31.8	28.8	9.4	3363.0
Average	32.8	28.7	12.4	3216.0

(Source- A field study was conducted by Prasad Rao and Manikandan at Kerela)

Case study 2:- A similar study was conducted under the project National Innovations in Climate Resilient Agriculture (NICRA) at Bengaluru and finding suggest that more and more benefit was obtained by farmers those getting AAS services through SMS or by other platform.

Table 2: Performance of real time contingent crop varieties with AAS and non AAS users

		2011	**2012**	**2013**	**2014**	**2015**
Yield	AAS	2593	1720	1967	2238	2500
	Non AAS	2556	1555	1700	2100	2600
Net return (Rs/ha)	AAS	19634	21161	23510	32122	33072
	Non-AAS	19281	18096	17972	28684	35107
B:C ratio	AAS	2.48	2.30	2.24	2.35	2.31
	Non-AAS	2.45	2.11	1.95	2.20	2.39
Date of sowing	AAS	22nd Jul	31st Aug	10th Jul	14th Jul	24th Jul
	Non-AAS	5th Aug	15th Aug	19th Aug	2nd Sep	23rd Aug

(Source- Study conducted by Ramachandrappa *et al* at Bengaluru)

It is evident from the studies that Agromet Advisory services helps in determining best suitable sowing dates for crops and it also helps in better crop management practices which ultimately increases crop yield and enhances farmer's income. The IAAS of IMD is envisioned to contribute to weather information based crop/livestock management approaches and operations dedicate to augment crop production and food security.

Personal View

AAS services are very helpful to improve weather based farming system and to enhance farmer's income. As of now AAS is mainly focused on major agriculture, horticulture crops and livestock. Now we need to focus on more area of farm operations such as fertilizer management, irrigation scheduling, timing of inter cultural operation to conserve soil moisture and information on pest and disease. Advisories on post-harvest methods or technique will definitely be beneficial for farmers as many farmers are not aware of it. By incorporating all these advisories in exiting advisory bulletin will enhance the farm income and reduces the ill effect of weather.

Conclusion

The application of agro met advisory bulletin, based on current and forecasted weather is a useful tool for enhancing the production and income. Farmers received weather forecast based agro-advisories, for major agriculture crops, horticulture crops including vegetable crops and livestock on real time basis. By incorporating advisories on the farm lead to increased yield and reduced ill-effects of crop and ultimately led to increased profit. IAAS being delivered for five days which incorporates 8 weather parameter i.e. maximum temperature, minimum temperature, rainfall, maximum RH, minimum RH, cloud cover, wind speed and wind direction. Agro met advisories are disseminated on every Tuesday and Friday by Agro meteorological Field Unit (AMFU). For the benefits of farmers of different district, district level agro met advisories bulletin are prepared and disseminated.

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Role of monsoon in Indian agriculture

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Introduction

India is world's largest producer of sugar, cotton and pulses. The country is also the second biggest producer of wheat and rice. Monsoon season which delivers about 70% of the country's annual rainfall, determines how successful cultivation would be. The monsoon is also critical for the wider economy.

A normal rainfall, and as a result higher agricultural output, can boost India's economic growth and keep inflation in check. The south – west monsoon irrigates over half of India's crop land. Its arrival marks the beginning of the cultivation of rainfed kharif crops which are heavily dependent on the monsoon. The quality of rainfall determines agricultural production. Early showers will help farmers start planting of major crops such as rice, Soybeans, cotton and pulses.

Monsoon importance for agriculture growth

India gets around 70 percent of its annual rainfall during the monsoon season, which also affects the yield of some kharif or summer crops like rice, pulses and oil seeds such as soybeans. Farmers start planting these crops with the arrival of monsoon rains in June. Union ministry of water resources says, "India receives an average rainfall of about 1170 MM which corresponds to an annual precipitation of about 4000 BCM (Billion cubic meters) including snowfall. Around 50% of India's total food output comes in the form of summer crops. A delayed monsoon can lead to supply issues and even accelerate food inflation.

Effect on demand

In a good monsoon season, farm output goes up, boosting demand for consumer goods as well as income of rural people. All of this leads to a stronger economic outlook that in turn help lift equities especially of companies selling goods in rural areas.However, a poor monsoon season weakens the demand for CG products, tractors, two – wheelers and rural housing also, it forces the government to spend on the import of food as well as take measures like farm ban waivers. The monsoon rains in India also replenish reservoirs and ground water that helps in improving irrigation and also boosts hydropower production.

Monsoon

A monsoon is traditionally a seasonal reversing wind accompanied by corresponding changes in precipitation, but now used to describe seasonal changes in atmospheric monsoon or rainy season, lasting from June to September. The season is dominated by the humid southwest summer monsoon which slowly sweeps across the country beginning in late may or early June. Monsoon rains begin to recede from north India at to beginning of October. South India typically receives more rainfall.

Changes of the monsoon

Monsoon typically occurs in tropical areas one area that monsoons impact greatly is India. In India monsoons create an entire season in which the wind's reverse completely. The rainfall is a result of the convergence of wind flow from the Bay of Bengal and reverse winds from the South China Sea.The onset of the monsoon cover the Bay of Bengal in may arrive at the Indian Peninsular by June, and then the winds move towards the South China Sea.

Ideal and normal monsoon rains

Normally, the southwest monsoon can be expected to "burst" onto the western coast of India (near Thiruvananthapuram) at the beginning of June and to cover the entire country by mid – July. Its withdrawal from India Typically starts at the beginning of September and finishes by the beginning of October. The northeast monsoon usually "Bursts" around 20 October and lasts for about 50 days before withdrawing.However, a rainy monsoon is not necessarily a normal monsoon that is one that performs close to statistical averages calculated over a long period. A normal monsoon is generally accepted to be one involving also to the average quantity of precipitation over all the geographical locations under influence and over the entire expected time period. Additionally, the arrival date and the departure date of both the southeast and northeast monsoon should be close to the mean dates. The exact criteria for a normal monsoon are defined by Indian.

Indian Agriculture's dependence on monsoon

Farming is the only source of income to many farmers in India. In fact taking in consideration the amount of GDP contribution that the Indian agriculture has, it is a primary factor to affect the economy as a whole Around 70 percent of the Indian population depends on farming and 58 percent of the total employment in the country is through agriculture which contributes to around 18 percent of the GDP. These numbers bring both, necessary responsibility and limitless to a large part of our population.

One cannot deny the dark clouds of monsoon bring hop and happiness to farmers, the soil of his farm comes alive when the first drops of monsoon touches his farmland. Seeds winding in the ground get moistened by the rainfall. It's just magical together. As a tropical country with limited irrigation facility, the fate of the kharif crops especially depends on the southwest monsoon. The amount of rainfall in a specific area determines the types of crop that can adapt and grow to the natural factors affecting the region. Monsoon friendly crops with a high requirement of water like sugarcane, jute and paddy can easily be cultivated during summers in areas with a high proximity for monsoons. Whereas, crops like wheat and barley require moderate temperature, humidity and water, therefore can only be grown in winters.

However, there are increasing incidences of floods during this season. Droughts due to erratic weather, it's a time to explore ways of bringing a sustainable model of farming for our farmers and minimize depressed every on monsoon.

More than anything else, the failure of monsoon has a huge impact on the life of Indian farmer. Most of the Indian farmers rely on good crop produce during monsoon to earn their living and in order to overcome debts incurred. Lastly, agriculture isn't the only sector which is affected by the performance of monsoon. Infect, as many as a dozen sectors depends on monsoon, either directly or indirectly. Thus, it is safe to say that Indian agriculture depends on monsoon but same time monsoon are bit rude to the farmers.

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Reviving the Blues- A Venturesome approach towards sustenance

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Nature's call for sustainability can never be put off the head. It being one of the most crucial environmental issue presently, there have been many interventions by those organizations Concerned for human and environmental protection. But however, may be due to lack of money or due to lack of awareness and public participation, a major breakthrough have not been achieved yet.

Fish since 2 million years ago, have been one of the most relished nutritious food item and even we do see our future food security tightly bound within the industry. But however, that typical human nature of greediness have placed a threat of overexploitation upon the resource and thence getting the stock plummeting. Scientists have even pointed out that, many of our valued fisheries is getting exhausted and even more getting extinct. This alarming situation is thus putting up the need for an innovative counteract. Apart from over exploitation, destructive fishing esp. using trawls, is yet another environmental hazard causative. It via its operation destroys ferociously the habitat and thereby affecting survival, food chain, breeding and many more such, finally culminating in stress. The stressed fish behaves beyond normal and dies after sometime or even as a part of over.

Control Measures

According to the recently published database (SOFIA-2020), the proportion of fish stock within biologically sustainable levels decreased from 90% in 1974 to 65.8% in 2017.Its even more startling to hear about the increasing carbon dioxide emissions associated with the unsustainable frequent fishing practices which contributed to a release of about 207 mt of carbon dioxide in 2016, that too alone by the marine fishing vessels.

Overfishing apart from affecting biodiversity and ecosystem processes, also causes social and economic consequences too. Regarding achieving Sustainable Development, FAO puts forward the following measures –

- Stronger political will, better technology and its transfer, enhanced governance, proper control over fishing, strengthening of global monitoring system for transparent and timely information to public and most importantly transforming consumer perception through market mechanism and education.
- Public participation with properly bound rules and regulations.

They have even pointed out that, it is the developing countries with least management, whose fishery resources is most affected. Hence there is need for re-adoption of policies in such areas to fulfill sustainability dreams.

Yet another major concern is regarding the fish “wasted”. One is the fish lost in quality and quantity driven by inefficiencies in the value chain esp. with regard to developing countries without proper facilities for post harvest handling and preservation. Another is regarding the fish by catch and discard, which became a serious wastage and an international issue in fisheries management since 1970’s .The survival possibility of discarded by catch and their disposal after harvest and its ultimate loss to the biodiversity, is a major subject matter. Hence solving these challenging factors to sustainability is the new major concern for the world and hereby I wish to provide through this article, an impetus towards this common goal.

An Impetus

An UK based innovative tech company named Safety Net Technologies, owned by Mr. Dan Watson, has introduced a valuable solution to counter the over exploitation of fish stock. Currently, it is accounted that about 1 in every 5 fish is discarded, thus causing 16 mt of fish getting wasted every year globally and about 20% of the vessel space too getting wasted. Hence, we have SN Technologies, who have come up with the solution –PISCES, which can reduce the by catch by 90%, improve revenue by 25%, decrease fuel cost by 20%, reduce sorting time, avoiding fines for unregulated fishing practices, help save labour cost and also to comply with the regulations.

They basically work in collaboration with the fisherman, thus initiating an interest in them to try the new technique‘s application.

Pisces

It is basically a light emitting device, whose coloured light could attract some fishes whereas repel some others, which can retrofit onto many of the used gears, which uses the principle of fish's different behavioural responses to different wavelengths of light. The device is easy to fit, recharge and contain 6 different colours, from which one's choice can be selected according to the species and by catch concerned. It offers minimal interference to fishing operation and automatically turns on underwater, that too only when needed. It uses wireless chargers and requires no additional tools or fittings for set up. The major advantage regarding PISCES is that, it doesn't weaken or weigh down the net.

Its features include –

- One kit with 10 lights
- Naturally buoyant and made out of impact resistant and UV stable plastic
- Robustly housed for deep sea fishing
- Extremely bright 80 lumen light source and has remote control select between 6 colours- deep blue, cyan ,blue, green, red and white
- Fully charged within 8 hours and one full charge gives 60 hours of underwater illumination.

Currently they have been successful with species including- Haddock, Eulachon, Turtle, Nephrops, Crab, Whiting , Plaice , Dab and still struggling on to building up success stories with other species too.

Conclusion

Sustainability –the concept of Live and Let Live, thus directs human power and intellect towards the goodness and well being of all mighty creatures on Earth, thence to cap off into coexistent harmony.

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Agricultural Biosecurity: An integrated and preventive avenue

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Abstract:

Agriculture is the key sector for economy for various countries and it can be exposed to major attacks which have dramatic economic consequences in food, feed and fiber sectors. As per the research from the few past years, the prevention and overcome of pests, diseases and other biological factors is the concerned issue in Agriculture and the big challenge for farmers, scientists and government because it affect the health ,production ,life and many more. As the threat increases, the need for its prevention increasing day by day. According to the Agricultural Biosecurity Bill, 11 March 2013 by the Minister of Agriculture Mr. Sharad Pawar, an integrated national Biosecurity structure encloses all the plant, animal and marine problems to resist the bio-terrorism from pest infection and weeds. This system not only protects the agriculture production but also the human health. So, Biosecurity is essential for stimulating the sustainable agriculture, food, livelihood security, regional and international trade and uniform economical development. This article describes the concepts of Biosecurity, its need and threats in agriculture.

Keywords: Biosecurity, Bioterrorism, Prevention, Sustainable agriculture, threat

Introduction:

Biosecurity is the integrated programme that analyses and manages the risk to plants, animals and human. As Biosecurity provides the prevention, control, eradication and management of pests and diseases of plant and animals and unwanted organisms for ensuring agriculture security. Biosecurity covers the pests, diseases, zoonoses, genetically modified organisms (GMO'S), the occurrence and management of invasive alien species and genotypes. Biosecurity was also added as an area of cooperation under the US-India Agricultural knowledge Initiative in June 2006, which aims to address the issue, starting with threat posed to crops by invasive alien species up to averting the release of bioagents of mass-destruction. As per the research study the pest, weeds and diseases like coffee berry borers in coffee beans and warts in potato in Netherland cause the economic loss at larger extent to reduce this lose The Department of Agriculture and cooperation made the Agricultural Biosecurity Bill, 2013.

Concept of Biosecurity:

Biosecurity means protection from the toxic effect of organism (human organisms, plant, animal and terrestrial or aquatic organisms). FAO (2003) has adopted that Biosecurity is a holistic term and encompasses the policy and the norms, regulations to protect Agriculture, food and the environment from the biological risks and threats.

- According to the Department of Agriculture and Cooperation the Farmer's Commission Report in 2006 had made a recommendation in the establishment of the authority. The Agricultural Biosecurity Bill, 2013 was introduced in Lok Sabha on March 11, 2013.
- The Bill repeals the Destructive Pests and Insects Act, 1914 and Livestock Importation Act, 1898.
- From the past years and for the future years; system has been developed for the protection of Plants, animals, marine and human health.
- Today's Agricultural Biosecurity systems were made for covering /protecting the national agriculture and food security. The Agricultural Biosecurity Bill would sufficiently booster the agricultural Biosecurity by incorporating the following features:

1) Integration of Plant and Animal Quarantine services.
2) Regulation for export of plants, animals, aquatic organisms and essential microorganisms.
3) Provision to declare 'Controlled area' to enable control measures for eradication of infestations.
4) Declaration of Biosecurity emergency actions and procedures to deal with it.
5) Power of Authority to give directions to importers /exporters.
6) Join activity by Agricultural Biosecurity Authority of India and State Governments to meet the challenges of pest's outbreaks and conduct pest eradication campaigns.

The Goal of Biosecurity:

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Major goal of Biosecurity is to prevent, control and manage the threats, risks to health and life to Biosecurity sector. The strengthening of Policy and Regularity framework for Biosecurity in Food and Agriculture must be among the top priorities. These policy and legislative frameworks need to be extended include biosafety needs within the overall framework of Biosecurity.

This will provide:

a) Optimization of scarce human and financial resources.
b) Improving the cohesiveness of advice on all aspects of Biosecurity, including biosafety.
c) Recognition of the special importance of biosafety to food and agriculture as well as the special impacts of food and agriculture on biosafety.

Animal Biosecurity:

The Biosecurity problem is most acute in livestock, particularly the threat from transboudary animal diseases (TAD).

TADs results in:

- Increase poverty of nations which are highly dependent on livestock farming for sustenance.
- Significant production losses for livestock products reducing farm incomes.
- Threaten food/feed safety and nutritional security through loss of animal protein as well as draught animal power for agriculture.
- Adversely affect the public health system when TADs are of zoonotic nature and can be transmitted to humans.
- Pain and suffering for affected animals; and ultimately emotional distress to human population as a consequence of TADs.
- Seriously disrupt or inhibit trade in livestock and livestock products either within a country or internationally.

➢ Some other diseases are endemic like pestedespetits ruminants (PPR), bluetongue, classical swine fever, infectious bovine rhinotracheitis/infectious pustular vulvo-vaginitis (IBR/IPV), caprine arthritis/encephalitis (CAE), equine rhinopneumonitis, bovine viral diarrhea (BVD) and bovine immunodeficiency (BIV). These diseases are responsible also for enormous economic losses and, therefore, need Biosecurity plan to be in place. Emergence of these diseases is well known and, therefore, Biosecurity is essential.

Here is the case study about: 'India's Poultry Industry Faces Unprecedented Crisis, as per National Egg Coordination Committee, April, 2006

India's Poultry industry contributes Rs.35, 000 crores to the GNP and provides employment to more than 3million persons-this is the only segment of our agriculture economy which has been growing rapidly at about 17%annum is facing the worst ever crisis in the history and situation of total collapse due to Avian Influenza caused by H5N1.This has dealt a severe blow, not only farmers but every input industry related to Poultry farming, breeders-integrators, feed-mills etc.

If the breeders decided not to continue in the business, it will have adverse impact on indigenous pure line research and breeding activity and the country will be totally exposed to total dependence on imported breeding stock –which will be nothing short of negation of all the good work done by indigenous genetic research for the past 3 decades .More than 1,000hatcheries in the country will face total closure.

Study by a renowned economist from USA revealed that in terms of competitiveness, India ranks No.1 while UAS is places at ranks No.4 .And presently India is Ranks No.2 - in the cost of chicken production which will soon the cheapest source of chicken production in the World and overtake Brazil .

It is projected that if the present rate of growth in the industry is sustained ,in the next 5 years ,Poultry can be second largest industry in our country .It is very unfortunate that industry ,which built based on Indigenous research over 3 decades, is destroyed by H5N1 and country is forced to depend upon imports of egg and chicken .An all out effort, including interim relief measure by the Government to the affected parties ,should urgently be made to save this vital industry and put it back on the track.

Plant Biosecurity:

India has been striving to become a biosecure nation. As regards plants, according to the National Bureau of Plant Genetic Resources (NBPGR) several Invasive alien species have been introduced into the country along with grain, seed and planting material imports. These introduced pests include, banana bract and streak viruses, American serpentine leaf miner, peanut stripe virus, cotton leaf curl, sunflower downy mildew, coffee pod borer, apple San.

Jose scale, Biotype B of white fly and invasive weeds like Lantana 10camara. Six of these were introduced in 1990s. With the increasing intensification of agricultural production, productivity and trade, such invasive alien species will further threaten our crops. A new wheat stem rust pathotypeUg 99 is causing serious damage in Uganda, Kenya and a few other countries, and threatens to reach India. Wheat being our main pillar of national food security and rural economy, India must take proactive steps to prevent entry and establishment of this race in India.

➢ There are other 24 plant quarantine stations for the upgrading of which an initial effort has been made for need assessment in terms of laboratory and green house facilities required under a FAO-TCP proposal.

➢ The establishment of national standards on sanitary and phytosanitary measures in line with the international standards is of critical concern to meet the stiff challenges under the international agreements.

Some Factors Influencing Biosecurity are:

- Globalization,
- New agricultural production and food processing technologies,
- Increased trade in food and agricultural products,
- Legal obligations for signatories of relevant international agreements,
- Increasing travel and movement of people across borders,
- Advances in communications and global access to Biosecurity information,
- Greater public attention to biodiversity,
- The environment and the impact of agriculture on both,
- Shift from country independence to country interdependence for effective Biosecurity,
- Scarcity of technical and operational resources,
- High dependence of some countries on food imports.

Conclusion:

Improved health and well being of human populations are the ultimate results of functioning Biosecurity systems. Poor practices in agriculture results direct favour on Biosecurity threats, food security threat and human health. This article shows how biosecurity in the world and India will helpful in overcoming many challenges in past and will help in future in regards of plants, animal life and health problems. We have to focus on the areas where the Biosecurity is not properly adapted.

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Fungicide resistance in plant pathogens: An emerging threat in Plant Disease Management

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Introduction

Agricultural productivity is greatly hampered by various plant diseases incited by virulent plant pathogens. Broad concepts like integrated disease management strategies have come up for rescue which includes host plant resistance, biological control, surveillance, quarantine, Good Agricultural Practices (GAPs), etc. Among various methods, Chemical control with fungicides still remains focused & quick relievers against a large group of plant pathogens. Fungicides holds a large share in agrochemical market in India. Besides other causes like insufficient dose, faulty application and heavy disease pressure, development of resistance can be one of the causes of poor disease management. Resistance to fungicides has become a challenging problem in the management of crop diseases .

Historical glimpse of resistance development

Practical problems of resistance development to pathogens emerged with introduction & widespread use of first generation site specific systemic fungicides groups like benzimidazoles, dicarboximides. Initially it was observed in *Penicillium* sp. causing citrus storage rots due to aromatic hydrocarbons and laterly in benzimidazoles and dicarboximides in many pathogens.

Fungicide resistance and its Mechanisms

It is referred to as genetic adjustment by a fungus that results in reduced sensitivity to a fungicide. It is result of genetic mutations occurring at low frequencies & subsequently selection pressure acting on resistant propagules found in natural populations. It is mostly established that alteration in biochemical target sites due to mutation leads to resistance which is seen among benzimidazoles, phenylamides , DMIs and QoIs (Brent, 1995). Certain site specific fungicide groups like benzimidazoles, phenylamides creates single gene mutation which is carried by sudden shift called as disruptive selection among wide differing responsive populations leading to resistance problems termed as Qualitative resistance. Another case, mutation in multiple genes favour resistant population development which under progressive selection called as directional selection encounters sub-lethal doses of fungicides over a time and becomes resistant termed as Quantitative resistance. Other mechanisms includes cross resistance and multiple resistance. Site specific fungicides groups like benzimidazoles, dicarboximides, phenylamides and strobilurins possess target site activity with different mode of action leading to high resistance risk.

Case Studies

Benzimidazoles

Benzimidazoles traded under name benomyl, carbendazim and thiophanates possess site specific mode of action and systemic movement in plants and showed interference with mitosis (Davidse, 1973) causing dislocation of spitzenkorper and disorganization of fine structure of fungal hyphae (Borck, 1973 and Howard, 1980). At Molecular level, Point mutations in beta- tubulin gene alters amino acid sequences at binding sites which reduces protein complex was confirmed by site directed mutagenesis followed by gene replacement (li *et al.*, 1996). Mutations observed at codon 6 & 198 leads to low and high resistance level in *Monilinia fructicola* (Ma *et al.*, 2005) and at codon 198 & 200 leads to medium and high resistance level in *Venturia inaequalis* (Koeraadt, 1992). Keinath *et al*. (1998) found resistance development in *D. bryoniae* isolates to benomyl with cross resistance relationships to thiophanate methyl. Khilare *et al*. (2010) found high number of resistant isolates in carbendazim compared to difenconazole and propiconazole due to high selection pressure. Khilare *et al*. (2004) observed increase in total sugars, amino acids, proteins, DNA, RNA contrast to decrease in orthodihydric phenols and total phenols due to infection of resistant isolates in different infected parts of grapes plant.

Dicarboximides

Traded under the name iprodione, vinclozolin act as contact fungicides and moves in systemic manner in plants. it mainly induce membrane lipid peroxidation in fungi by interfering with flavin containing enzymes (Edlich *et al.*, 1988) and also causes hyphal swelling and bursting of tips (Eichhorn, 1978) but no effect on ion & water permeability (Yoshinaga, 1993) & negligible effect on respiration, sterol synthesis, nucleic acids were observed. At Molecular level, *adr-1* gene isolated from cosmid library fragment of *U. maydis* was confirmed to confer resistance (Orth, 1995). Dry *et al*. (2004) compared iprodione susceptible and resistant isolates of *A. alternate* & suggested premature termination of open reading frame to be cause of resistance. Hubbard *et al*. (1997) observed gradual development of resistance in *S. minor* isolates against iprodione with cross resistance to vinclozolin. Myresiotis *et al*. (2007) observed resistance development in *B. cinerea* against iprodione with strong cross resistance relationships between dicarboximides and anilinopyrimidines.

Phenylamides

Traded under name: Metalaxyl, Furalaxyl etc. Phenyl amides fungicides possess site specific multistep resistance effects which attacks RNA polymerase I & inhibits rRNA synthesis (Davidse, 1995). Thind *et al*. (2010) observed normal pathogenic potential among metalaxyl populations and strong competitive fitness with sensitive populations when inoculated in mixture. Kaur *et al*. (2010) revealed prevalence of metalaxyl resistant to vary levels with high pathogen city with nil cross resistance to novel action fungicides.

Demethylation inhibitors(DMIs)

DMIs also called as sterol biosynthesis inhibitors (SBIs), inhibits sterol C-14 a demethylation of 24 methylene dihydrolanosterol, a precursor of ergosterol in fungi (Brent, 1995). At Molecular level, Delye *et al*. (1997) confirmed single gene mutation in *CYP51* gene of *Uncinula necator* responsible for resistance. Overexpression of *CYP51* gene was also confirmed for resistance (Marichal *et al*., 1997). Hamamoto *et al*. (2000) confirmed 126 bp repeats in *CYP51* gene for resistance development. Stevic *et al*. (2010) showed high sensitivity of *V. inaequalis* to both flusilazoles, Difenconazole. Wong *et al*. (2007) established single discriminatory dose for differentiating sensitive and resistant isolates of *C. cereale*.

Strobilurins

Traded under name : azoxystrobin, Kresoxim- methyl, trifloxystrobin etc. They possess site specific action and inhibits electron transport in mitochondria respiration (Bartlett *et al*., 2002). At Molecular level, Fisher *et al*. (2004) confirmed point mutation at cy b gene changes phenylalanine to leucine which alters enzyme activity by site directed mutagenesis. Vincelli *et al*. (2002) found emergence of QoI resistant biotypes of perennial ryegrass infecting strains of *P. grisea*. Ishii *et al*. (2001) showed distribution of pathogen isolates highly resistant to kresoxim-methyl.

Fungicide resistant management

Main principles emphasizes on delaying of resistance development and to keep its level under control. Fungicide resistance management focuses on various strategies as follows: Avoiding sole use of “at risk” fungicides , integration with cultural practices to reduce selection pressure in pathogens (Damicone,1999), Reduction in number of applications, use of new fungicides with novel sites and exploiting negative cross resistance to eliminate other phytopathogens (Hewitt, 1998).

Conclusions

- Development of fungicide resistance in pathogen leads to failure of disease management strategies.
- Single Point mutation and Selection pressure play an important role in resistance development.
- Site specific fungicides like Benzimidazoles, Dicarboximides, Phenylamides and strobilurins characterized at high resistance risk due to target site activity.
- Resistant management strategies emphasizes on prophylactic measures aiming delaying resistant development and approaching for integrated management strategies.

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Weather Forecast and its Application in Agriculture

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Weather forecast:

Foretelling the coming weather in advance is known as weather forecasting. It may be defined as advance information about the probable weather conditions for few days to follow. So the time for which weather forecast is made is also important which is known as lead time. The accuracy of a forecast decreases with increasing lead period and decreasing area under forecast.

Elements of weather forecast: Generally the weather forecast includes the following elements:

- Amount and type of coverage of sky by clouds
- Rainfall and Snow
- Maximum, Minimum and Dew point temperatures
- Relative humidity
- Wind Speed and Direction
- Extreme events like heat and cold waves fog, frost, hail, thunderstorms, wind squalls and gales, low pressure areas, different intensities of depressions, cyclones, tornados.

Types of weather forecast:

1. **Now casting:**
   This type of forecast is valid for 12 to 24 hours and issued for earthquake, hail storm, typhoons and tornados.
2. **Short range weather forecast:**
   Forecasting of weather for 2 to 3 days in advance is called short range weather forecasting.
3. **Medium range forecast:**
   Forecasting of weather for 4-10 days in advance is termed as medium range forecasting.
4. **Long range weather forecast:**

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Forecasting of coming weather for more than 10 days or a month or a season in advance is called as long range weather forecasting. It may also be categorized as monthly forecast or seasonal forecast depending on the lead time. Long range forecasting is issued by India Meteorological Department, New Delhi for south west monsoon rains, first in April and then the forecast is updated in July.

Name of the weather forecast	Issued by	Clients	Mode of communication	Forecasting weather elements	Methods used in India	Lead time	Accuracy (%)
Now casting	IMD	Public including farmer	Radio and Television and Dailies	Thunder storm, dust storm Cold and heat waves	Synoptic and weather map	One to two hours earlier	90-98
Short range	IMD	Public including farmer	Radio and Television and Dailies	Cloud spread, rainfall, temperature, cyclone warning	Synoptic and weather map, NWP	One day	80-90
Medium range	NCMRWF (IMD)	Farmers	SMS through mobile, Web site, Dailies, television	Rainfall, temperature, RH, wind speed, wind direction and cloud cover	GNWPM, RCM	3-10 days	70-75
Long range	IMD	Farmers	Television, dailies, radio	Seasonal rainfall	Statistical regression like ARIMA model	30 to 40 days	60

Tools of weather forecasting:

- Use of barometer
- Use of radar
- Use of weather satellites
- Radiosondes
- Automated surface-observing systems
- Supercomputers
- Advanced Weather Interactive Processing System (AWIPS)

Methods of weather forecasting:

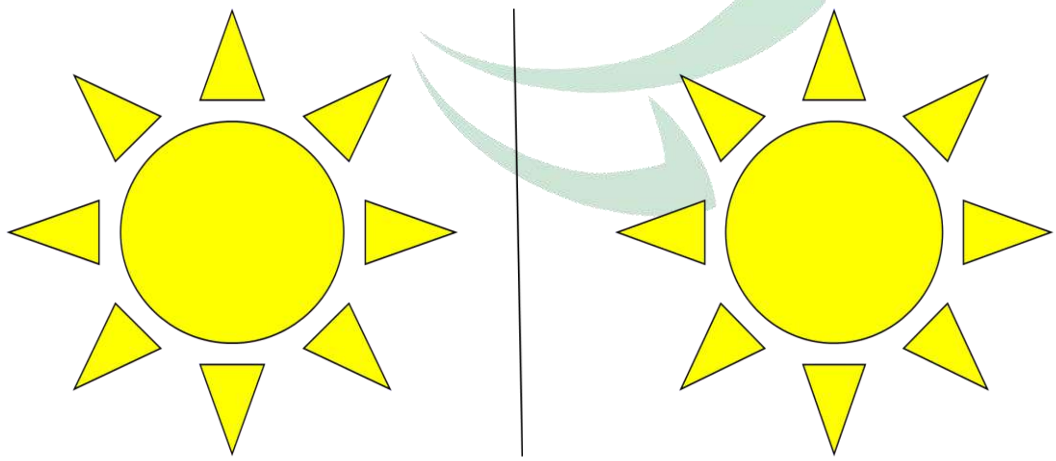
Synoptic method:

- A synoptic chart is the scientific term for a weather map.
- Synoptic charts provide information on the distribution, movement and patterns of air pressure, rainfall, wind and temperature.
- This information is conveyed using symbols, which are explained in a legend.
- Synoptic charts are used to report on the current weather and to predict future weather patterns.

Analogue method:

- This method is defined as any particular type of system if it is present in the past also, it is assumed that the present system is likely to behave in the same way as the previous one.
- There are a number of limitations on the success of this method. First, it is difficult to select right analogue, and second, even if we succeed in picking up the right ones, there is no guarantee that they will evolve in the same way.
- It has been suggested that analogue should be used in conjunction with other methods, either as an aid or a check on pressure pattern prognosis.
- The success of forecast depends upon the knowledge and the experience of the forecaster.

Persistence method: Tomorrow will be much the same as today.



Today`s Weather (Clear skies, 19^0C, Low winds)   Tomorrow Weather (Clear skies, 19^0C, Low winds)

Climatological Method:

- This method involves historical weather data over long periods of time (years) to predict conditions on a given date.
- The weather statistics accumulated over many years has been averaged to make the weather forecast.
- For example, if you were using the climatology method to forecast for temperature and precipitation for Hisar on September 4th, you would go through the temperature and precipitation data that has been recorded for every September 4th and take an average.
- If these averages were 35°C with 25 mm of rain, then the weather forecast would be 35°C temperature and 25 mm of rain for Hisar on September 4th.
- The climatology method only works well when the weather pattern is similar to that expected for the chosen time of year.

Statistical methods:

- This method is based on statistical approaches such as regression and auto regressive integrated moving average techniques.
- The regression equations are used to predict weather parameters.
- Knowledge of correlation coefficient will also help to access effect of one parameter over the other.
- This method is used for long range forecasting of Indian monsoon rainfall.

Application of weather forecast in agriculture:

Weather plays an important role in agricultural production. It has a profound influence on the growth, development and yields of a crop, incidence of pests and diseases, water needs and fertilizer requirements in terms of differences in nutrient mobilization due to water stresses and timeliness and effectiveness of prophylactic and cultural operations on crops. Weather aberrations may cause

(i) physical damage to crops

(ii) (ii) soil erosion.

The quality of crop produce during movement from field to storage and transport to market depends on weather. Bad weather may affect the quality of produce during transport and viability and vigor of

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seeds and planting material during storage. Weather forecasts provide the necessary meteorological information to aid farmers in making certain special "crop and/or cost saving" decisions on farm operations. Therefore it plays a vital role in minimizing the crop losses due to aberrant weather. Weather forecast enhances the crop production and productivity and farm income. It can be applied in various areas in agriculture to increase the yield of crop by minimizing the losses due to aberrant weather which includes:

- Field preparation
- Sowing/planting
- Application of agricultural chemicals
- Evaporation losses for irrigation
- Weeding
- Crop harvest and post harvest operations (including crop curing/drying of meat and fish)
- Control of plant diseases
- Control of noxious insects
- Transportation of agricultural products
- Operation of agricultural aviation
- Prevention of damage due to chilling, frost and freezing
- Forestry operations
- Fishery operation
- Safeguarding animal husbandry
- Protecting Horticulture and Arboculture (non forest trees) plants

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Aatmanirbhar Bharat Abhiyan: Implications in Indian Agribusiness

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COVID-19 pandemic has postulated a new set of reforms to fortify Indian economy. One such step announced by the Indian Government is Aatmanirbhar Bharat Abhiyan, aimed at making India a self-reliant nation. Indian Economy is primarily based on agriculture, where more than half of its population directly or indirectly depends on agriculture and allied sectors. India must aim to be self-reliant and self-sustainable in this sector well, not only in production but also in technology adoption and modernization. Agriculture, which accounts for 17 per cent of the GDP, could soften the blow on India's shrinking economy if it gets due consideration of the government. For this, we need to increase the adoption and usage of agricultural technologies in the field level.

Over the last 10 years (2008-09 to 2018-19) India has been a net exporter of farm produce. In fact, in 2018, the Government has come up with a new agricultural export policy aimed at doubling farm exports by 2022 in line with doubling farmers' income. However, in 2019-20, the agricultural exports were just \$36 billion and the agri-trade surplus was \$11.2 billion. The net agri-trade surplus has been falling over a period of time, making it difficult to achieve doubling of farmers' income and doubling of agriculture exports by 2022. Considering the scenario, the Government has come up with some schemes and policy changes to boost the agriculture sector. The major schemes are discussed here:

- **Agri-Infrastructure Fund:**

A fund of Rs. 1 lakh crore will be created for agricultural infrastructure development projects at farm gate and centers of aggregation (FPOs/ Cooperatives). Farm gate refers to the market where buyers, purchase products from the farmers directly.

- **Concessional Credit Boost to farmers:**

Institutional credit facilities to the farmers will be extended at concessional rates through Kisan Credit Cards. This scheme approximately covers 2.5 crore farmers with concessional credit worth Rs. 2 lakh crore.

- **Emergency working capital for farmers:**

An additional fund of Rs 30,000 crore will be released as emergency working capital for farmers. It is meant for meeting their crop loans requirements, which will be disbursed through NABARD to Rural Cooperative Banks and Regional Rural Banks. The allocation of funds is expected to benefit 3 crore small and marginal farmers. This disbursal is addition to the financial support of Rs 90,000 crore that will be provided by NABARD to RCBs and RRBs to meet the crop loan demand this year.

- **Animal Husbandry Infrastructure Development:**

With the objective of supporting private investment in dairy processing, value addition, and cattle feed infrastructure, an Animal Husbandry Infrastructure Development Fund of Rs 15,000 crore will be framed. For establishing plants for export of niche dairy products, incentives will also be given under the scheme.

- **Support to the fishermen:**

The Pradhan Mantri Matsya Sampada Yojana (PMMSY) will be launched for integrated, sustainable, and inclusive development of marine and inland fisheries. Under this scheme, Rs 11,000 crore will be spent on activities in Marine, Inland fisheries and Aquaculture. An amount of Rs 9,000 crore will be spend for developing marketing infrastructure in the forms such as fishing harbours, cold chain, markets.

- **Agricultural marketing reforms:** A central law will be formulated to provide:
  - (i) Sufficient choices to farmers to sell out their produce at remunerative prices.
  - (ii) Barrier free inter-state trade.
  - (iii) Framework for e-trading of agricultural produce.

Presently, the farmers are forced to sell their produce to the licensees in Agricultural Produce Market Committees. The proposed amendments seek to enable free flow of agricultural produce and establish a smooth supply chain providing options of better price realization to farmers.

- **Amendments to the Essential Commodities Act:**

The Essential Commodities Act, 1955 authorizes the central and state governments in controlling the production, supply and distribution of listed commodities to meet unforeseen circumstances in the country. The commodities covered under the Act are edible oil and seeds, pulses, sugarcane and its products, and paddy. The Act will be amended to deregulate commodities including cereals, edible oils, oilseeds, pulses, onions and potato. This is expected to allow better price realization for farmers by attracting investments and enabling competition in the sector. No stock limit will be applied to processors or value chain participants, considering their installed capacity, or to any exporter subject to the export demand. Stock limit will be imposed under some exceptional circumstances such as war, with surge in prices.

- **Agriculture Produce Pricing and Quality Assurance:**

Government aims to come up with a legal framework to enable farmers to operate with processors, aggregators, large retailers, and exporters in a transparent and fair manner. Risk mitigation for farmers, assured returns, and quality standardization are advantageous of such a policy. This helps the farmers to predict the price of crops at the time of sowing. It may also facilitate in bringing private sector investment in the sector.

- **Employment push using CAMPA funds:**

The government will approve plans worth Rs. 6,000 crores under the Compensatory Afforestation Management and Planning Authority (CAMPA) to facilitate job creation for tribals. Funds under CAMPA will be used for (i) Forest management, soil and moisture conservation works; (ii) Artificial regeneration, assisted natural regeneration; (iii) Afforestation and plantation works, including in urban areas; (iv) Forest protection, forest and wildlife related infrastructure development, and wildlife protection and management. Currently, the CAMPA funds are being used for protection of forest and wildlife management. As the majority of the country's population are dependent on agriculture for living, the sector must attain self-reliance. A specific long-term strategy is need of the hour with commodity wise plans that factor in comparative advantages, market, production, productivity, processing and consumption. Strictly speaking, India can't be an economic superpower without becoming self-reliant in agriculture sector. The successful implementation of the aforementioned changes in the existing polices and new schemes have the power to achieve this aim of becoming self-reliant.

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Ongoing Efforts of NDRI in Discovering New Clones of Milch Animals in India

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TEJAS is a new clone of Murrah buffalo for high milk yield by NDRI, Karnal. In the last ten years, 16 clones of buffaloes have been developed by NDRI.

Recently National Dairy Research Institute, Karnal has developed a male calf TEJAS by using hand guided cloning technology .Tejas is a clone of high yield buffalo.NDRI was working on the cloning technology from a long time period in year 2009 they developed first female buffalo calf Garima which gave birth to normal birth .NDRI is working effectively to enhance the milk yield and the economical condition of farmers. By developing new breeds of milch animals the feed conversion ratio and the production of milk will be affected. If we talk about buffalo then, they are known to be more efficient converters of poor quality of roughage and crop residue into a valuable milk output. Dairy farmers get double access from getting paid for various milk constituents that are Fat and SNF percentage in milk. Fat composition in milk of Buffalo (7.4g /100g) is higher than that of cow (3.9g/100g) . India ranks first in milk production across the world with production record 187.7 MT the milk production by buffalo is much more higher 61 MT than the cow 44 MT this is because our country is having hot and humid climate condition and specially water buffalo has inherent ability to thrive under adverse climate condition .

The present condition of the cloning technology in India needs to rise up because the clone are developed by collecting the cell sample from milk, urine, blood, ear and semen .And in upcoming year 140 million doses of semen will be required and the current availability is only 85 million doses. The detoriation of these discoveries starts from the unawareness and lack of knowledge about the availability of better breed among the dairy farmers. India needs to explore the various aspects of dairy sector and needs to introduce the various new breeds of milch animals to the dairy farmers for their better economic condition and to provide high nutrition milk to the people of the country as Tejas will set a mark in milk production in India in future.

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Strategies for Doubling Income of Farmers

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To achieve doubling farmer's income might require novel strategies and some change in the policy stance. One could be identification and targeting of the poor or low-income farmers. Unless it is known who within agricultural sector have low income and/or are disadvantaged in term of access to technology, markets, credit, information and infrastructure, it would be difficult to accomplish the target of doubling farmer's income in such a short period. About 70% of the farmers in India have annual per caput income less than Rs. 15,000. Only 10% of them earn more than Rs. 30,000. Land size and income are identified important correlate. Since more than three-fourths of the low income farmers (<Rs. 15,000) are marginal farmers who cultivate landholdings less than or equal to one hectare. Only 7% of the marginal farmers fall in the high-income class (>Rs. 30,000) might be due to a more diversified income portfolio in terms of the number of income sources accessed and the intensity of engagement.Approximately 80% of the low income marginal farmers are concentrated in eastern (58%) and Western (21%) regions due to several factors, such as under-investment in agricultural research, poor electricity, markets and roads infrastructure, under-development of institutions like credit, extension, insurance etc.

India agriculture is passing through difficult times due to two consecutive drought situations in several parts of the country, thereby resulting into wide spread distress among farmers. The rural areas in these parts are facing food and livelihood crisis, more specifically the shortage of fodder and drinking water. Government need to proactively address the situation and make more long term farmers centric policies related to irrigation, farm diversification, farm profitability and community support programs so as to socially and economically empower farmers.

A three-pronged strategy for faster agricultural growth to double farmer's income pursues (1) improved productivity and production efficiency. (2) Agricultural diversification

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including secondary and speciality agriculture, and (3) policy support and linking farmers to market.

There is however, almost unanimity that the net income of farmers can surely be doubled well within the short period. A total of 40 recommendations for increasing income of farmers, have been divided into 5 parts as under:

1. increasing income by improving productivity
2. water and Agri.- input policies
3. integrated farming system
4. better market price realization
5. special policy measures

Increasing income by improving productivity

1. **Biotechnology is set to play critical role in crop and livestock production** by enhancing yields nutritional profit, stress tolerance and crop protection. The policies support accordingly to be provided for the development of seed and biotech industry in the country. As per studies BT cotton along has contributed more than Rs. 80,000 crores of additional output value to farmers. Similar potential many other crops may have for Indian agriculture and towards enhancing farmers' profitability.
2. **Improving agricultural productivity in rainfed regions of India**, which constitutes more than 50% of the country's arable land. Besides watershed management, construction check dam and farm ponds should be taken up in a mission mode for providing life, saving irrigation for the crops. The area expansion and subsidy to the states must be linked with the adoption of precision agriculture model.
3. **Bridging yield gaps** among the states is important in improving national productivity i.e. the gap in price yields almost 3 times between Punjab and Chhattisgarh. there is need for developing a strategy document for assessing the present trends of crop productivity vise-a-vise the potential yield of major crop system, so that specific action plans can be taken up for bridging the yield gaps, which in turn will contribute to enhanced productivity of farming system.

Water and Inputs

1. **Fertilizer subsidy and rationalizing** the NPK pricing for maintaining NPK ratio in the soil and better application technologies to improve efficiency and reduce fertilizer subsidy by Rs. 25,000- 30,000 annually. Policy on promoting crop specific fertilizer and fertigation, besides setting standards and regulating Biofertilizer under soil health mission is needed. Since the year 2010 NP/NPK fertilizers have been reformed and put under Nutrient Based Subsidy (NBS) whereas urea continues under direct control. Consequently, the gap in MRP of urea and NP/NPK fertilizers has been widening. Therefore, unless corrections are made in the fertilizer policies, the benefit of soil health card will not be realized and desired increase in yields in major crops will continue to delude the nation.
2. **Crop losses** in India are huge. Pesticides play an important role not only in crop productivity, cost reduction and quality improvement but also in protecting crop from pest and diseases. The cost benefit ratio in using pesticides is heavily in favour of farmers. The government however needs to check flood of false pesticides in market by-fly-night operators by regulating registration, strengthening quality enforcement and tackling corruption through provisions of joint testing of samples.
3. **Farm mechanization** in India has been a story of tractorization. Time has come to promoting efficient equipments and tools and small engine driven tractors to address small farm requirements adequately. Through a mix of specialized CHCs (custom hiring centers) and with state Agros, co-operatives and input dealers, developing and custom hiring facility in farm mechanization should be given high focus.
4. **There is a need for integrated water use policy**. India should critically examine several ongoing initiatives and develop its country wide system for judicious and integrated use and management of water. A national commission on efficient water use in agriculture should be established to assess the various issues, regulatory concerns, water laws and legislations, research, technology development and community involvement. This will especially help resource poor farmers in the rainfed ecosystems, who practice less-intensive agriculture.
5. **Farmers however need to be educated on water usage system** to drift them away from flood irrigation systems, which affects productivity and wastes water. The most important part is the crops planning, which needs to be done keeping water resources

of region and the water intake by various crops in mind. For example high water consuming crops like paddy and sugarcane should be grown in high rainfall areas.

Integrated Farming system

1. **Promotion of integrated farming system** approach involving synergic blending of crops, horticulture, dairy, fisheries, poultry, etc., seems viable option to provide regular income and at site employment to small land holder, decreasing cultivation cost through multiple use of resources and providing much needed resilience for predicted climate change scenario.
2. **Dairy husbandry** is a boon for small farmers, as a family with three cows or buffaloes can earn an annual income of Rs. 50,000 to 60,000, while conserving our precious native breeds. With stall-fed, high yielding animals, the dung availability will increase by 3 to 4 times, giving a boost to biogas and agricultural production. With introduction of good goat husbandry practices by appointing local youth to facilitate the activities as field Guides.

Better market price realization

1. **Direct marketing and contract farming** should be made easy for the farmers. Also to encourage the States for contract farming under which the buyer can provide the farmer access to modern technology, quality inputs, other supports and a guaranteed price.
2. **Norms of licensing** to enable seamless participation of buyers from across the county, movements, of goods without restriction, harmonization of tax laws (including a uniform GST), standardization of grades and recognition of electronic trades. Exchanges would also have to widen the participation by facilitating farmers to take positions through cooperative or other aggregators.
3. **Endorsement of policies that enforces the standardization of agricultural produce** such signify that the product meets all the standardization and grading requirement for packing, sealing etc., and only traders who are willing to follow the regulation are given" Certificate of Authorization".

4. **Agri infrastructure, storage system and market yards** need to be strengthened. More multipurpose market yard complexes, comprised of go downs, cold storage, farmers service centre etc, need to be set up for farmers to directly participate. Farmers need to be educated on the available scheme of the Government. Enabling policy provisions can be done for large scale play of corporate in agricultural marketing and storage operations.
5. **Reducing post harvest losses** by strengthening grain storage infrastructure, cool chain systems for perishables, post harvest processing and value addition, transport, marketing, commerce and trade.

Special Measures

1. **Structural reforms in agriculture pertaining to land leasing and market restrictions** need to be addressed. The market regulation on movement and procurements by private players is hampering market growth and prices realization by farmers, similarly due to land leasing policies of state Governments the concept of contract farming is not successful, the experiments of contract farming are based on " win all", bringing value to all partners in operations, this needs to be encouraged on a large scale.
2. **Through nationwide crops competitiveness study**: States profiling of crops and animal resources should be done, indexing them against national and global benchmarks on cost, quality and productivity parameters, and their short, medium and long terms national crop planning needs to be done. If India has to succeed in global market on a long term basis, this task is unavoidable.
3. **Agriculture to be brought to the concurrent list:** Bringing the entire gamut of post-production activities in agriculture, such as Post Harvest Management, marketing, processing, infrastructure, agribusiness etc., under the concurrent list of the constitution for better central planning, as the business of food and agriculture is globalizing and role of central Government is increasing in making laws and policies, especially in post-harvest, trade and agribusinesses, where Multi-National Companies and corporate sector is involved in big way.
4. **Review of current scenario of farm credit and subsidy disbursement system**. All financial benefits, mainly the subsidies in different forms, should be provided and

transferred directly to farmers account through e-governance through which tracking of farmers' application, status and approval of all schemes is available online. Gradually phase out all subsidies including fertilizer and only transfer money to farmers, calculating aggregate measure of supports. This improves efficiency of govt. investments.

5. **Implementing ambitious Agribusiness Hubs Model**, operating on a national platform and establishing multi-functional Agribusiness hubs in all the Gram Panchayats of the country. This will revolutionize the farm economy and create jobs. The project will create additional annual farm value, providing increased market opportunities and initiating various multifarious socio economic activities, aimed at improving farm incomes.
6. **ICP based agricultural extension** brings incredible opportunities and has the potential of enabling the empowerment of farming communities. Information technology can support better crop, fertilizer and pesticide use planning as well as disease monitoring and prevention, both in crop and animal husbandry, bedside improving farmers' operational and financial management and to effectively connect them with the markets for better price realization.
7. **Diversification of agriculture in the First Green Revolution Areas** such as Punjab, Haryana and western U.P. seems need of the hour. To promote diversification on ecological principles, will require making monitoring equivalence (profit margin) between the replaced crop/commodity and enterprise with the once planned to be introduced. Farmer is mainly concerned with the profit he gets from a particular crop or commodity. Crops like maize, soybean, pulses, oilseeds, fruits and vegetables have the potential to replace rice and wheat in this area upward push in MSP (maximum selling price) in favour of proposed diversification crops will be a practical option to achieve this objective.
8. **Integrating all central and state subsidies**, instead of reducing costs of inputs, need to be targeted to empower farmers through infrastructure development in rural areas to promote Agri business, food processing, water management, soil health and enhancement, seed production and processing, custom hiring , plant protection, dairy,

poultry, fisheries and enterprises, etc., this will boost up agriculture sustainability and farm profitability.

9. **Strengthening organic food program for India** to make 10% of the global 60 billion USD market for each. Major parts of India such as NER., H.P., J&K, Uttarakhand, M. P., Chhattisgarh, Jharkhand, which are organic by default, must be made organic by process for the producers to get advantage of market value.
10. **Establishing Special Agriculture Zones (SAZ)** by selecting expert oriented and industrial use crops, promoting crop stewardship programs, Good Agricultural Practices and Certification, formation of global commodity boards, on the pattern of California Walnuts, Washington Apples etc., can help double in 5 years the current level of Agri exports, which will benefit farmers significantly. We need to globally position Indian food and Agri produce such as North Eastern region as Organic Zone, spices of Kerala, Cardamom of Sikkim, orange of Nagpur, Mangoes of Ratnagiri and Malihabad, Tea of Darjeeling and Assam, Kashmiri Apples, Bihar Litchies, Soybean of Indore and Nilgiris and so on for promoting Geographic Appellation. The nation has to streamline the different crop belts like rice, wheat, apple, mango, banana, tomato, ginger, turmeric, orange-lime-lemon, orchid, flowers, etc. Likewise livestock, fisheries, diary and sericulture shall be created across the country with the objective to improve production and export.
11. **Promoting scientific agriculture micro-irrigation** on a very large scale along with nutrient application can be highly efficient and priority should be given to empower farmers with micro irrigation. Advance concept of precision Agriculture need to be promote on a large scale.

Conclusion

- In conclusion, doubling farmers' income in a short period could be possible if the stake holders follow a comprehensive multi-prolonged and targeted approach encompassing income opportunities and their enabling conditions including Investments in agricultural research and development of institutions and human resources.
- To achieve doubling farmers income might require novel strategies and some change in the policy stance.

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- Income of farmer would come mainly from seven sources like increase in productivity of crops, increase in production of livestock, improvement in efficiency of input use that saves cost, increase incropping intensity at farmers' field.
- Diversification towards high value commodities, better remunerative price realized by farmers and shifting way surplus labour from agriculture to non-farm activities, technology generation and dissemination besides policies and re forms in agriculture sector.

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Environmental Social Governance : A way to Sustainability for small organizations

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ESG the term widely used by major investors and big organizations to attract rich investment. Environmental, social and governance (ESG) criteria are a set of standards for a company's operations that socially conscious investors use to screen potential investments. Here we are going to talk in brief about the effect of small companies using ESG. Before that we will take view on individual factors of ESG i.e. Environmental, Societal and Governance factor.

Environmental criteria, includes the energy your company takes in and the waste it discharges, the resources it needs and the consequences for living beings as a result. Not least, *E* encompasses carbon emissions and climate change. Every company uses energy and resources; every company affects, and is affected by, the environment.

Societal factor, how can a company manage its relationships with its workforce, the societies in which it operates, and the political environment this is the central question behind the social aspect of sustainable investing.

Corporate Governance, Corporate governance is concerned with the internal company affairs and its relationships with the main company's stakeholders, including its employees and the shareholders. In addition, corporate governance is directly linked to a company's long-term success, as proper governance policies can help to attract and retain talented employees.

Now coming back to the objective we are going to discuss here is; small companies should adopt ESG and small investors or investors who invest in small companies should follow ESG for sustainable investment. Number of small companies, organizations, firms, manufacturing units etc. are multiple times higher than the number of big business groups who have adapted ESG and following the same. For example, TATA, BIRLA, Reliance, Mahindra and Adani some of the big business groups in India. If this five groups working very strictly adopting ESG still they can contribute to environment with some limitations but small companies like we can take banking and financial institutions, service industries etc. they are very big in number like microfinance institutions.

Here we can also compare contribution on number of companies in any industry. We will take example of Telecom and Microfinance industry. There are only four major telecom companies in India. At the same time there are 223 microfinance institutions in India. The total contribution of small 223 microfinance institutions will be way more than the 4 telecom companies even though are very big companies in the country.

The areas where small companies can work to contribute or give back to Mother Nature are:

- Environmental performance in areas such as emission reductions, resource efficiency, recycling, substitution or reduction of toxic substances. The main drivers entail the adoption of improved technologies and operating procedures, the development of eco-friendly products and services and raising customer awareness
- **Embrace climate change -** A special subject within the management of environmental issues is the subject of climate change. We request that we should have a climate policy and strategy including a process to integrate climate change risks and opportunities into the company's centralized risk management framework and a governance structure which ensures sufficient oversight over the management of climate change related risks. An important aspect of this is water management, and companies should be aware of their exposure to water related risks and develop appropriate mitigation strategies.
- **Manage water risks -** Water-related risks are an important issue with a number of environmental and social implications. Depending on the company's exposure to water stressed areas, we want to track daily water use, quality & quantity, set ambitious reduction and recycling targets.
- **Low Carbon Emission –** Most important factor to consider and work on.

Tools to work at ground level as per the individual factors of ESG:

Environmental factors –

1. **Plantation –** This is the simplest tool to start off ESG in any and every organization. This can go with number of branches of any organization or number of employees. The goal is to reach a mark of one year plant life for all the plantations to be made on initial day.
2. **Paper –** Going paperless is the need of time. Also in this era we are way ahead at online platform so we are basically wasting our cost on paper usage.
3. **Electricity –** Saving electricity will be always cost saving tool to any company apart from which we can go solar as per the small occupancy of the company. The cost of installation will be low and will be bigger helping hand in cost saving from electricity bill.
4. **Water –** This is the tool we need to look from sustainable perspective because this will not be bigger cost saving factor but definitely we will be saving water for our future generations. Premises to be accommodate with rain water harvesting systems and strict tracking of water usage and wastage along with necessary actions.
5. **Food –** Every firm has the food wastage in small or large quantity. If we convert it into manure that would be helpful and contributing towards our sustainability goal. This will be directly used in same plantation yard of the company. It will strengthen the waste management system.
6. **Fuel –** Major saving factor in terms of cost and pollution as well. Unnecessary travels are now a days are way more important which directly saving cost to company and also contributing to the pollution control and fuel saving.

Social factors –

1. **Employee safety –** Awareness programmes on employee safety measures are of mere importance. The tools we use for employee safety attracts the employees to join and retain the organization. Travel safety awareness, helmet usage, safety training in manufacturing unit are some of the low hanging fruits in the topic.
2. **ESG awareness** – The lowest effort and highest impact generating activity we can say to this ESG awareness among stakeholders and shareholders. This creates impact of your company in the industry. Investors will get attracted to know the smaller

organizations working very seriously on sustainable development goal and the company will get benefitted.

3. **Governance Factor** – Internal governance/risk check system to be indulged with ESG criterion. All the maker checker policies assigned for smother functioning of the company should also be assigned with the work ESG tracking of each tools in all three factors and generate higher score.

Above mentioned tools are very basic and easy to adapt tools by any small company or business. This will attract investors towards the organization. This will retain employees in the organization. This will save cost to company in some ways and this will create value for the company in entire industry. Any medium, small or marginal company or firm can work towards Environmental, Social and Governance factors and can lead the company towards sustainable investment.

“SMALL DEEDS BY THE LARGE NUMBER WILL BE THE LARGEST CONTRIBUTION”

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A review on impact of groundwater crisis on agriculture in Indian perspective

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Abstract

Water is an imperative hotspot for the survival of plants, creatures and person. Because of variation in the climatic states of present time ground water emergency be noticeable amongst the most necessary world issue and it will be more extreme in future. Since water accessibility is most testing factor for our Indian horticulture. With the progression of time our ground water level will decay step by step because of the same editing design from numerous years. Ground water sources will be in a basic condition of corruption inside the following twenty years. Urgent changes are required to take care without bounds demand of water for edit generation. Ground water exhaustion is debilitated to social and financial improvement. There are various strategies like yield revolution, dry land cultivating, reusing of waste water; distinctive water system techniques for proficient utilization of water are received to satisfy the future request of water.

Keywords

Ground water level, crop selection, water recycling, dry land farming, central pivot system.

Introduction

As the most essential asset forever, water has been a focal issue on the worldwide plan for a very long while. These days, numerous regions of the world are influenced by water shortage. The anticipated increment of the total populace development rate proposes that higher nourishment request is expected later on, with an immediate impact on horticultural water use. Likewise, because of the expanded water shortage and dry season because of environmental change, broad water use for water system is anticipated that would happen with regards to expanding rivalry amongst horticulture and different areas of the economy. So as to adapt to future appraisals of water deficiencies, a few measures went for streamlining and enhancing the proficiency of water utilization in the agrarian segment are basic in perspective of the substantial volumes of water required for the creation of products. Water system is utilized to supplant misfortunes because of yield evapotranspiration and to accomplish full creation under the given developing condition. Groundwater is the water discovered underground in the breaks and spaces in soil, sand and shake. It is put away in and moves gradually through geologic developments of soil, sand and shakes called aquifers. The nature of groundwater influences soil wellbeing as well as low quality groundwater can extremely confine edit yields. Water is a basic contribution to farming in nearly every one of its angles having a deciding impact on the inevitable yield. Great seeds and composts neglect to accomplish their maximum capacity if plants are definitely not ideally watered. Overviews led by the Tata Institute of Social Sciences (TISS) demonstrated the greater part of urban communities are water lacking. About 40% of water request in urban India is met by ground water. Therefore ground water tables in many urban areas are faling at disturbing rate of 2 - 3 meters for each year.

“The earth, the land and the water are not an inheritance from our forefathers but on loan from our children. So, we have to handover to them at least as it been handed over to us.” -Mahatama Gandhi.

Attributable to poor water asset administration framework and environmental change India faces an industrious water lack. According to OECD ecological viewpoint 2050, India would confront serious water compels by 2050. Indian horticulture represents 90% water use because of quick track ground water exhaustion and poor water system frameworks.

Ground water depletion

Groundwater exhaustion is a genuine danger to the earth. The dominant part of our bodies and the Earth is comprised of water. We may see the delightful, streaming surface waters that make up the seas, lakes and waterways, yet this water isn't generally alright for utilization and is considerably harder to channel than groundwater. Groundwater levels in India are diving at a disturbing rate where a few states encounter water levels waning to criticality. Use of groundwater ranges from water system purposes to ventures and human utilization. The poor dissemination framework on part of the administration too adds to the current poor state of water. Urban areas like Pune and Delhi lose 40% of water supply because of spillages.

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India has 18% of total populace, having 4% of world's new water, out of which 80% is utilized as a part of farming. India gets a normal of 4,000 billion cubic meters of precipitation consistently. Be that as it may, just 48% of it is utilized as a part of India's surface and groundwater bodies. A shortage of capacity procedure, absence of satisfactory foundation, wrong water administration has made a circumstance where just 18 - 20% of the water is really utilized. Rice, wheat and sugarcane constitute around 90% of India's harvest generation and these are the most water expending crops. Rice, which is a critical fare trim, devours as much as 3,500 liters of water for a kilogram of grain created. Over-reliance on groundwater past reasonable level utilize has come about into noteworthy decrease in the groundwater table, particularly in northwest India.

Groundwater utilization for irrigation in India

All around, around 40% of water system water is provided from groundwater and in India it is required to be more than half. The normal pool nature of groundwater and the trouble of watching it straightforwardly make this asset hard to screen and control, particularly in creating nations. Groundwater assets are being exhausted on account of unsustainable extraction levels that surpass normal energize rates. In India, groundwater water system covers the greater part of the aggregate flooded region (around 42 million ha). Since India is a nation with a critical farming segment, and more than 55% of populace is subject to agribusiness, numerous state governments are putting forth motivating forces to guarantee accessibility of water for water system purposes, for example, State legislature of Punjab (Northern India) are putting forth free power for ground water pumping. Moreover, states of Gujarat and Maharashtra (Western India) offer high endowment for sun oriented pumps. Varieties in water system power are due to among others shifted geological conditions in various parts of the nation. Tough mountains, sandy deserts and rough territories profound aquifers from which extricating water turns into a costly recommendation have a tendency to have exceptionally poor water system offices. A hectare of high-yielding rice requires roughly 11 million L water for each ha for a normal yield of 7 metric tons (t) per ha. By and large, soybeans require around 6 million L water for each ha for a yield of 3.0 t for each ha. Conversely, wheat, which delivers less plant biomass than either corn or rice, requires just around 2.4 million L for each ha of water for a yield of 2.7 t for each ha. Under semiarid conditions, yields of no irrigated crops, for example, corn, are low (1.0 to 2.5 t for every hectare) not withstanding when sufficient measures of composts are connected.

With no pumping limitations, huge request, and reasonable access to groundwater, extensive scale groundwater pumping has prompted outrageous water worry crosswise over a lot of north India. This incorporates Uttar Pradesh, where around 80% of all water utilized is coordinated toward water system. Here, the groundwater levels have been dropping at a disturbing rate, with agriculturists frequently detailing a yearly water level decrease of 0.5 meters or more. It requires greater investment and vitality to reach groundwater at more profound levels, making it more costly to flood, and further troubling India's smallholder ranchers, huge numbers of whom are now attempting to bring home the bacon from the land. Water is the backbone of rustic India, however its restricted supply isn't surely known.

Sustainable Use of Water in Agriculture: More Food with Less Water

The initial phase in the rural division is to register how much water is required by crops with respect to atmosphere conditions. A few systems, for example, soil observing, lysimeter, whirlpool covariance, the Bowen proportion and surface recharging, are utilized to screen and measure water system needs. While observing approach may require fragile and costly sensors or help of specialists, utilization of models (e.g., soil water adjust models) could give a minimal effort strategy to on-cultivate and local frameworks for figuring the product water pre-requisite and evaluating the profundity of water stockpiling required. Once the product water pre-requisite is known, enhancing the productivity of the water system application is a key technique for water reserve funds in horticulture. To boost trim yield and meet the harvest water prerequisite, water system to refill soil water consumption is normally connected at every water system. This approach is legitimate for most field crops and numerous plantation crops. Enhancing the product specialized productivity might be another answer for defeat the water for sustenance issue. The decision of the best cultivar, for example, more dry spell tolerant cultivars, or harvest administration with respects to the dirt and atmosphere conditions can give a strategy to enhance water profitability.

Methods of Efficient utilization of groundwater:

1. **Drip Irrigation -** Drip irrigation systems deliver water on to a plant's roots throughout the cooler times of the day, minimizing water loss. Properly put in drip irrigation save to eighty one more water than typical spray water systems, and end in higher crop yields.

2. **Capturing and Storing Water -** Properly managed ponds produce a natural home ground for life whereas serving to farmers minimize their would like and impact on the encompassing watersheds.
3. **Irrigation programming -** Intelligent water management is that the properly management of water resources that involves application of water at the correct time, correct quantity, right place and right manner to extend productivity and water use potency alongside reduction in energy price on irrigation.
4. **Drought-Tolerant Crops -** Growing crops that are applicable to the region's climate is otherwise that farmers have gotten additional crop per drop. Crop species that are native to arid regions are naturally drought-tolerant; whereas alternative crop varieties (olives, Armenian cucumbers, tepary beans) are hand-picked over time for his or her low tide desires get additional crop per water drop.
5. **Dry Farming -** Dry farmers don't irrigate. Dry farming depends on soil wetness to provide their crops and special cultivation practices and careful attention to micro-climates. Dry farming tends to reinforce flavors, however produces lower yields (wine grapes, olives, potatoes, and apple trees) than irrigated crops.
6. **Rotational Grazing -** Rotational grazing could be a method within which placental are stirred between fields to assist promote pasture regrowth. Grazing management will increase water absorption and reduces water runoff. Magnified soil organic matter and higher forage cover are water-saving advantages of move grazing.
7. **Compost and Mulch -** Compost, or rotten organic matter (mulch) used as fertilizer improves soil structure whereas preserving wetness, will increase its water-holding capability.
8. **Cover Crops -** Planted to shield soil that will otherwise go vacant, cover crops cut back weeds, increase soil fertility and organic matter, and facilitate forestall erosion and compaction.
9. **Conservation Tillage -** Conservation untilage uses specialized plows that partly till the soil however leave vegetative crop residue on the surface to assist increase water absorption and cut back evaporation, erosion, and compaction.
10. **Going Organic -** Organic ways facilitate retain soil wetness whereas keeping virulent pesticides out of our waterways and improve our groundwater provides.

11. **Plastic Buckets for Starting Young Trees -** An incredible help for watering recently planted trees is to utilize reused 5-gallon plastic cans. These are frequently disposed of at development locales. You first need to bore maybe a couple 1/32 inch or littler openings towards one side of the base of the basin. Set it alongside your little tree and load with water each 1 to 2 weeks. You may move it to the contrary side of the tree each time you refill it. Or on the other hand, you can interface a little tube from the container into the dirt to gradually flood. Gravity does the rest of the work for you. In the event that you have a column of seedling trees for another windbreak, you can refill your water pails from a tractor water tank on the off chance that you have one. The thought might be adjusted to flood berry bushes and tomatoes, as well.
12. **Productivity through Centre Pivot Irrigation -** When contrasted with the days of yore when focus rotate water system lost a colossal measure of water through vanishing by splashing the water high into the air amid sweltering climate, the present frameworks are substantially more proficient. This productivity originates from putting sprinkler heads, or spouts on hose drops, as presented above, to limit water float and dissipation. (Regularly the hose drops are lower than in this photograph.) The frameworks can be modified with numerous accessible choices. These more current Low Energy Precision Application (LEPA) focus rotate frameworks additionally utilize less power.
13. **Water reusing -** sewage water ,household water and other waste water is dealt with in water treatment plants and further use for horticulture reason and different purposes, other than drinking reason to take care of the demand of water. In exhibit water declining period water reusing is critical advancement.

Conclusion

Ground water emergency is one of the significant world issues and it turns out to be extremely basic with the progression of time. To control this issue government need to make a few laws and approaches and furthermore to ration our water assets. People groups of our nation additionally receive such strategies for cultivating like dry land cultivating, drip irrigation, plastic buckets for starting new trees, central pivot system, water reusing, and water system planning and so forth to preserve water assets.

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Hi-tech Horticulture: The Emerging Era

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Horticulture is the branch of agriculture concerned with the cultivation, production, and sale of fruits, vegetables, flowers, herbs, ornamental or decorative plants. It forms a major share of agriculture. With the increasing population and climate change, food insecurity is increasing day by day. Achieving food, nutritional and income security is a matter of prime concern. Food security is therefore a multi-dimensional phenomenon, going beyond the availability of supply and involving human nutritional security and farmer's income security. In the present scenario, the increasing population is to be fed from declining land and water due to climate change. The effect of climate change is likely to increase in terms of high temperatures, weather instability, the emergence of new pests and diseases, in addition to the danger of increasing sea levels and water decline from glacier sources, therefore to feed the increasing population we have to work smartly and also it is our moral responsibility to preserve the natural resources for future generations

The Food and Agriculture Organization (FAO) forecasts a 15-20 percent decline in global agricultural production by 2080. Consequently, designing appropriate solutions to reduce the effects of climate change is one of the greatest challenges for plant scientists today. To meet the needs of agriculture, strong research and development support is required to provide science-based solutions to improve the quality of life of people including farmers who also consume food and produce food for their livelihoods.

Hi-tech horticulture is a technology that is trendy, less environment-dependent, and capital intensive however with a capability to boost productivity and farmer’s financial gain. Hi-tech horticulture is beneficial not just for raising fruits, vegetables, and flower’s crops however conjointly for conservation, plant protection, and post-harvest management together with value-addition.

In general, hi-tech agriculture practices requires a high level of preciseness for the application of inputs and management of the crop right from sowing to harvesting.

Advantages of hi-tech farming:

- Yield increases up to 5 to 8 times – high productivity per unit area
- Better quality growth and uniformity is there
- Big savings in key inputs such as water (up to 50 percent), fertilizers (up to 25 percent), and pesticides.
- Possible even in problematic areas like undulating terrains, saline, and waterlogged areas.
- Produce is available during off-seasons
- One can reap the benefits throughout the year
- Impact on natural ecosystems will be reduced
- Less runoff of chemicals into rivers and ground waters.

Hi-tech horticulture involves the following:

- Integrated Nutrient Management(INM)
- Integrated Disease Management(IDM)
- Protected/greenhouse cultivation
- New technologies like GPS, GIS
- Precision farming
- Vertical gardening
- Use of Drones
- Hydroponics
- Fertigation
- Food processing
- Value addition

1. **Integrated nutrient management(INM):**

INM refers to preserving the soil fertility and the supply of plant nutrients to an optimal level to ensure the required crop production by maximizing the benefits from all available plant nutrient sources in an integrated way. Hi-tech horticulture heavily depends on the judicious use of water and nutrients. As land is limited and production has to be increased, the soil will be unable to provide the nutrients required for the proliferation of crop. So it is necessary to use fertilizers in balanced proportions. The use of drip irrigation has resulted in higher yields as it works on the principle of the specific area requiring water and nutrition.

2. Integrated Disease Management(IDM):

It means compiling up the different methods of disease control. Physical, chemical, mechanical methods are together used to eradicate the different diseases in different crops.

3. Protected\Greenhouse cultivation:

This is the type of cultivation where the microclimate around the plant is fully\partially controlled to protect the plant from adverse climatic situations. This not only provides a higher yield in limited space but also gives the facility of growing crops in unfavorable environments and during off-seasons. Mostly the cut flowers used for export purposes come from hi-tech floricultural units. Even the government is promoting protected cultivation by giving various schemes with subsidies.

Benefits of protected cultivation:

- ✓ Ensures the production of any plant at any place and is available throughout the year
- ✓ Blemish-free high-quality product
- ✓ Insect pests and diseases can be controlled easily
- ✓ Water requirement reduces
- ✓ Labour requirement is less
- ✓ Earliness as it reduces crop duration

4. Precision farming:

Precision farming focuses on the very latest technologies and innovations concerning the production of the crops. This means that the grower knows exactly how to direct his production process to achieve optimum yield and quality of the crop concerned. By combining minimum input with maximum production without waste of energy, it not only promotes environmental wellbeing but also increases its profitability. All the hi-tech horticultural tools come under precision farming.

5. **New technologies like Global Positioning System (GPS) and geographic information systems (GIS) :**

GPS receivers collect location information for mapping the boundaries of the fields, irrigation systems, roads, and the problematic areas in crops like weeds or diseases. GPS accuracy helps farmers to build farm maps with correct acreage for field areas, positions on the road, and distances between points of interest. In farm preparation, field mapping, soil sampling, crop scouting, and yield mapping, such technologies are used. These advanced systems allow the farmers to produce their crops accurately by applying the accurate quantities of pesticides, herbicides, and fertilizers.

6. **Use of Drones:**

Drones are the wireless and sensor-equipped devices used for surveying in the fields. They easily capture the whole data at lower altitudes and also capture high-quality images. These are also used for spraying insecticides and pesticides in the fields.

7. **Hydroponics:**

An emerging cultivation practice where the plants are grown in water. The nutrients are supplied through the mineral nutrient solution in the water solvent. It not only reduces the weed and disease infestation arisen by the soil but also results in higher yields. Tomatoes, pepper, cucumber, and lettuces are some common plants which are grown using hydroponics.

8. **Vertical farming:**

The practice of growing crops in layers which are stacked vertically is referred to as vertical farming. Here plants are grown by incorporating different soil less farming techniques like hydroponics and aeroponics. Currently, the production of mushrooms, poultry, hydroponic fodder, strawberry, leafy-vegetables particularly lettuce, herbs, ornamental horticulture, and other crops production are happening with the help of vertical farming.

9. **Food processing and value addition:**

As most of the crops in horticulture are perishable in nature, it is necessary to process them so they can be used for longer periods. Moreover, horticulture food processing forms a major percent of the entire food processing industry. For long term use, horticultural foods such as fruits and vegetables are processed into various value-added products such as pickles, preserves, squashes, marmalade, concentrate, fruit mixes, jam, jelly, canned vegetables, and canned fruits. Talking about flowers, they not only excel for their aesthetic value, but they are also rich sources of neutraceutical goods. Hi-tech horticulture has scope for many new avenues in the future.

Disadvantages of hi-tech farming:

- Initial expenses are very high means requires high capital
- Skilled labour is required to operate
- Need for research and development
- Requires time and commitment
- Experience and technical knowledge is very necessary
- Water and electricity risks are always there
- System failure threats
- Diseases and pests may spread quickly

Conclusion

As the world is developing new techniques day by day if one incorporates modern innovations and techniques with traditional agriculture, we can feed the increasing population despite having so many challenges. This will not only help in sustainability of the produce but will also help to improve the economic conditions of farmers.

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Indoor Vertical Farming: The New Era of Agriculture

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ARTICLE ID: 069

Introduction

As the world's population grows exponentially, our total supply of fruits and vegetables is falling. Traditional farming methods are having difficulties meeting this demand as it faces increasing problems such as water shortage, land scarcity, and an aging farming population with decreased interest from newer generations. In recent years, controlled environment agriculture has experienced a surge of popularity as it presents a compelling solution to all these problems and more. Indoor vertical farming can increase crop yields, overcome limited land area, and even reduce farming's impact on the environment by cutting down distance travelled in the supply chain.

What is Indoor Vertical Farming?

Indoor vertical farming can be defined as the practice of growing produce stacked one above another in a closed and controlled environment. By using growing shelves mounted vertically, it significantly reduces the amount of land space needed to grow plants compared to traditional farming methods. This type of growing is often associated with city and urban farming because of its ability to thrive in limited space. Vertical farms are unique in that some setups don't require soil for plants to grow. Most are either hydroponic, where vegetables is grown in a nutrient-dense bowl of water, or aeroponic, where the plant roots are systematically sprayed with water and nutrients.

Vertical Farming is the practice of producing food in vertically stacked layers, such as in a skyscraper, used warehouse, or shipping container. The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where all environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases...) and fertigation. Some vertical farms

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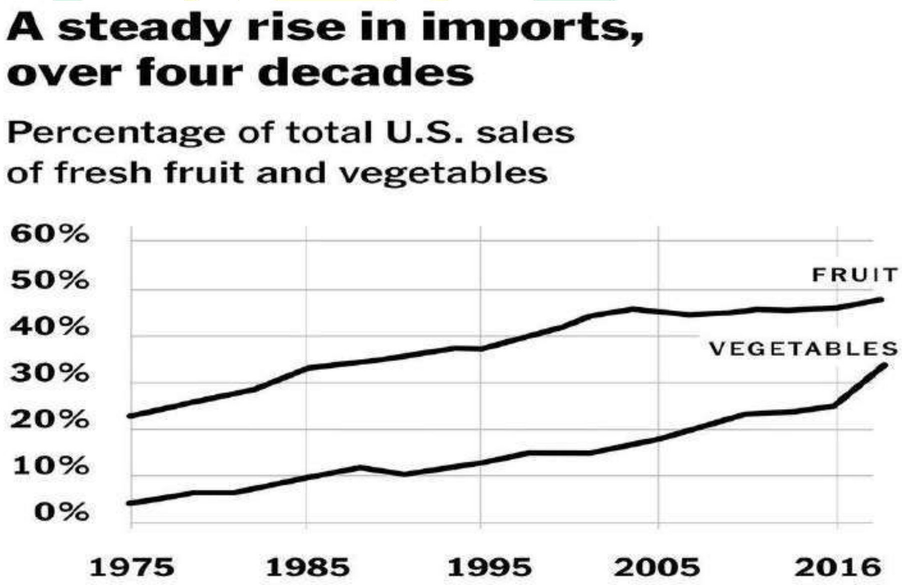
use techniques similar to greenhouses, where natural sunlight can be augmented with artificial lighting and metal reflections

How Vertical Farming Works:

There are four critical areas in understanding how vertical farming works:

1. Physical layout
2. Lighting
3. Growing medium
4. Sustainability features.

- The primary goal of vertical farming is producing more foods per square meter. To accomplish this goal, crops are cultivated in stacked layers in a tower life structure.
- A perfect combination of natural and artificial lights is used to maintain the perfect light level in the room. Technologies such as rotating beds are used to improve lighting efficiency.
- Instead of soil, aeroponic, aquaponic or hydroponic growing mediums are used.
- The vertical farming method uses various sustainability features to offset the energy cost of farming.



(Source: New York Times)

Advantages and Disadvantages of Vertical Farming:

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Advantages of Vertical Farming

Having greater output from a small cultivation area is not the only advantage of vertical farming. Following are some of the major benefits of vertical farming:

- Preparation for Future: the world population is expected to rise in urban areas, and the growing population will lead to an increased demand for food. The efficient use of vertical farming may perhaps play a significant role in preparing for such a challenge.
- Increased and Year-Round Crop Production: Vertical farming allows us to produce more crops from the same square footage of growing area.
- Less Use of Water in Cultivation: Vertical farming allows us to produce crops with 70-95 percent less water than required for normal cultivation.
- Not Affected by Un- favourable Weather Conditions: Crops in a field can be adversely affected by natural calamities such as torrential rains, cyclones, flooding or severe droughts—events which are becoming increasingly common as a result of global warming. Indoor vertical farms are less likely to feel the brunt of the un-favourable weather, providing greater certainty of harvest output throughout the year.
- Increased Production of Organic Crops: As crops are produced in a well-controlled indoor environment without the use of chemical pesticides, vertical farming allows us to grow pesticide-free and organic crops.
- Human and Environmentally Friendly: Indoor vertical farming can significantly lessen the hazards associated with traditional farming. Farmers are not exposed to hazards related to heavy farming equipment, diseases like malaria, poisonous chemicals and so on.

Limitations of Vertical Farming

Vertical farming has both pros and cons. Sometimes the pros of vertical farming are highlighted and not the cons. Following are the major limitations of vertical farming:

- **Difficulties with Pollination:** Vertical farming takes place in a controlled environment without the presence of insects. As such, the pollination process needs to be done manually, which will be labor intensive and costly.
- **Labor Costs:** As high as energy costs are in vertical farming, labor costs can be even higher due to their concentration in urban centers where wages are higher, as well as

the need for more skilled labor. Automation in vertical farms, however, may lead to the need for fewer workers. Manual pollination may become one of the more labor-intensive functions in vertical farms.

- **Too Much Dependency on Technology:** The development of better technologies can always increase efficiency and lessen costs. But the entire vertical farming is extremely dependent on various technologies for lighting, maintaining temperature, and humidity. Losing power for just a single day can prove very costly for a vertical farm. Many believe the technologies in use today are not ready for mass adoption.

Conclusion:

Vertical farming technologies are still relatively new. Companies are yet to successfully produce crops at scale and make it economically feasible to meet the growing food demand. The performance of farms like Aero - Farms will determine how important a role vertical farming will play in the future to face the challenge of growing food demand.

Environmental Effect on CoronaVirus

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Abstract

Viruses survive and infected underneath specific environmental conditions and causes infection. Totally different environmental factors result viability of virus and cause infection to humans and animals. Surrounding conditions like temperature, ratio ,Precipitation result survival rate of corona virus. Warmth and ratio areas having lesser community happening. The severe acute respiratory syndrome CoV transmitted through varied modes. This review summarized the varied observations concerning the implications of environmental conditions on corona infection.

Introduction

Corona viruses are unit of measurement a family of viruses that change from the respiratory disorder to MERS corona virus, that's Mideast metabolism Syndrome corona virus and severe acute respiratory syndrome, Severe acute metabolism syndrome corona virus. Corona viruses unit of measurement current in animals and some of these corona viruses have the potential of sending between animals and humans. Corona viruses represent the taxon Orthocoronavirinae, within the family Coronaviridae. Corona viruses were initial discovered within the Thirties once an acute tract infection of domesticated chickens was shown to be caused by infectious respiratory illness virus (IBV).

Human corona viruses were discovered within the Sixties. The diameter of the virus particles is around 120 nm. They vary considerably in risk issue. Some will kill over half-hour of those infected (such as MERS-CoV), and some unit of measurement comparatively harmless, just like the respiratory disorder. It cause colds with major symptoms, like fever, and pharyngitis from swollen adenoids, occurring primarily within the winter and early spring seasons.

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Effect of Environmental conditions on corona virus

- **Temperature and Relative Humidity:-**

Most virus survive and cause infection underneath specific temperature vary however variety of them will tolerate warmth. The dried virus on swish surfaces preserved its viability for over five days at temperatures of 22–25°C and ratio of 40–50%, that is, typical cool environments. virus viability was quickly lost at higher temperatures and better ratio . Some have recommended the prospect that weather factors may have an impact on the virus – notably the intensity and quantity of hours of sunshine additionally as heat and humidness. virus is extremely sensitive to warmth. A notable feature of this illness was its transmission within the health care setting and to shut family and social contacts. The environmental conditions of nations like Malaysia, Indonesia, and Thailand are thus not conducive to the prolonged survival of the virus. Incountries like Singapore and urban center where there's a intensive use of air- conditioning, transmission largely occurred in well-air-conditioned environments like hospitals or hotels.

- **Precipitation:-**

Another environmental factor which will influence viral transmissibility is precipitation. Several large-scale studies are conducted in tropical and equatorial countries so as to see the connection between rainfall and respiratory disorder, particularly that related to RSV and, to a lesser extent, influenza virus. An association between rain and RSV infection has also been seen in several other studies . in contrast, a large, 3378-children study in Northern Taiwan (23°N) failed to find any association between rainfall and RSV infection , nor did a 2002 study in Santiago, Chile (33°S). Of note, however, the Chilean study focused on cases in precisely one public pediatric hospital ; it's possible that a limited sampling of cases in barely one hospital would hinder the flexibility to draw statistically significant conclusions. However, studies in other locations have found the connection between RSV disease and rainfall to be inversely related. in a very 24- month study of over 1000 symptomatic children in India (22°N), RSV infection rates were negatively correlated with millimeters of rainfall; these findings were statistically significant.

- **Airflow And Ventilation**

Though relatively few data exist, airflow and ventilation seem to play a task in respiratory virus infectivity and transmission. Schulman and Kilbourne again made prescient early observations of the effect of airflow on the transmissibility of influenza viruses within the mouse model, demonstrating that the speed of transmission decreased with increasing ventilation of a closed chamber during which mice were housed . an identical phenomenon was observed with rhinovirus; the probability of detecting airborne picornavirus RNA in office buildings was directly correlated with the carbonic acid gas (CO_2) content of the air, which is successively inversely associated with ventilation with fresh outside air ; however, there have been too few positive nasal samples to correlate CO_2 content with actual human infection.

Conclusion:-

In this review Precipitation, temperature, humidity, air flow are often determinants of infection and transmission. Corona virus causes tract infection among humans and animals. Non- Environmental effects , also as however not also on seasonal changes in behaviour, family and scheme and pre existing immunity might even be enjoying an important role in metabolism meteorological parameters having totally different ranges underneath that corona virus survive.

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Farmer's Bill: are they Bane or Boon

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Ordinance: An ordinance is an executive order issued by the President of India that holds the same force and effect an Act passed by the Parliament. After the ordinance is passed, it lapses after a period of six weeks from the date, the parliament reassembles.

Agricutural Produce Market Committee(APMC)

APMC is a marketing board established by a state government in India to ensure farmers are safe guarded from exploitation by large retailers, as well as ensuring the farm to retail price spread does not reach excessively high levels.

Minimum Support Price(MSP)

The minimum support price is an agricultural product price set by the government of India to purchase directly from the farmer. This rate is to safeguard the farmer to a minimum profit for the harvest, if the open market has lesser price than the cost incurred, It is also known as price.

Here are the three agriculture ordinances passed by the government:

The farmers are demanding a roll back of the:

1. Produce Trade and Commerce (Promotion and Facilitation)Ordinance,2020.
2. .Farmer's (Empowerment and Protection)Agreement on Price Assurance and Farm Service Ordinance,2020.
3. Essential Commodities(Amendment)Ordinance,2020.

Why farmers are protesting against three agriculture ordinances?

Thousands of farmers in Punjab, Haryana and several states are on the roads to protest against three farm ordinances which were presented in Lok Sabha. The opposition and many farmers unions have threatened to protest till the controversial ordinances are withdrawn. A statement by the leader of Bhartiya Kisan Union (BKU) is "The protest will be indefinite,if the

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ordinances are not withdrawn. We will go to New Delhi and compelled to take extreme steps. The farmers are already stressed and committing suicide everyday. If the ordinances become law,they will destroy agriculture".

Some of the main reasons given by the farmers to oppose these ordinances are:-

- .Farmers claim that the ordinances will not only phase out the Minimum Support Price(MSP) and the traditional grain market but also crush the small and marginal farmers.
- The biggest reason is that they avail finances from the commission agents to raw the crop and return it when the product reaches the market .As the banks are hestitant to lend money to the poor farmers , they solely depend on the private money lenders and the commission agents.
- The another main reason which is haunting the farmers is losing the MSP.They say farming is no more a profitable avocation and if MSP is withdrawn they will not be able to survive.
- The farmers are also afraid that once the private grain markets are established ,the traditional grain markets will become history.The farmers will have to depend on corporations and private firms.
- Farmers scared of that these ordinances will end the Mandi System of selling of agricultural products and lead to sell their products below the MSP.

What is the government defence ?

The government says that these ordinances are pro-farmer and will provide barrier free trade for farmers produce outside notified grain market and empower farmers to enter into the farming agreements with private players to prior to the production,for the sale of agri-products.These provisions will be beneficial to all farmers,consumers and traders.It will lead to helping the farmers to having a better price.By enacting on these ordinances, the small farmers will go to the big cities for other more occupations.Because mostly the farmers are only emerged in crop production .They don't show their interest in marketing,food processing and industries related to the agriculture etc. As a result , the governmental godowns becomes fully filled with different several types of grains.

Police reaction towards the protestors:-

Police uses Lathicharge on the Haryana Farmers protesting against 3 Farm ordinances-

Hundreds of farmers protesting against three farm ordinances given by the central government ,were lathicharged by the police in Haryana's Kurukshetra. A day after,they ignore the state and district administrations warnings and marched towards the rally ground.

Will these Ordinances encourage the farmers to commit suicide?

Now, at this time farmers are only protesting against these three ordinances but if it will not withdrawn this will cause the numbers of farmers suicides.

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Farmer died by suicide at Punjab Muktsar:-

Pritam Singh,resident of Akkanwali village of Mansa district, consumed the poison, on friday morning and later die at the hospital .He had participated in the protest since September 15, which is being held by the Bhartiya Kisan Union (Ekta Ugrahan) at Badal village,the native of former Chief Minister Parkash Singh Badal.

Support of politicians to the farmers-

The politicians are saying that these ordinances are the 'anti-farmers'.

Farmers are the backbone of the country.

- Harsimrat Kaur Badal said that "She quits Modi Govt., while making the annoucement in parliament,her husband and party chief Sukhbir Singh Badal said that the Akalis will continue to support the government and BJP but will oppose the "anti-farmers" policies.

- Haryana Chief Minister Bhupendra Singh said that "These ordinances are against the interests of farmers.If the government wants to implement them ,then it should to be ensure that no purchase are made below MSP.

What should be the "Solution"?

The farmers unions are saying that they will continue the protests against 3 Farm Ordinances until they are not withdrawn by the government, because it will lead them to big loss. But the central government is saying that these ordinances will be beneficial for the farmers and traders.So to make the farmers fear out of the loss, which they think they will having after implement of these ordinances .Government has to also implement that the purchase will done on the basis of MSP despite purchase done by govt. stores or by private stores-industries, no purchase done below the MSP.

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Augmentation of Zero Budget Natural Farming For Sustainable Agriculture

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Abstract:

The 'Green Revolution' due to conventional farming succeeded due to adoption of improved varieties of seeds, synthetic and chemical fertilizers, pesticides and farm machineries incorporation. Owing to this it lead a serious concerns related to human health and soil texture and fertility. Thus, there's a need to move towards the sustainable farming which is economically viable and environmentally acceptable. This article enlightens chaos caused in agriculture and health due to current conventional farming and its adverse effects. It gives the present fact, scenario, and solutions, an alternative to completely destroy rising crises in Indian agriculture. Exploring an alternative solution, Zero Budget Natural Farming (ZBNF) is found the only way to deal with this problem in the integrated and sustainability of natural resources. The method of ZBNF in present-day agriculture enlightened several ideas, concepts, and processes to be effectively utilized for the long term sustainability of Indian farming. ZBNF's system of approach is primarily based on the natural ecosystem which includes seed rotation, compost and green manure, biological pest control, and mechanical cultivation. The four wheels of ZBNF's are most common and cost-effective namely Jivamrita, Acchadana, Bijamrita, and Whapasa. The importance and practicability of ZBNF is though time memorable but their benefits are never-ending. Therefore efforts are made to describe the ZBNF system, utility, and sustainability for Indian farming practices.

Keywords: Agriculture, sustainability. Zero Budget Natural Farming (ZBNF).

Introduction

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In recent decades, the presence of toxic chemicals in the atmosphere has been subject of serious debate (Bao et al., 2015). The latest WHO reports documents that more than 50 percent of eatables have chemicals of a carcinogenic nature (Prasad, 2016). Food that we eat to sustain our lives is a gradual poison as everyone is known to the fact that in agriculture synthetic pesticides are commonly used to monitor harmful pests and to avoid crop yield losses or damage to goods. Pesticides can have adverse effects on human health and the environment, resulting in high biological activity and, in certain cases, a long duration in the climate. Farmers are regularly exposed to high levels of chemicals, typically much higher than customers (Damalas and Koutroubas, 2016). Exposure to growers happens especially during much of the preparation and implementation of chemical spray solutions and during the spray system clean-up. Pesticides and other foreign substances in foodstuffs and drinking water along with harmful air pollution present an imminent danger to public health (Fig 1), although other toxins eventually grow in the ecosystem and in the human body and induce disease far after the first contact (Gavrilescu et al., 2015).

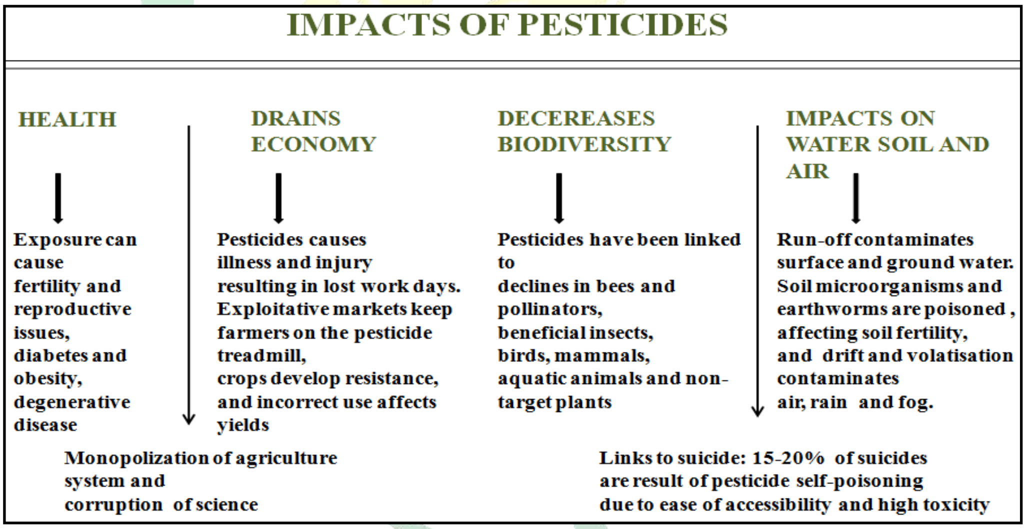

Fig 1. Imapcts of pesticides on health and other factors

In 2017, 20 farmers died from pesticide poisoning in the Yavatmal district located in Maharashtra state's Vidarbha area, more than 700 were in the hospital. A farmer figurehead reported that even more than 700 farmers have been hospitalized and 25 lost eyesight due to chemical spraying infection. Cocktails of highly hazardous pesticides after that year's

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incidents, the Yavatmal government hospital introduced acetyl cholinesterase serum tests to detect organophosphate poisoning. Added chemicals are being used in Vidarbha, however. Pertaining to the report called "Of Rights and Poisons, Accountability of the Agrochemical Industry (Pesticide Action Network Asia Pacific 2018)", Polo pesticide contains the active ingredient of the insecticide 'diafenthiuron.' Diafenthiuron is a compound called the thiourea and not an organophosphate. This finding is disturbing because all cases of poisoning cannot be treated with one remedy. About 200k farmers in India alone committed suicide in 2016 because of the heavy debts they had to bear to finance the costly and deadly crop growth enhancers.

Question arises, solution to such crises?

The newly adopted farming strategy among farmers, after seeing the adverse effects of chemical cultivation, is (ZBNF) classified scientifically as Zero Budget Natural Farming, as it is called by the United Nations Food and Agriculture Organization. Zero budget farming is a collection of farming practices requiring zero agricultural credit and the use of artificial fertilizers. The zero budget farming seeks to bring the farmers out of the debt trap they've found themselves in with Indian economy liberalization. The zero budget farming model aims to dramatically slash agricultural expenses and eliminates loan dependence. It also decreases reliance on imported products, as it facilitates the use of own seeds and natural fertilizers available locally. However, the concept of natural agriculture is not something that is brought from Japan. Similar theories have been commonly practiced over thousands of years of Indian agriculture. Natural agriculture is also referred to in India as 'Rishi Kheti,' based on ancient Vedic farming concepts such as the use of animal waste and herbal juices to combat pests and foster plant production (Kulrajan 2018). The four wheels of ZBNF - Jivamrita, Acchadana, Bijamrita, and Whapasa.

Defining the ZBNF System

Zero Budget Farming, as the name suggests, is an agricultural cycle in which the plant growing and processing costs are null with an evolving range of farming practices intended to drastically minimize farmers' direct costs ('zero budget') though increasing yields

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and farm productivity through the use of non-synthetic inputs generated locally ('natural agriculture'). Like Agroecology, which is a research discipline, collection of practices, and a zero-budget (Wezel et al. 2009), the agricultural social revolution implies both a collection of practices and a social movement too. This means farmers do not have to buy fertilizers and pesticides to ensure nutritious production of the crops. The method governs organic biodegradable materials attainable locally, filled with the technical knowledge of nature and modern technologies with sustainable farming methods based on naturally occurring biological processes. Shri Subhash Palekar who is regarded as the “Father of zero budget natural farming” all over the country dragged this idea into the light, for which he was awarded Padma Shri in 2016 (Anon., 2016).

Is zero budget natural farming working?

One of Budget 2019's main declarations was a huge promotion of zero budget natural agriculture (ZBNF). Terming it as 'returning to fundamentals,' the Minister of Finance made a clear case for ZBNF adoption. The reaction to this initiative has been mixed, however, with some analysts hailing it as a landmark move that would rejuvenate the beleaguered farming industry.

It has achieved wide-ranging popularity in southern India, especially in Karnataka where it first emerged (Kumar N., 2012). Now, it is spreading across India, very quick and dynamic. ZBNF is making headlines in Andra Pradesh, where the methodology has already been adopted by more than 500,000 farmers as part of a state government-led initiative in the State which plans to scale up to 6 million by 2024. ZBNF supporters believe that the soil already provides all the nutrients required to grow plants and that the activity of microbial crops applied to the soil removes certain nutrients from the soil itself. But if only nitrogen were produced by stimulating release from the topsoil, the resulting depletion of organic matter would result, and all organic matter would be removed from the topsoil within 20 years. That would contribute to a rapid decline in crop production and make soils less vulnerable to droughts, the scientists argued.

The basic method of ZBNF is given by Palekar, progressive farmers of the Vidarbha region and pioneer of zero budget agriculture in the Nation is used. In his experiment-based over six years of dedicated research, Palekar came up with some solutions and methods. (Bishnoi and Bhati 2017). ZBNF has essentially four wheels Jivamrita, Bijamrita, Acchadana, and Whapasa (Palekar, 2014).

Important component of Zero budget farming

Bijamrita (a seed treatment) and Jivamrita are reservoirs of beneficial bacteria that have plant defence qualities and stimulate plant growth (Sreenivasa, Naik, and Bhat 2009). Jivamrita consists of jaggery (20 kg), cow-dung (20 kg), urine (5-10 liters), and dicot flour (2 kg) and is added directly to crops with each Irrigation cycle. Bijamrita consists largely of water (20l), cow dung (5 kg), urine (5l), lime (50gm), and just a handful of soil. Contrary to traditional agriculture, Palekar suggests that the soil already has all the nutrients required for plant production and that no additional inputs need to be added; rather, the current nutrients need to be "unlocked" and made bio available by Jivamrita (Palekar 2005) - this concept by Palekar is called Annapurna.

In ZBNF mulching takes various shapes. "Live mulching" is encouraged with a combination of monocotyledons (like millets) and leguminous dichotylledons (like beans) to cover crops. The monocots provide nutrients such as potash or phosphate, while the nitrogen-fixing dicots support (Palekar 2006). Straw mulching is also promoted, using residue from dry crops. Acchadana may be made by soil mulch, straw mulch or live mulch.

Waaphasa stands for water vapour. Palekar maintains the roots contain water vapour rather than water. He supports a microclimatic state around the roots where there is a combination of molecules of air and water and opposes overwatering. For optimum Waaphasa formation, he prescribes watering only when the sun is high at noon. Irrigation should be minimized and in substitute furrows, irrigation should be done only at midday. Palekar believes that ZBNF activities will minimize water use by up to 90 percent, making it suitable for rain-fed farming (Palekar 2006).

Other essential concepts are the intercropping, furrow cropping process, contour and bunds scheme, and the use of local earthworm organisms. Palekar also provided the pest control formulae (Table 1) that he called, Agniastra, Brahmastra, and Neemastra (Palekar, 2014).

Table 1. Name, Composition, and Controls

Sr. No.	Name (Management formulae)	Composition	Controls
1.	*Agriastra*	It consists of 10 liters of Local Cow Urine, 1 kg of Tobacco, 500 grams of Local Garlic, 500 gm of Green Chili, 5 kg of Neem leaves pulp (crashed in urine). The 2l Brahmastra is taken in 100 l of water for spraying.	This works well against pests such as Leaf Roller, Stem Borer, Fruit borer, Pod borer
2.	*Brahmastra*	It is prepared by leaves of neem, custard apple leaves, lantern camellia leaves, guava leaves, leaves of pomegranate, papaya leaves, and leaves of white dhatura crushed and boiled in the water.	It controls all the sucking rodents, pod borers, fruit borers, etc.
3.	*Neemastra*	It consists of 24 hours fermented local cow urine (5l), cow dung (5 kg), and neem leaves and neem pulp (5 kg).	Using this to suck pests & Mealy worm

Findings and benefits of ZBNFs system adoption in India

Intensive farming activities have significant environmental impacts. Any of the issues related to agriculture are climate change, erosion, genetic modification, irrigation challenges, pollution, soil depletion, and waste. Increased use of chemicals such as urea, nitrate, phosphorous and many other pesticides has compromised the quality of the air, water and soil. Genetically altered crops are herbicide-tolerant and herbicide-resistant 'super weeds' have been produced by their overuse. Non-target trees, birds, fish, and other wildlife were also killed due to the application of pesticides. Soil erosion has changed the soil's microbial population, modifying the soil's nitrogen balance, pest management, and chemical transition properties (Kulrajan 2018).

Natural agriculture is the alternative to that all such hazards. Often known as 'do-nothing farming' or 'no-tillage farming' is this sustainable method of cultivating. It was first popularized in Japan in the 1940s, by Masanobu Fukuoka. The aim is to encourage nature to play a dominant position in as far as possible. The farmer is considered a pure facilitator of natural farming, and the actual job is performed by nature itself. There are no good or poor species in a natural farm; all of these are important to a healthy environment.

The fundamental principles of natural agriculture

- No-till farming – soil plugging changes the soil's natural ecosystem and encourages plant production.
- No-tillage weeding or herbicides-weeds are not removed but can be prevented by spreading straw over freshly sown soil and increasing soil cover.
- No chemical fertilizers – it's because introducing chemical fertilizers makes the plant expand but not the soil, which begins to worsen.
- No reliance on toxic pesticides-the juggling act of nature itself stops any animal from acquiring the upper hand.

Benefits of zero budget natural farming

In turn, this approach lets farmers get out of debt and increases soil fertility, yield, and product quality. Earthworm demolishes the plants and animals, thereby enriching the soil with humus. It also increases the soil aeration and the capacity to retain water by creating micro and macro pores in the soil. Pest prevention approach used in this not only works us get rid of pest destruction but also defends us from the amusing side effects of chemical processes such as distortion, contamination, carcinogenic substances, and food poisoning. Unlike chemical fertilizers, soil and water degradation and their depletion are not caused by this. Rotation and intercropping of crops protect the soil from drought and nutrient depletion. Mulching, though, reduces the evaporation and retains sufficient soil moisture. It provides the microorganism present in the soil with a favourable climate. By the term, drug consistency, it means nowadays free from unnoticeable disease causing contaminants, which is a serious concern. For a brief, ZBNF is unquestionably a revolutionary strategy, politically, psychologically, biologically, and physiologically.

Constraints in zero budget natural farming

A recent study has reported that wider adoption of zero-budget natural farming (ZBNF), which the central government is trying to encourage as a way to help farmers double their incomes, could potentially lead India to failure to fulfill its food requirement for all its population in the coming decades. There are, however, a few critics who doubt ZBNF's feasibility and have discounted the initiative outright, saying that ZBNF is far-fetched in helping boost farmers' revenue, let alone doubling it. In addition to livestock health expenses, cattle feed prices are still relatively high. In recent years, feed costs have skyrocketed making it as pricey as milk because of the reduced grazing lands and the depletion of small water bodies. The cattle feed wholesale price index (WPI) rose from 106.7 to 159.3 between 2012 (April) and 2019 (November), a rise of around 50 percent.

ZBNF, above all, supports the need for an Indian breed cow, whose numbers are decreasing at a rapid rate. How can the optimistic dream of doubling farm income by 2022 be fulfilled, considering the declining numbers of Indian breed cows? The preliminary figures of the 2019 Livestock Census show that the overall indigenous and non-described cattle population in the country has dropped by 8.1 percent, while that of exotic and cross-breeds has soared by 29.5 percent over that of the previous 2012 Census.

The coalition-requirement in all ZBNF projects declined over time relative to chemical farming. Farmers interviewed therefore clarified that the labour requirement depends on farm size and crop type; sugarcane and paddy are labour intensive. A small farm, below 1–2 ha, can be handled with the farm family's own labour and according to a survey many families who relied solely on their own extended support for the property. Farmers with greater holdings of land (above 2 ha) will employ labour. In Karnataka, (Satishkumar and Umesh 2018) the availability of farm labour, particularly during peak seasons such as harvest, has deteriorated sharply and farmers across the board are adopting strategies to cope with labour shortages such as the farm mechanization, alternative crops, leasing out the land, and leaving land fallow among others.

Conclusion

The common consciousness and laid bare the hundreds of thousands of farmers who lost their lives because of helplessness we as a community refuse to imagine and react. Let us not be in any doubt about the Indian agriculture crisis. It is under this that the Zero Dependent Natural Farming, which resonates with agroecology concepts and answers the issues of the twin-dimensions of the risk one, sees a way out. A majority of respondents indicated that they have seen changes in yield, soil fertility, seed diversity, and product quality, household food autonomy, revenue, and health over time, by implementing ZBNF.

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Farmer's Amendment Bill / Ordinance

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On 5th June 2020 the Centre passed three agriculture bills aiming at 'One Nation ,One Market' policy, which lead to widespread protests taking place in Punjab , Haryana and mostly the Northern states of India. Hundreds of farmers were involved in the tractor march and protests which lead the police to lathicharge them for defying the administration's warning during the raging pandemic. During the current COVID-19 scenario such news are very disturbing. The Union minister for Food Processing Industries, Harsimrat Badal also resigned from the Union Council of ministers as a protest against these bills, which she said are anti-farmer. Punjab and Haryana occupy an extremely important place in agriculture in India. Both of these two states are regarded as the Breadbasket of India and have contributed substantially to the country's food security.

What are the Three Bills

1. **The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill,2020**

The bill assures to give farmers a freedom of choice to sell their farm produce outside the registered mandis/markets under the Agricultural Produce Market Committee(APMC). This would serve as an "additional marketing channel" for farmers, promote inter-state and intra-state trade of the farmers produce outside mandis and help improve the farmer's income. But for this kind of trade all farmers need not be capable of affording the transportation charges. In the long run this bill can put an end to the APMC system and hence farmers will lose the minimum support price (MSP) they earned for their farm produce, which the APMC system had ensured them with. Also in states like Kerala where there is no APMC system, this bill fails to prove its relevance. Eventually if the APMC markets would come to an end, it is not clear if the unified integrated market e-NAM (electronic National Agriculture Market) will materialise. A fear that such laws would create two market spaces with two completely different sets of rules and that it would make the task of knowing anything about transactions in these new markets difficult, also persists.

2. **The Farmer (Empowerment and Protection) Agreement of Price Assurance and Farm Service Bill,2020**

This bill claims that farmers can access modern technology and get better inputs by entering into a contract with agricultural firms, wholesalers and exporters. Also that this will help eradicate middlemen, as farmers will be directly involved in marketing. Though this sounds good on the surface, but will the poor farmers who cannot manage the pressure from middlemen itself , be able to solve disputes with huge multinational companies , exporters and agribusiness firms? The farmers will again be the weak players in negotiating their needs and big private companies will have an edge in disputes .The APMC was in fact set up to safeguard farmers from middlemen and limit distress sale by farmers under the pressure of intermediaries. But the first bill stated above, The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Bill,2020 is passed to gradually bring an end to the monopoly of APMC.

3. **The Essential Commodities (Amendment) Bill, 2020**

This bill comes with the provision to remove commodities like cereals, pulses , oilseeds , onions and potatoes from the list of essential commodities . This would do away with the imposition of the stock holding limits of such items, except under extraordinary circumstances like war and will attract private sector investment for farm infrastructure like cold storage. While, this can also allow corporates to create an artificial shortage of commodities and dictate the prices due to the increase in demand. Hence the corporate and private sector will be making huge profits and these bills will ultimately prove no good for the farmers as well as consumers.

Conclusion

As in most developing countries, agriculture is an important pillar of the Indian economy. Contribution of Agriculture sector in Indian economy is much higher than world's average (6.4%). The Indian farming sector is very vulnerable to conditions like drought, flood, pest attack and crop damage and farmers find it difficult to earn a livelihood under conditions of such severe scarcity. The GDP growth rate is estimated to be 5% in 2019-20 as compared to 6.8% in 2018-19. Growth of agriculture sector has been fluctuating: it increased from -0.2% in 2014-15 to 6.3% in 2016-17, and then declined to 2.8% in 2019-20. (Economic Survey 2019-20). During the current COVID crisis, besides the uncertainty in other sectors, only the agricultural sector proved to have not perished and contributed to the growth in GDP in India. The Centre has targeted Doubling the Farmer's Income (DFI) by 2022 and the action plan to strengthen agriculture in India needs to be on domestic reforms, not through reduction of government intervention in the market economy but playing major role as evaluator and implementation of the policies, increased investment and prioritising the area to invest.

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Technology For Higher Pulses Production in Bihar

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Grain legumes though have formed an important place in our agriculture since millennia as source of protein to vegetarian dietary, soil fertility builder and as an important constituent of feed of the livestock's, their production potentials have been low. Production of a crop increase only when package of production technology developed for agro- ecology and socio-economic, services and public policies are mutually re-in forcing and are in harmony with each others.

Greengram *(Vigna radiata*), known as moong or mungbean in India. It is the third important pulse crop of India after chickpea and pigeon pea. Its utilization as food in many forms, haulms is used as fodder and green manure. Due to its shorter duration, it can be fitted in several multiple cropping systems. Pulse crops, inclusion of green gram in cropping systems improves soil health and fertility.

Causes of low Production:

- Larger emphasis on production of cereals specially with the availability of high yielding management responsive varieties.
- Under realization of the importance of pulses in diet.
- Non –availability input responsive varieties.
- Poor extension of developed production technology leading traditional scheme of production characterized with
- Low plant population
- Rare utilization of fertilizers and insecticides

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- ❖ Use of traditional or local varieties
- ❖ Poor care after the harvesting the crops.

Attention on these aspects are strongly needed for the increase in the possibility of increase in yield thus, the pulses production can be increased.

- ➢ Increase in the area
- ➢ Adoption of newer technology to the farmers.
- ➢ For getting the higher yields of Mungbean & Urdbean the following production technology should be adopted.

Advantages of Growing Moong:

- ➢ The crop has very little or no infestation of insect-pest and diseases because of high temperature and desiccating winds.
- ➢ . The crop/varieties take lesser time (normally 60-65 days).
- ➢ . The cropping intensity can be increased.
- ➢ The area and production can be increased under pulses without eliminating a grain crop to be grown during *kharif* season.
- ➢ It utilizes the residual soil fertility when grown after heavily fertilized crop like potato, wheat and winter maize.
- ➢ In return it adds at least 30-35 kg available nitrogen/ha through *Rhizobium* fixation which may be adjusted while applying fertilizers in following *kharif* season crop.
- ➢ After picking of pods the foliage can be incorporated into soil as green manure.
- ➢ To add organic matter into the soil as bonus for boosting soil fertility and improving physical conditions of the soil.

ORIGIN, DISTRIBUTION AREA AND PRODUCTION:

Green gram is primarily a native of India (central Asia) may be a secondary center. Carbonized grains of green gram are found in archaeological sites of Navadatoli – Maheshwar in Madhya Pradesh dating between 1440 and 1660 BC. Green gram is cultivated throughout southern Asia.It is also cultivated in parts of Africa to a smaller extent. About 45 per cent of global production is in India. In India, major green gram producing states are Andhra Pradesh, Odisha, Maharashtra, Madhya Pradesh, Rajasthan, Bihar and Jharkhand.

- ➢ Coverage of area and its production was maximum in Rajasthan (32.76% & 30.61%) followed by Maharashtra (11.95% & 10.58%)

- The highest yield was recorded by the state of Punjab (845 kg/ha) followed by Jharkhand (704 kg /ha) and Andhra Pradesh (696 kg/ha).
- The lowest yield observed in state of Karnataka (227 kg/ha.) followed by Chhattisgarh (326 kg/ha.) and Odisha (327 kg/ha.)

Mungbean Varieties And Its Suitability With Seasons:

Improved variety	Duration (Days)	Season/Sowing	Yield (Q ha^{-1}.)	Suitability
PUSA VISHAL	70 - 75	***Kharif*** : Mid-June to first week of July (mixed or intercrops). ***Rabi*** **:** Second fortnight of October to first week of November is the Optimum sowing time. (Sole crop). ***Late Rabi*** : Relay crop in *kharif* standing crop of rice in Peninsular India. Sowing time is from December to end of January or even early February. The crop comes up with the residual soil moisture. It is grown as sole crop. ***Summer :*** As a sole crop optimum sowing time is from third week of March to second week of April. As a relay crop, it is sown a week before the harvest of wheat (May) Followed by irrigation.	12- 15	NEPZ
SMRAT	60 - 65		12 - 14	NEPZ
SONA	60 - 65		09 - 10	NEPZ
SML - 668	65 - 70		15 - 18	NEPZ
HUM - 16	60 - 65		15 - 18	NEPZ
PUSA VISHAL	70 - 75		12 - 15	NWPZ
GANGA 8	72-75		12 – 14	NWPZ
SATYA	65 - 70		12 – 15	NWPZ
IPM 02-03	65 - 70		12 - 14	NWPZ

NEPZ: Bihar, Jharkhand
NWPZ: Punjab, Haryana, Western UP, Uttrakhand, Delhi & Rajasthan

Tillage Seeding and Plant Population:

There is no need for a fine seedbed. One or two ploughings followed by harrowing is adequate for a *kharif* crop. Green gram on deep soils during *rabi* is usually on *kharif* fallows that are kept weed free by repeated harrowing. There is no tillage for late *rabi* (relay crop) as the seed is broadcasted in sanding crop of rice about a week before its harvest, for a summer crop, tillage depends on the time available between the harvest of the standing crop and seeding of green gram.

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Seed Treatment: Apply fungicides @ 2 – 2.5 gm Carbendazim or Thiram for1 kg seed and after 3-4 hr intervals used Rhizobium culture @ 5 pkts./ha.

Nutrient Management:

Sowing Pattern or Seed requirements:-

a) **Small Grains** – 20-25 kg ha^{-1}
b) **Bold grains** – 30-35 kg ha^{-1}
c) **Spacing** – 30 cm x 10 cm. (Row to Row 30 cm) an (Plant to plant 10 cm.)

Fertilizer management:

Application of nutrients as per recommendation as below:

N: 20 kg $ha.^{-1}$: P_2O_5 - 45kg ha^{-1} : K_2O - 20 kg ha^{-1} : Sulphur - 20 kg ha^{-1}

Water Management:

Crop	Total No. of Irrigation	Time of application	Total irrigation requirements (cm)
Summer / Rabi(Moong)	1-2	• Pre sowing (If needed). • Flower initiation stage.	06 - 12

Weed Management:

Weeds are major problem in rainy and post rainy season greengram compared with summer irrigated crop.

- ✓ Apply as pre-emergence - Pendimethalin @ - 1 $kgha^{-1}$ in 500 - 600 lit water.
- ✓ Apply as post-emergence - Quizalofop ethyl @ 1.5 ml/lit. Water at 15 - 25 DAS .

Plant Protection Measures:

Generally attacks trips or white fly on the crops then for which plant protection measures can be taken as given below.

- ✓ Basal application: - Appliction of Thiram or Furadon granular 10 $kgha^{-1}$. or
- ✓ Apply chlorpyriphos or monocil @ 1.25 ml/lit. water at flower initiation stage.

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Harvesting and Storage:

- The crop comes to harvest in three months..
- However, early varieties will mature in 60 to 65 days.
- To prevent shattering of pods, the crop is harvested before it is dead ripe.
- The plants are uprooted or cut above the ground level with a sickle, dried on a threshing floor for about a week and threshed under the feet of cattle or beating with sticks. One or two hand pickings of pods are common.
- The produce is cleaned and sun dried to about 12 per cent moisture content.
- Method of storage and control of storage pests are similar to other pulse.
- When 75 – 80% pod are mature then crop will be harvested.

Quality Consideration :

On an average, green gram contains 24 per cent protein, 1.2 % fat and 62 % carbohydrates.

- Green gram is primarily consumed in the form of dhal.
- Green pods are also used as vegetable and haulms as green fodder.
- It is an excellent green manure crop.
- Dry seed is boiled and used in soups, made into porridge with rice and wheat.
- Sprouted seed is consumed as salad.
- The flour is used in cakes and desserts.
- Starch is used in making noodles.

Food Value:

- The green gram forms a very nutritious article of diet.
- It is consumed in the form of whole dried seeds and in the form of dal, prepared by splitting the seeds in a mill.
- The sprouted moon beans are a highly nutritious food.
- The beans are soaked overnight, drained and placed in containers in a dark room.
- They are sprinkled with water every few hours and the sprouts are ready in about three days.

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Pre disaster planning and preparedness for earthquake in India: A review

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Abstract

Earthquake is one of the most damaging natural disasters on earth. Earthquake consequences can cover hundreds of thousands of square km's; cause destroy to structures and infrastructures facilities, that may results in loss of many life and major injury to hundreds of thousands of people, and disrupt the social and economic functioning of the affected area. Although it is impossible to prevent earthquake from taking place, but it is possible that we can mitigate the effects and to reduce loss of many life, injuries and damages. The researches done by the author's involves exploration and provision of the problems created by damaging earthquakes. The research work covers the seismic menace assessment,; susceptibility and risk studies of structures and infrastructures; practical application of new inventive products for earthquake disaster solutions, such as new types of base isolators, dampers; sensors and intellectual system in monitoring and managing earthquake-resistant structures and facilities. The there are some other aspects of this disaster

- vision- Zero Tolerance to avoidable deaths due to earthquakes.
- mission- To formulate Guidelines for the preparation of plans to reduce earthquake risk, and minimize the impact, loss of lives and damage to property caused by earthquakes.

Introduction

An earthquake can be defined as the series of vibrations on the earth's surface caused by the generations of elastic (or) seismic wave due to sudden deformation or rupture within the earth during the releases of an accumulated strain energy. Indian mainland is highly defenseless, to earthquakes; (As per seismic zoning, as much as 59% of India's land region could face modest to harsh earthquakes). Given the high seismic risk and earthquake vulnerability in

India;, inclusive;, institutionalized and coordinated mechanism are required for effective disaster mgt. at the nationwide, statewide, and districtwide levels, which should include -

1. **Analyzing the risk-**:-
    - functioning the susceptibility mapping of earthquake-prone areas and creating supply of resources for effective response.
    - An recognition of the serious areas which necessitate special concentration;
    - Analyzing and documenting the lessons learnt from preceding earthquakes , and working over future stratagem in coping comparable emergencies in future ;
    - intensification of urgent situation response potential in earthquake prone areas;
    - Estimating the level of harm to living and possessions in the occurrence of an earthquake (so that appropriate disaster managing strategies can be evolve).
2. **Predicting the risk**:-

Predict the Earthquakes-The short- or mid-term forecast of earthquakes is tricky; but use of animal actions in predicting earthquakes can recommend some assist.

3. **Precautionary measures**:-

a. The **pre-disaster preparedness** based on systematic and practical principles (with special focus on building technique). This forms an imperative foundation of earthquake disaster mitigation efforts -

- Seismic security of artificial structure such that it ensures the structure do not disintegrate.
- Revision of town preparation bye-laws and acceptance of model bye-laws.
- Assessing the seismic susceptibility of the accessible buildings by carrying out structural safety audit.
- Increasing seismic intensification & setting up standards and guiding principle for existing upcoming decisive lifeline structures & also of buildings of nationwide significance
- Undertaking compulsory technical audits of structural design of foremost projects like dams, bridges etc.
- Amalgamation of earthquake anti design features in the new buildings.

- Ensuring the fulfillment of earthquake-resistant building code, city preparation laws and other safety rules.

b. Refining masses & the function of community participation

- Introducing earthquake safety instruction in schools, colleges and universities.
- Conducting mock drills for greater public awareness.
- Participation of the community at the local level in the planning, implementation and monitoring processes.
- Launching public alertness campaign on seismic safety and threat diminution.
- Technical instruction following inclusive curriculum linked to earthquake management.

c. Medical emergency & preparedness –

- The emergency medical arrangement to be straight away put to work on getting information from the earthquake unnatural areas.
- Punctual and proficient emergency medical reply with effective reach to affected ample.
- Resuscitation, triage and medical evacuation of victims who require hospitalization,
- Appropriate analysis will be provided to the sufferers suffering from pshyco-social distress.

d. Creation "**Disaster Response Force**" battalion in high seismic danger zones, guidance and equipping them.

e. A brief evaluation of the position of earthquake management efforts occasionally.

4. Response/ Emergency measures

Emergency respite measures –

- Planning and setting up emergency shelter, respite camp for people exaggerated
- Distributing relief amongst the affected community,
- Identifying misplaced people and initiation search & salvage operations for them,

- Addressing the desires like- health care, water provide and cleanliness, food etc.,
- Deployment of military for post-earthquake response employment,
- Establishing systems for proper recognition of the departed, recording the facts of victims, and their DNA fingerprinting.

5. **Rehabilitation & Recovery**:-
    - Steps to be taken to make sure adequate nutrition, therapeutic services, water & cleanliness services.
    - Providing psychosomatic care and communal support,
    - Re-housing of those render shelter-fewer after-quake,
    - Rehabilitate amputees and other disable
    - Providing them through opportunities for earning living wage & arrangement.

Challenges ahead –

- More R&D is desired on –"How to improve seismic protection?"
- insufficient numbers of skilled and capable civil engineers, structural engineers, architects and masons skillful in earthquake-resistant design and manufacture of structures.
- Revising the prospectus in professional courses, incorporate disaster management in them.
- require of generating public alertness on seismic risk decrease features in non-engineered manufacture in earthquake-prone area.

Executive Summary

The Disaster Management Act, 2005 (DM Act, 2005) lays down institutional and coordination mechanisms for valuable disaster management (DM) at the national, state, and district levels. As mandate by this Act, the Government of India (GoI) created a multi-tiered institutional system consisting of the National Disaster Management Authority (NDMA), headed by the Prime Minister, the State Disaster Management Authorities (SDMAs) by the Chief Ministers and the District Disaster Management Authorities

(DDMAs) by the District Collectors and co-chaired by elected representatives of the local authorities of the respective districts. These bodies have been set up to facilitate the prototype shift from the till now relief-centric approach to a more upbeat, holistic and included approach of intensification disaster preparedness, alleviation and emergency response.

Soon after the NDMA was set up, a series of consultation were initiated with various stakeholders to assist the expansion of guidelines for escalation earthquake management. Senior legislative body from government department and agency, academics, professionals, polygonal and compassionate agencies and commercial sector representatives participated in these meetings. These meetings recognized that several initiative taken up by government agencies in the recent past have been significant and far-reaching, but they also painted the need for a holistic and integrated strategy. On the basis of these negotiations, the NDMA has prepared these procedure for the Management of Earthquakes, (here in after referred to as the procedure), to assist the ministries and department of the GOI, state governments and other agencies to prepare DM plans.

Earthquake Risk in India

India's high earthquake danger and susceptibility is obvious from the fact that about 59% of India's land area could face modest to harsh earthquakes. through the era 1990 to 2006, more than 23,000 life were lost due to 6 main earthquakes in India, which also caused massive damage to property and civic infrastructure. The incident of several troubling earthquakes in areas hitherto calculated safe from earthquakes indicates that the build environment in the country is tremendously fragile and our capacity to get ready ourselves and efficiently respond to earthquakes is derisory. through the International Decade for Natural Disaster Reduction (IDNDR) experiential by the United Nations (UN) in the 1990s, India witness several earthquakes like the Uttarkashi earthquake of 1991, the Latur earthquake of 1993, the Jabalpur earthquake of 1997, and the Chamoli earthquake of 1999. These were follow by the Bhuj earthquake of 26 January 2001 and the Jammu & Kashmir earthquake of 8 October 2005.

Conclusion

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To figure up;, we can say that;, an growing need is being felt for orderly, holistic and integrated exertion to address the dangerous areas of concern dependable for the weak seismic safety measures ; & formulating an "**Earthquake Management Plan**" covering all aspects like earthquake attentiveness, mitigation, public alertness, capacity building, guidance, education, Research and Development (R&D), documentation, earthquake reaction, cure and recovery with a negligible loss of life and damage to belongings, assets and transportation.

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Climate Change: World and India

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Climate Change

- A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
- Climate Change is the defining issue of our time and we are at a defining moment. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale without drastic action today, adapting to these impacts in the future will be more difficult and costly.
- India's average temperature has already increased by around 0.7 degree Celsius during the 1901–2018 period due to greenhouse gas emissions and by the end of 2100 it is expected to rise by approximately 4.4 degree Celsius (relative to 1976–2005 average, in the worst-case scenario), warns the first-ever climate change.

TIMELINE OF MAJOR UN CLIMATE CONVENTION

- **1992-** The UN Framework Convention on Climate Change (UNFCCC) was adopted and opened for signatures in Rio de Janeiro, Brazil, at the UN Conference on Environment and Development, also known as the Earth Summit. 154 signatories to the UNFCCC agreed to stabilize "*greenhouse gas concentrations* in the atmosphere at a level that would prevent dangerous interference with the climate system." The United States was the fourth nation to ratify the UNFCCC, and the first industrialized nation to do so. The treaty is not legally binding because it sets no mandatory limits on GHG emissions. Instead, the treaty provides for future negotiations to set emissions limits. *The first principal revision is the Kyoto Protocol.*
- **1994-** The UNFCCC Treaty entered into force after receiving 50 ratifications.

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- **1995-** The first Conference of the Parties (COP 1) to the UNFCCC was held in Berlin, Germany. Parties agreed that mechanisms under the UNFCCC were inadequate and agreed to what would be called the Berlin Mandate, which allows parties to make specific commitments. Non-Annex 1 countries are exempted from additional obligations.
- **1996-** COP 2 was held in Geneva, Switzerland. Attendees endorsed the results of the IPCC's second assessment report. The Geneva Ministerial Declaration, which in part called on parties to accelerate negotiations on a legally binding protocol, was noted, but not adopted.
- **1997-** COP 3 was held in Kyoto, Japan. On December 11, the Kyoto Protocol was adopted by consensus with more than 150 signatories. The Protocol included legally binding emissions targets for developed country Parties for the six major GHGs, which are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The Protocol offered additional means of meeting targets by way of three market-based mechanisms: emissions trading, the Clean Development Mechanism (CDM), and Joint Implementation (JI). Under the Protocol, industrialized countries' actual emissions have to be monitored and precise records have to be kept of the trades carried out.

  The United States signed the Kyoto Protocol, but the Clinton administration never sent it to Congress for ratification. In July 1997, the Senate expressed its opposition to the terms of the Berlin Mandate by passing the "Byrd-Hagel" Resolution.
- **1998-** COP 4 was held in Buenos Aires, Argentina. Parties adopted the Buenos Aires Plan of Action, allowing a two year period to develop mechanisms for implementing the Kyoto Protocol. The COP also decided to review the financial mechanism of the Convention every four years.
- **1999-** COP 5 was held in Bonn, Germany. According to the UNFCCC, Parties continued negotiation efforts with a focus on "the adoption of the guidelines for the preparation of national communications by [developed] countries, capacity building, transfer of technology and flexible mechanisms."

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- **2000-** COP 6 part I was held in The Hague, Netherlands. Negotiations faltered, and parties agreed to meet again. COP 6 part II was held in Bonn, Germany. Consensus was reached on what was called the Bonn Agreements. All nations except the United States agreed on the mechanisms for implementation of the Kyoto Protocol. The U.S. participated in observatory status only.
- **2001-** COP 7 was held in Marrakesh, Morocco. The detailed rules for the implementation of the Kyoto Protocol were adopted and called the Marrakesh Accords. The Special Climate Change Fund (SCCF) was established to "finance projects relating to: adaptation; technology transfer and capacity building; energy transport, industry, agriculture, forestry and waste management; and economic diversification." The Least Developed Countries Fund was also "established to support a work programme to assist Least Developed Country Parties (LDCs) carry out, inter alia [among other things], the preparation and implementation of national adaptation programmes of action (NAPAs)."
- **2002—** COP 8 was held in Delhi, India. Parties adopted the Delhi Ministerial Declaration that, among other things, called for developed countries to transfer technology to developing countries.
- **2003—** COP 9 was held in Milan, Italy. New emisssions reporting guidelines based on IPCC recommendations were adopted. The Special Climate Change Fund (SCCF) and the Least Developed Countries Fund (LDCF) were further developed.
- **2005—** COP 11/CMP 1 was held in Montreal, Canada. This conference was the first to take place after the Kyoto Protocol took force. The annual meeting between the parties (COP) was supplemented by the first annual Meeting of the Parties to the Kyoto Protocol (CMP). The countries that had ratified the UNFCCC, but not accepted the Kyoto Protocol, had observer status at the latter conference. The parties addressed issues such as "capacity building, development and transfer of technologies, the adverse effects of climate change on developing and least developed countries, and several financial and budget-related issues, including guidelines to the Global Environment Facility (GEF)." (UNFCCC).
- **2009-** June, as part of the UN Framework Convention on Climate Change (UNFCCC)

- process, governments met in Bonn, Germany, to begin discussions on draft negotiations that would form the basis of an agreement at Copenhagen.December – COP 15 was held in Copenhagen, Denmark. It failed to reach agreement on binding commitments after the Kyoto Protocol commitment period ends in 2012. During the final hours of the summit, leaders from the United States, Brazil, China, Indonesia, India and South Africa agreed to what would be called the Copenhagen Accord.
- **2014-** At COP 20 in Lima in 2014, Parties adopted the 'Lima Call for Action', which elaborated key elements of the forthcoming agreement in Paris. More on the Lima Call for Action.
- **2015-** Intensive negotiations took place under the Ad Hoc Group on the Durban Platform for Enhanced Action (ADP) throughout 2012-2015 and culminated in the adoption of the Paris Agreement by the COP on 12 December 2015. More on the Paris Agreement.
- **2019-**The 2019 United Nations Climate Change Conference, also known as COP25, is the 25th United Nations Climate Change conference. It was held in Madrid, Spain, from 2 to 13 December 2019 under the presidency of the Chilean government.

Effects of climate change:

The UN Intergovernmental Panel on Climate Change (IPCC)

- The Intergovernmental Panel on Climate Change (IPCC) was set up by the World Meteorological Organization (WMO) and United Nations Environment to provide an objective source of scientific information. In 2013 the IPCC provided more clarity about the role of human activities in climate change when it released its Fifth Assessment Report.

Fifth Assessment Report

- The report provides a comprehensive assessment of sea level rise, and its causes, over the past few decades. It also estimates cumulative CO_2 emissions since pre-industrial times and provides a CO_2 budget for future emissions to limit warming to less than 2°C. About half of this maximum amount was already emitted by 2011. The report found that:
- From 1880 to 2012, the average global temperature increased by 0.85°C.

- Oceans have warmed, the amounts of snow and ice have diminished and the sea level has risen. From 1901 to 2010, the global average sea level rose by 19 cm as oceans expanded due to warming and ice melted. The sea ice extent in the Arctic has shrunk in every successive decade since 1979, with 1.07 × 106 km² of ice loss per decade. Given current concentrations and ongoing emissions of greenhouse gases, it is likely that by the end of this century global mean temperature will continue to rise above the pre-industrial level. The world's oceans will warm and ice melt will continue. Average sea level rise is predicted to be 24–30 cm by 2065 and 40–63 cm by 2100 relative to the reference period of 1986–2005. Most aspects of climate change will persist for many centuries, even if emissions are stopped.
- There is alarming evidence that important tipping points, Ecosystems as diverse as the Amazon rainforest and the Arctic tundra, may be approaching thresholds of dramatic change through warming and drying. Mountain glaciers are in alarming retreat and the downstream effects of reduced water supply in the driest months will have repercussions that transcend generations.

Global Warming of 1.5°C

- In October 2018 the IPCC issued a special report on the impacts of global warming of 1.5°C, finding that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society.
- The report also highlights a number of climate change impacts that could be avoided by limiting global warming to 1.5ºC compared to 2ºC, or more. For instance, by 2100, global sea level rise would be 10 cm lower with global warming of 1.5°C compared with 2°C. The likelihood of an Arctic Ocean free of sea ice in summer would be once per century with global warming of 1.5°C, compared with at least once per decade with 2°C. Coral reefs would decline by 70-90 percent with global warming of 1.5°C, whereas virtually all (> 99 percent) would be lost with 2ºC.
- The report finds that limiting global warming to 1.5°C would require "rapid and far-reaching" transitions in land, energy, industry, buildings, transport, and cities. Global net human-caused emissions of carbon dioxide (CO_2) would need to fall by about 45 percent from 2010 levels by 2030, reaching 'net zero' around 2050. This means that
- any remaining emissions would need to be balanced by removing CO_2 from the air.

Melting of glaciers:

Wild fires:

Disasters in recent times

- March 2019, Cyclone Idai took the lives of more than 1000 people across Zimbabwe, Malawi and Mozambique in Southern Africa and it devastated millions more who were left destitute without food or basic services. Lethal landslides took homes and destroyed land, crops and infrastructure. Cyclone Kenneth arrived just six weeks later, sweeping through northern Mozambique, hitting areas where no tropical cyclone has been observed since the satellite era.
- The start of 2020 found Australia in the midst of its worst-ever bushfire season following on from its hottest year on record which had left soil and fuels exceptionally dry. The fires have burned through more than 10 million hectares, killed

at least 28 people, razed entire communities to the ground, taken the homes of thousands of families, and left millions of people affected by a hazardous smoke haze. More than a billion native animals have been killed, and some species and ecosystems may never recover

- More than 44 percent of India's area was under drought conditions according to IMD (Indian meteorological department 23 percent below the normal rainfall during the time of year.
- Higher sea temperatures, linked to climate change, have doubled the likelihood of drought in the Horn of Africa region. Severe droughts in 2011, 2017 and 2019 have repeatedly wiped out crops and livestock. Droughts have left 15 million people in Ethiopia, Kenya and Somalia in need of aid, yet the aid effort is only 35 percent funded. People have been left without the means to put food on their table, and have been forced from their homes. Millions of people are facing acute food and water shortages.
- The last year deadly floods and landslides have forced 12 million people from their homes in India, Nepal and Bangladesh. Just 2 years ago exceptionally heavy monsoon rains and intense flooding destroyed, killed, and devastated lives in the same countries. In some places the flooding was the worst for nearly 30 years, a third of Bangladesh was underwater. While some flooding is expected during monsoon season, scientists say the region's monsoon rains are being intensified by rising sea surface temperatures in South Asia
- An El Niño period, supercharged by the climate crisis, has taken Central America's Dry Corridor into its 6th year of drought. Guatemala, Honduras, El Salvador and Nicaragua are seeing their typical three-month dry seasons extended to six months or more. Most crops have failed, leaving 3.5 million people, many of whom rely on farming for both food and livelihood, in need of humanitarian assistance, and 2.5 million people food insecure.

INDIA's progress in combating climate change

- In recognition of the growing problem of Climate Change, India declared a voluntary goal of reducing the emissions intensity of its GDP by 20–25%, over 2005 levels, by

2020, despite having no binding mitigation obligations as per the Convention. A slew of policy measures were launched to achieve this goal.

- As a result, the emission intensity of our GDP has decreased by 12% between 2005 and 2010. It is a matter of satisfaction that United Nations Environment Programme (UNEP) in its Emission Gap Report 2014 has recognized India as one of the countries on course to achieving its voluntary goal.
- India has a definite plan of action for clean energy, energy efficiency in various sectors of industries, steps to achieve lower emission intensity in the automobile and transport sector, a major thrust to non-fossil based electricity generation and a building sector based on energy conservation. India's on-going mitigation and adaptation strategies and actions are detailed in the following sections, along with the expected direction of activities in the near future.

Calamity or grave occurrence in any area, arising from natural or manmade causes, or by accident or negligence which results in loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the recovering capacity of the community of the area affected".

In simple words it is an event or a series of events, which give rise to life threatening circumstances and acute damage or loss of property, environment and most importantly means of livelihood on a scale which is beyond comprehension and far beyond the recovering capacity of the community affected. These unfortunate events disturb the balance and progress of infrastructure development activities pushing nations back by several years in terms of GDP. Therefore, efficient disaster management has received great attention.

Disaster Management can be described briefly by the integration the following:

- Planning and implementation of disaster specific measures which are mandatory
- Mitigation of consequences
- Capacity building
- Pre-planned and prepared response
- Assessment of the severity
- Evacuation, Rescue and Relief
- Rehabilitation and Reconstruction

Largely due to its geo-climatic conditions combined with high population density and other socio economic factors, India is one of the most disaster prone countries in the world. The risk of damage of lives and property during and even after the occurrence of such an event is high due to the population spread and tendency of people to rehabilitate the areas prone to natural disasters such as earthquakes, Bhuj in Gujarat being a perfect example of such an occurrence.

Increased vulnerability to the effects of disaster can be related to country specific problems such as population expansion, urbanization and industrialization, infrastructure development within high-risk zones and global problems such as environmental degradation and climatic changes. The current scenario of preparedness of our country in case of an earthquake has been discussed very categorically further.

Literature Review

Ministry of Earth Sciences (MoES) (India Meteorological Department (IMD)) is the nodal Ministry for the management and mitigation of earthquakes in the country. In terms of National Disaster Management Guidelines on Management of Earthquakes issued in April 2007, MoES was to prepare the Earthquake Management Plan covering all aspects including earthquake preparedness, mitigation, public awareness, capacity building, training, education, research and development, documentation, earthquake response, rehabilitation and recovery. MoES did not prepare any disaster management plan for earthquakes. However, in reply to a query of the Committee regarding status of disaster management and mitigation plan for earthquake, the MHA informed as under:

"ESSO-IMD is only responsible for monitoring seismic activity in and around the country and disseminates the information to all the user agencies including the concerned State and Central Government agencies responsible for carrying out emergency response, relief and rehabilitation measures. It is to mention that the institutions of MoES/ESSO only deal with monitoring, detection and warning of cyclones and tsunamis and only carry out aspects of monitoring and detection in respect of earthquakes and hence have no experience of developing and monitoring the associated components of disaster management cycle viz., preparedness, mitigation, risk reduction, response and relief, etc., that are all along being dealt with by different Central and State Government authorities. Moreover, the implementation of disaster mitigation plans also has a significant component of techno-legal, and regulatory components that are operated by various competent authorities at different

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levels of governance in the country".

A project on "Optimum Seismological Network Program" was sanctioned in May 2009 by the IMD at an estimated cost of ₹ 48 crore, which was reduced to ₹ 25.17 crore. The project implementation was proposed to be carried out in two phases spread over a period of three years from 2009-10 to 2011-12. The objective of the project was to strengthen and modernize the National Seismological Network for improving the detection and location capability for earthquakes of magnitude greater than or equal to 3.0, occurring anywhere in the mainland of the country. The project was found by audit as still in the preliminary stages of implementation even after expiry of three years. The MHA in their submission about the status of OSNP stated as under:

"Earlier plan of "Optimum Seismological Network Program" was reviewed in the light of recent networks established in the country by various R & D groups. Under this approach, already 65-stations (40-seismic stations and 25-GPS stations) are operational and very soon the network would have 90-stations (50-seismic stations and 40-GPS stations) by which already medium and low seismic intensity is successfully getting monitored and analysed in real-time. Accordingly a new scheme was taken up for deploying a total of 78 additional state-of art broadband systems to the national seismological network in October, 2012. Global tenders have been floated and technical evaluation of bids received has been completed. Further action is in process for placement of order is under progress".

MOES/IMD had set up the Earthquake Risk Evaluation Centre at Delhi, in February 2004. During 2007-12, IMD proposed to carry out three projects:

(a) Seismic micro-zonation of Mumbai, Guwahati, Ahmedabad and Dehradun on 1:10000 scale;

(b) Creation of national database for seismic hazard and regional risk appraisal; and

(c) Impact assessment of utilization of database in planning and mitigation

An allocation of ₹ 298.38 crores was made for these projects. MoES stated (September 2012) that the micro-zonation of Guwahati, Bangalore, Ahmedabad, Dehradun and Delhi was completed. IMD initiated a project titled "Archival digitization of seismic analogue chart" in May 2008 at an estimated cost of ₹ 13.50 crores for two years. The duration of the project was extended from time to time and finally till June 2012. In their submission, the MHA furnished as under:

"Seismic data base comprises scanning and digitization of analog seismic charts for the period 1927-1996, on-line archival of digital wave form seismic data since 1996 in real time. The scanning of about 89,000 analog charts and out of which digitization of about 5000 earthquake events are taken up since 2008. As things stand today, the scanning of all the charts is completed and digitization of events is in its final stage. Archival-digitization of seismic analogue charts is pursued till December 2013 to complete the activity. The National NDMA had undertaken the task of preparing the upgraded hazard maps and atlas of Indian land Mass. In this connection the MHA informed that as per the recommendations of the Working Committee of Experts (Geophysical-Hazards), NDMA has undertaken a project through Building Materials Technology Promotion Council (BMTPC) for upgradation of Earthquake Hazards Maps for the country at a cost of ₹ 76.83 lakh. Project which started in June, 2011 is yet to be completed. It is getting delayed due to non-availability of district boundaries data from the Census of India.

NDMA has also taken up National Earthquake Risk Mitigation project. This Project was still in preparatory phase after a lapse of five years. The Ministry while furnishing the status of project stated as under:

"The Centrally Sponsored Scheme for National Earthquake Risk Mitigation (Preparatory Phase) has been approved in April, 2013 at an outlay of ₹ 24.87 crore, to be implemented within a period of two years viz. 2013-2015. The aim of the project is to demonstrate the effectiveness of strategies proposed for implementation of activities under four components namely, **(i) Techno-legal Regime, (ii) Institutional Strengthening, (iii) Capacity Building and (iv) Public Awareness**. The scheme will be implemented in 21 States/UTs that lie in seismic Zones V & IV in the country.

Present Status

1. NDMA has initiated preliminary steps for implementing the scheme
2. A Project Steering Committee has been constituted under chairmanship of Member(Earthquake), NDMA and Secretary, NDMA, JS(DM), Financial Advisor, Town & Country Planner, Technical experts, representatives from BMTPC, CPWD, NIDM etc. as members."

The Committee has noted that considering the vulnerability of the country's landmass to the risks of earthquake, various efforts are underway to prepare for such eventualities. It includes archival-digitisation of seismic /analogue charts since 1996, preparation of hazards map and atlas of India etc. Also following the Optimum Seismological Network Programme sanctioned in 2009 by the IMD, 65 stations are now operational and the capacity is being further enhanced. However the Project for up gradation of Earthquake Hazards Maps for the Country costing ₹ 76.83 lakh, which started in June 2011, is yet to be completed due to non-availability of district boundaries data from the Census of India. Another project 'National Earthquake Risk Mitigation', approved in April, 2013 is under implementation during 2013-15 [8]. Considering the increased seismic activity in the Himalayan region, which has been witnessed recently, the Committee emphasise upon an early completion of the earthquake preparedness activities at all levels. They desire that the MHA must take up the matter urgently with the Census Commissioner for supply of requisite boundaries data so that the hazard atlas/map could be completed early. The Committee hope that the preparatory phase of the Earthquake Mitigation project would be completed this year as stipulated and final phase would start on time. Meanwhile the MHA must strive to create maximum public awareness on earthquakes in the Country as an essential part of disaster preparedness.

Conclusion

India, one of the fastest growing GDPs of the world estimates unprecedented growth over the next decade, a situation both exciting and challenging. The growth prospects for all those in the construction industry are huge, yet with the possibility of repeating many of the potentially fatal mistakes discussed above. The most important among the unfinished agenda to improve this construction process are:

(a) Competence-based licensing for engineers in general and structural engineers in particular

(b) Enforcement of building codes by the municipal authorities, and

(c) Development and propagation of building typologies that are inherently earthquake-resistant.

The emphasis, with particular urgency, should be on new construction of all kinds, from the millions of housing for the masses that the central government has identified as a priority, to the expensive apartment buildings for the affluent. Clearly, India has come a long way on the road to earthquake safety and yet, much remains to be done before this journey is completed. Creating a system and culture for building safe houses in 21st century India is something not only possible but an absolute necessity. This is the least that the general masses of our country expect from technically qualified engineers and management professionals and others associated with the construction industry. Provisions for such safe housing are both our challenge and obligation.

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Foliar Fertilization: An Approach To Enhance Nutrient Use Efficiency and Crop Production

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Foliar fertilization is a technique of feeding plants by applying liquid fertilizer directly to their leaves. Foliar feeding has been used as a means of giving supplemental doses of major and minor nutrients, plant hormones, stimulants and other beneficial substances. Observed effects of foliar fertilization included yield increases, resistance to diseases and insect/pests, improved drought tolerance and enhanced crop quality. Plant response is dependent on species, fertilizer form, concentration and frequency of application as well as the stage of plant growth. Foliar applications are often time to coincide with specific vegetative or fruiting stages of growth. The soil application of any fertilizer including organic and commercial forms for higher crop production may be relatively inefficient due to biological, chemical and physical properties of the soil that can decrease nutrient availability. Increasing cost of commercial fertilizers (nitrogen, phosphorus, and potassium) also make their non-traditional fertilizer applications, specifically foliar fertilization is more attractive, but foliar fertilization take care of all the plant's nutrient needs. Foliar fertilization is generally used for better management of nutritional status, growth, to correct deficiencies quickly, and improve disease resistance for better crop quality.

Soil application is most common method to supply essential nutrients to plants. In this case applied nutrients are absorbed by plant roots. However, higher plants can also absorb mineral nutrients when applied as foliar sprays in appropriate concentrations. However, in modern high yielding cultivars, nutritional requirements (macronutrients) are rarely met with foliar applications. Furthermore, foliar application of macronutrients requires several sprays, can also be washed off by rain, plant should have sufficient leaf area for absorption and leaf

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damage by high nutrient concentrations is a serious practical problem. Despite these drawbacks, under certain circumstances foliar application is most effective methods to correct nutritional disorder. For example, iron deficiency in calcareous soils can be corrected by foliar application of ferrous sulphate or iron chelates solution more efficiently than the soil application of iron sources. Other advocated foliar fertilization as a visible economic way to supplement the plants' nutrients for more efficient fertilization. Furthermore, interest in foliar sprays increased because the development of high concentration soluble fertilizers and the increasing use of machinery for spraying fungicides, herbicides, and insecticides and overhead irrigation further facilitate the application of nutrients to crops in the form of sprays. Advances in agriculture include reducing the cost of crop production, maintaining soil quality, and potential increasing of agro-ecosystems, human, and animal health. Use of nutrients in adequate amounts and its methods of application associated with these objectives. The objective of this review is to discuss latest advances in foliar fertilization and reveal gaps in the existing knowledge and to reflect on both.

Objectives of foliar fertilization:

- To stimulate the production process of high yielding crops by application at deficit peak / critical requirements.
- To promote crop growth under adverse conditions (Stress).
- To improve nutrient use efficiency.
- To reduce chemical load.

Factors influencing foliar fertilization:-

Air temperature:

In higher temperature it causes evaporation of nutrition and decreases the effect of spray solution.

Relative humidity:

High relative humidity increases nutrient absorption and also maintains turgidity of cell, uptake is lower at the time of low relative humidity.

Post-application irrigation:

Irrigation after foliar spray is neglected due to solution may down word movement to the soil.

Time of day for application:

Foliar spraying should be done at early in the morning and in the late evening it is most profitable.

Rainfall:

- Foliar spraying should not be done immediate after and before rainfall.

Advantages of Foliar Fertilization:-

Higher Yields: Foliar fertilizer gives extra boost for growing to their truly potential.

Healthier Plants: Foliar fertilizer provides extra nutrients that plant may need to boost its immunity against pest and disease incidence.

Immediate Results: The stomata of a leaf have the ability to soak up the nutrients quickly.

Less expensive: One of the most significant benefits of using a foliar fertilizer is that it is cheap as compared to many other means of boosting crop plant growth.

Ideal Period for Foliar Spray

The cuticle is more permeable when swollen. Foliar Fertilization should be carried out at times when the relative humidity of the air is high i.e. in the early hours of the morning and in the evening, not during the hot hours of the day. Another advantage is the spray deposit evaporates more slowly and so there is less danger to the leaves being burned by bright sunlight. The high humidity in the evenings and during the night causes the nutrients from dried spray deposits to be dissolved so that they can enter in the leaves.

Components of Foliar Fertilization

1. Liquid fertilizer:-

Materials added to the soil or applied directly to crop foliage to supply elements needed for plant nutrition. These materials may be in the form of liquid, aqueous solutions. Liquid fertilizers provide plants with concentrations of easily-absorbed, soluble nutrients, thereby enhancing their health and productivity.

2. Water soluble fertilizer:-

A powdered and granule synthetic fertilizers that is mixed with water and poured on the soil or sprayed on the foliage of plants. Water Soluble Fertilizers are Urea, Urea phosphate, Magnesium Sulphate, Potassium Sulphate, Ammonium Sulphate, NPK 18-18-18, NPK 15 -30- 15.

3. Sticker:-

Sticker is the agent which improves the adhesion of spray droplet on target plant. A fertilizer is fairly water soluble, it may be washed off the leaf during heavy rainfalls that follow deposition.

4. Neutralizing agent:-

It is a foam concentrate formulation that can be mixed with either acid or alkaline water-based solution and discharged through an air-aspirated foam discharge device to produce an expanded foam. The foam produced is extremely stable, meaning that it will slowly release its solution from the bubble walls and neutralize the spill.

Keys to success

- Understanding the interaction between the leaf surface and the foliar material.
- Uptake and mobility.
- Spray coverage, droplet size, etc.
- Understanding product quality–avoid Chloride and Nitrate based products especially.

Foliar application may be preferred under the following conditions

- When visual symptoms of nutrient deficiencies observed during early stages of deficiency.
- When unfavorable soil physical and chemical conditions which reduce fertilizer use efficiency (FUE).
- Small quantity of micronutrient is needed to apply and it cannot be applied effectively through root or soil.
- During drought period where in the soil application could not be done due to lack of soil moisture.
- Foliar application is effective for the application of minor nutrients like iron, copper, boron, zinc and manganese.

Conclusion

Foliar feeding is a very effective short term solution for certain nutrient deficiencies and perhaps during the time of stress. However, the greater degree of the deficiency of nutrient is less likely to be corrected completely with foliar fertilization. Foliar fertilizer applications increases plant growth, fruit set and yield in case of limited availability of nutrients essential for flowering and fruit set due to reduced transpiration and/or nutrient acquisition by the roots. If a visual micronutrient deficiency is observed, micronutrient fertilizers should be applied as foliar spray as soon as possible.

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Marker Assisted Selection and it's Schemes in Plant Breeding

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Introduction :

Marker assisted selection (MAS) is a process in which a marker (morphological, biochemical or DNA/RNA variation based) is used for indirect selection of a trait of interest. It is indirect selection process where a trait of interest is selected based on a marker linked to it. For instance, if MAS is being used to select individuals with a disease, the level of disease is not quantified but a marker allele which is linked with disease is used to define the presence of disease. The assumption is that linked allele associates with the gene or quantitative trait locus (QTL) of interest. MAS is suitable for the characters which are difficult to measure, have low heritability and are expressed late in the development. At first, Sax (1923) showed the association of a simply inherited genetic marker with quantitative character in plants while he had detected segregation of seed size associated with a seed coat colour marker in beans (*Phaseolus vulgaris* L.). Rasmusson (1935) demonstrated linkage of flowering time (a quantitative trait) in peas with a simply inherited gene for flower colour.

The Gene vs marker

The gene of interest is straight related with protein production. This protein produces certain phenotypes. In contrary markers should not effect the character in study but it is genetically linked. In many characters, genes are discovered. They can directly be examined for their presence with a great level of confidence. Nevertheless, if a gene is not isolated, then we have to take marker's help to tag a gene of interest. In this case, there may be some false positive results because of recombination between marker of interest and gene or QTL. A perfect marker would cause no false positive results.

Steps involved in Marker Assisted Selection

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Generally the first step is to map the gene or QTL of interest first by using different techniques and then use this information for marker assisted selection. Usually, the markers to be used should be close to gene of interest and there distance should be less than 5 recombination unit or centi Morgon (cM). This is because one have to ensure that only negligible fraction of the selected individuals will be recombinants. Normally, two markers are used so as to reduce the probabilities of an error as a result of homologous recombination. For instance, if two flanking markers are used at the same time with an interval of 20cM, so there is higher probability (99%) for recovery of the target gene.

Single Step Marker Assisted Selection and QTL mapping

Contrary to two-step QTL mapping and MAS, a single-step method for breeding characteristic plant populations has been advanced. In this approach, first few breeding cycles includes, identification of markers linked to the trait of interest by QTL mapping and then the same data is used in the same population. Again in this method, pedigree structures are derived from families. These families are created by crossing number of parents (in three-way or four way crosses). Phenotyping and genotyping is done using molecular markers and mapped the possible location of QTL of interest. This will categorize markers and their favourable alleles. Once these promising marker alleles are detected, the frequency of such alleles will be increased and response to marker assisted selection is calculated. Marker allele(s) with needed effect will be supplementary used in next selection cycle or other experiments.

Use of MAS for backcross breeding:

A minimum of five to six-backcross are needed to transfer a gene of interest from the donor to a recurrent-adapted cultivar. The recovery of the recipient genotype can be speeded with the use of molecular markers. If the F_1 is heterozygous for marker locus, plants with recurrent parent allele(s) at the marker locus in first or succeeding backcross will also carry a chromosome tagged by the marker.

Advantages of marker-assisted selection:

Marker-assisted selection may significantly be enhances the productivity and efficiency for breeding as compared to conventional breeding. The important advantages of MAS compared to conventional phenotypic selection are enlisted here as,

1. Very simple as compared to phenotypic screening
2. Selection may be carried out at seedling stage
3. Single plants may be selected with high reliability.

These advantages may changes into (1) more efficiency or (2) enhanced line development in breeding programs. For example, time and labour savings may arise from the substitution of difficult or time-consuming field trials with DNA marker tests. Additionally, selection depends on DNA markers may be more consistent due to the effect of environmental factors on field trials. Additional benefit from MAS is that the, total number of lines that need to be tested may be reduced. As many lines can be discarded after MAS at early stage, this allows a more effective breeding design. The greater efficiency of target character selection which may allow certain traits to be 'fast-tracked', since some genotypes can be easily identified and selected. Furthermore, 'background' markers may also be used to hasten the recovery of recurrent parents during marker-assisted backcrossing.

Schemes of Marker Assisted Selection in plant breeding :

1. **Marker assisted backcrossing :**

   In total, there are three levels of selection in which markers may be useful in backcross breeding. In the first level, markers are used to screen for the trait of interest, which may be useful for those traits which are laborious in phenotypic screening procedures or those have recessive alleles. The second level of selection includes selection of backcross progeny with the gene of interest and tightly-linked flanking markers so as to minimize linkage drag i.e. recombinant selection. The third level of MAB involves selecting backcross progeny with 'background' markers. In other words, markers can be used to choose against the donor genome, which may speed up the genome recovery of recurrent parent. By using conventional backcrossing, it would takes minimum of five to six generations to recover the recurrent parent. As a minimum two but perhaps three or even four backcross generations can be set aside by using markers.

2. **Marker assisted pyramiding** :

"Pyramiding is the process of simultaneously combining multiple genes or QTLs together into a single genotype". This is possible through conventional breeding but very much difficult at early generations. By using conventional phenotypic selection, specific plants must be phenotypically screened for all the characters tested. Hence, it may be very problematic to evaluate plants from certain population types (e.g. F_2). As DNA marker assays are non-destructive, DNA markers may ease selection and markers for multiple specific genes or QTLs can be tested using a single DNA sample without phenotyping. The most extensive use of pyramiding has been for merging several disease resistance genes in order to develop long-lasting or durable disease resistance.

3. **Early generation marker assisted selection :** One of the most spontaneous stage to use markers to select plants is at an initial generation. The key advantage is that many plants with undesirable gene combinations, particularly those that lack vital disease resistance traits and plant height, can be simply rejected. This has important significances in the advanced stages of the breeding program because the evaluation for other characters can be more efficiently and inexpensively planned for less breeding lines.

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Organic farming

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Organic farming is a technique which involves the cultivation of plants in natural ways. This process involves the use of biological materials, avoiding synthetic substances to maintain soil fertility and ecological balance and thereby minimizing the pollution and wastage.

It is an integrated farming system that strives for sustainability, the enhancement of soil fertility and biological diversity while, with rare exceptions, prohibiting synthetic pesticides, antibiotics, synthetic fertilizers, genetically modified organisms, and growth hormones.**Components of organic farming**

- ✓ Fertilizers management
- ✓ Weed control
- ✓ Insect pest and disease management

Fertilizer Management

World population is increasing day by day so food and fibre need also increases with population and will increase in passage of time.To fulfil the requirements of population should need high yield that is possible by increasing cultivated area or yield.To get higher yield fertilizers are applied to provide nutrients to the crop plants.But by the use of fertilizers land, water and air is polluted that cause serious disease in human beings and animals.So,I order to avoid these problems organic farming plays important role in organic farming. We can use only natural ways to increase yield or to fulfil the demand of population.

MANURES

Manures are simply defined as the organic materials that are derived from animals,humans and plant residues which contain different nutrients in complex organic forms.Manures can be grouped in two major categories as –

- ✓ Bulky organic manure
- ✓ Concentrated organic manure

Bulky organic manures

Bulky organic manure contains small percentage of nutrients and they are applied in larger quantities.

Some of the well-known bulky organic manures are-

- Farm yard manure
- Sheep and goat manure
- poultry manure
- Green manure
- Crop residues

Farm yard manure

- FYM refers to the decomposed mixture of dung and urine of farm animals.
- The quantity of nutrients in manures varies with type of animal,feed composition,quality and quantity of bedding material,length of storage and storage conditions.
- The farm yard manure contains 150 kg of N,35 kg of P,and 140 kg of K.

Sheep and Goat manure

Droppings of sheep and goat contains higher nutrients than farm yard manure and compost.

An average the manure contains 3% of N,1% P,2% k.

Poultry manure

- It ferments very quicky,50% of its N is lost in 30 days
- It contains 3.03% N, 2.63% P,1.4% K.

Green manures

Many crops are grown and at vegetative stage mix up in the soil just to improve the organic matter of the soil.At vegetative stage these crops are easily decomposed in soil and worked like inorganic fertilizers due to having low C:N ratio.

Crop Residues

Crop residues can be an important source of nutrients to subsequent crops.It is well documented that different quantities of N,P,K and minor nutrients are removed from and returned to the soil depending on the crop species concerned.

The quantity and quality of crop residues will clearly influence the build up of soil organic matter.

Concentrated organic manure

They have higher nutrient content than bulky organic manures.They have

- Oil cakes
- Bio-fertilizers
- Compost

Oil Cakes

After oil is extracted from oilseeds the remaining solid portion is dried as oil cake which is used as manure.

Compost

Mass of rotten organic matter made from waste is called compost.

- Farm compost
- Town compost

Bio fertilizers

It is defined as preparations containing living cells of efficient strains of microorganisms that helps crop plants uptake of nutrients by their interaction with rhizosphere when applied through seed and soil.Most common bio fertilizers are-

- Nitrogen fixing
- Phosphorous solubilizing
- Phosphorous mobilizing
- Plant growth promoter

Weed management

Weed can decrease the yield of crop upto 60% so weeds are killed by herbicides that cause pollution and resistance in crop plantin organic farming system weeds are killed by –

- Allopathy
- Rotation
- Organic mulch
- Integrated weed control

Allopathy

Crops having allelochemicals can be used as growth promoter and also for weed control through

- Use of mulch of these crops
- Use these crops in rotation
- Use these crops in intercropping
- Use crop's extract as foliar spray

Crop rotation

Use of legumes crops that provide nutrients by biological nitrogen fixation.Use of allopathic crops that suppress the growth of weeds. Continues monoculture is unacceptable due to the likely increased pressure from weeds,pests and diseases as well as difficulties of maintaining soil fertility.

Organic mulch

Organic residues, grassdipping, leaves, hay, straw, animal manure etc.organic mulches are temporary decay overtime.

They add organic matter in the soil. Increase water retention capacity

Provides nutrients

Supress weeds.

Integrated weed control

1. **Indirect methods-** Indirect methods include
   - Preventive methods
   - Cultural methods
   - manual methods
2. **Direct methods-** Direct methods include- mechanical methods and biological control

Insect,Pest and Disease Management

It includes -

- Agronomic practices
- Mechanical control
- Biological control
- Genetic control

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- Natural plant products(allelochemicals)

Benefits of organic farming

- It promotes biodiversity.
- It reduces farm pollution.
- Reduces toxic substances in the environment.
- safer water
- Better tasting food
- Better soil
- Preservation of culture and agriculture
- Reduce production cost because farmers do not use expensive chemicals.

Ill sides of organic farming

- Expensive products
- More labour
- Lack of awareness
- Financial problem
- No smooth marketing channels.
- Poor infrastructure and cold units.
- lack of marketing knowledge

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Bacterial Endophytes: The Invisible army of Plant System

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ARTICLE ID: 080

Introduction

Endophytes, usually the bacteria or fungus that resides within the plant system and forms a microenvironment, supporting their growth and development. They exhibit a symbiotic relationship with the host plant. These endophytes get the nutrient-enriched intracellular environment as their site of multiplication and directly benefit plants by stimulating their growth and/ or indirectly protecting against the diseases. Recent studies suggest their role in aiding tolerance to plants against abiotic as well as biotic stresses. Therefore, an increasing effort is being made to utilize endophytes as biological control agents (BCAs) for crop improvement.

Role of Endophytes in plant development

The emergence of the concept "Plant Microbiome", has changed the scenario and thus the coevolution of symbiont and their host plant has tracked the benefits out of their existence. Endophytes may directly or indirectly enhance the plant's growth, development, yield as well as tolerance against diseases and abiotic or biotic stresses.

Direct Mechanism

Direct mechanism involves the production of certain phytohormones, solubilizing inorganic phosphate or biologically fixing nitrogen, etc., that directly ascertains plant's development.

Phytohormone Production

Phytohormones are the key compounds in the growth and development of plants. Numerous bacteria and fungi are there that produces plant growth regulators (PGRs) *viz.*, auxin, gibberellin, cytokinin, abscisic acid (ABA), and ethylene. Of these PGRs auxin indole acetic acid (IAA) are the most common ones to be produced by endophytes. Auxin is known for the apical dominance, cell elongation, root initiation, and phototropism in plants. Root initiation and abundance of root hairs help the plants to absorb more of the water and nutrients from soil. Also, the roots provide more sites for infection and nodulation in the case of legume plants.

Biological Nitrogen Fixation

A unique feature exhibited by endophytes is that some bacterial genera are capable of fixing biological nitrogen in a similar way as of rhizospheric bacteria. The development of endophytic bacteria provides a means to improve crop yield and can substitute the chemical requirement of nitrogen. These microbes are termed as diazotrophs and are majorly found in rice, sweet potato, maize, sugarcane, etc.

Phosphate Solubilization

Phosphate are classified as macronutrients and are vital for plant growth. Inorganic phosphate is not directly absorbed by the plants and is required to be solubilized. Endophytic bacteria releasing organic acids into the soil solubilizes the phosphate, converting them into ortho-phosphate that is readily available for absorption. These live microbial biofertilizers can prove a promising substitute for today's chemical fertilizers.

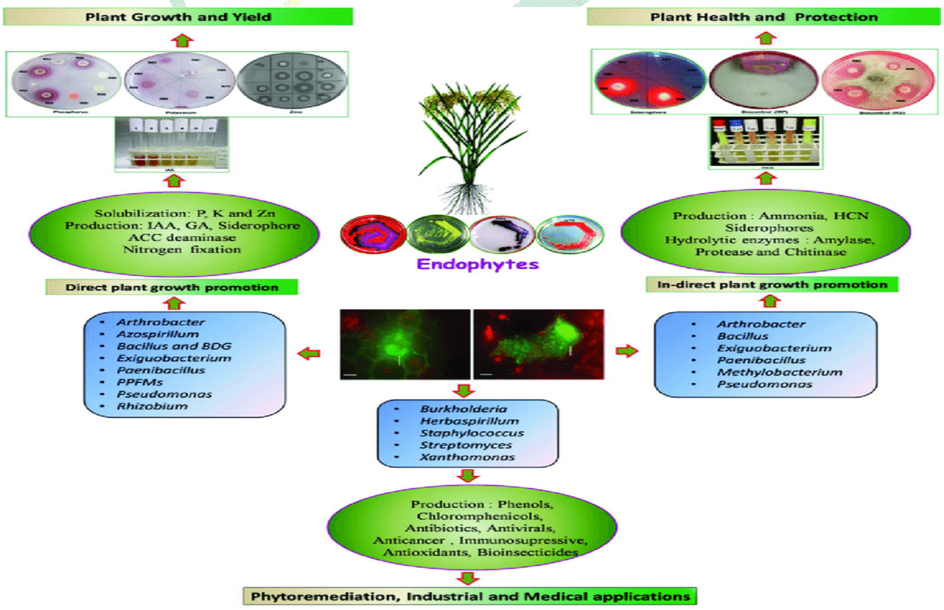

Fig. 1: Schematic diagram of plant endophytic interaction and their application

Indirect Mechanism

Indirect mechanisms supporting the plant's growth include the protection against the diseases, tolerance towards the abiotic and biotic stresses, production of secondary metabolites, etc.

Tolerance against abiotic stresses

Abiotic stresses continue to be a major threat to crop production. Depending upon the environmental impact these include heat stress, salinity stress, drought stress, cold stress, etc. Endophytes have paved a way as an alternative strategy for the plant's survival during the stresses. Studies suggest, these endophytes colonize in the plant's root and shows effective tolerance against abiotic stresses by modifying the metabolic pathways. They produce enzymes like, peroxidases, heat shock proteins, phosphotransferases, etc., that directly or indirectly helps in the signaling pathways to combat these stresses.

Secondary Metabolite Production

Secondary metabolites are the compound produced by plants that protect them against diseases, stresses, or grazers, etc., Several endophytes also produce these secondary metabolites that aids in plant defense. Reactive oxygen species (ROS) are produced as a signal during environmental stress and interact with metabolites resulting in necrosis and cellular anomalies. These endophytes produce antioxidants in response to these ROS to maintain cellular integrity. Additionally, it has been found that maytansinoid d, an anti-tumor compound that earlier was thought to be obtained from plants is actually of microbial origin.

Conclusion

Endophytes dwelling within the host plants can actually occupy a prominent space in agriculture as well as the medicinal area in coming future. Being able to biologically fix the atmospheric nitrogen and solubilize inorganic phosphate, these microbial biofertilizers can substitute the chemical fertilizers. More research is yet to be done at the genomic aspect so that it can be helpful in crop improvement.

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Shark Fin Food Culture: Adapting to a New World

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Archaeological reveal with carbon dating back about 400 million years, the oldest vertebrate predators live in our oceans before the time dinosaur and as an apex predators help to play a major role in maintaining a balanced population of marine ecosystem. With vast sizes ranging from 6 inch – 39 feet, there are over 500 species of sharks around the world. This heritage creature need a quick attention before it considered to be extinct in upcoming years.

Introduction:

Sharks are including in the class of chondricthyes with some traits like K selection life history make them more threatened with greater mass extinction. More than one fourth part of all shark variety face risk of extinction due to human activities like targeted species overexploitation, bycatch, climate change and habitat loss. Most common species faces the risk of extinction that end up in the shark fin business are *Carcharhinus falciformis*, *Carcharhinus limbatus*, *Lamna nasus*, *Carcharhinus longimanus*, *Carcharhinus brevipinna*, *Galeocerdo cuvier*, *Prionace glauca*, *Carcharhinus leucas*,*Carcharhinus plumbeus*, *Carcharodon carcharias*, *Isurus oxyrinchus*. More than 30 percent of the 1,200 shark species worldwide are currently threatened with extinction and 99 species are classified as endangered or critically endangered. Hong Kong alone handles more than 40 percent of the global shark fin trade.

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Every year around73 million of different shark species are caught for dorsal fins trade for shark fin soup alone globally.

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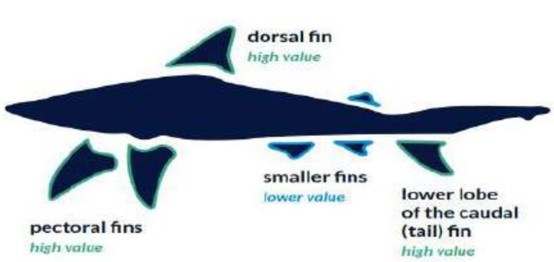
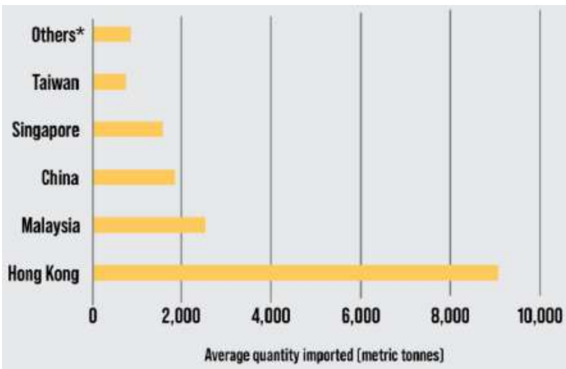
Practice of finning is inhumane and wasteful - cutting off the fins from the live body and discarding at ocean which unable fish to swim effectively due to which they sink at the bottom, die a slow death because of suffocation for 20 minutes.

Among fisherman, Shark fins are tempting targets solely because of cultural value, high monetary, medicinal benefits and traditionally used to make shark fin soup widely. With the time and population expanding of china the demand of fin trade increasing among Asian and European countries and become a staple food globally. So among the fisherman shark collection and selling is more incentive i; e., $500 a pound ($1,100 a kilogram). Fin of sharks are actually flavorless and is marinated with other meat such as pork or chicken for hours until it has the desired flavor.Shark fins are the most valuable, expensive traditional seafood products commonly consumed in china, Hong Kong, Malaysia, Macao, Singapore and other countries retailing at US$400 per kg. Since 1997, the demand of shark finning has increased sharply for shark fin soup a popular dish on table globally and traditional medicinal products particularly in China as a result of improvement in fishing technology and market economics.



Ranges from US$540 million - US$1.2 billion, shark fin are trading globally according to data 2017. While the shark fining is prohibited in United States, some whale shark buyers pay as much as $10,000 -$20,000 for a fin. According to wildlife trade monitoring, TRAFFIC report between 2010 and 2016, Malaysia trade on an average 2,556 tons of shark fin per year, with Hong Kong an average of 9,069 tons and third and fourth position handled by China and Singapore with 868 tons and 1,587 tons respectively. 90% of average annual global shark fin imports globally by these 4 largest importers during the same period. The TRAFFIC 2017 report revealed Malaysia ranked third after Hong Kong and China.



Narrow streets of Sai Ying Pun neighborhood, the centre of Hong Kong's dried seafood trade offered shark fins in all shapes and sizes on shelves, stuffed in jars and stacked in bags. Among many shark species two species ie., the smooth hammerhead and the scalloped hammerhead population declined from around 155,500 (1981) - 26,500 (2005) due to excessive shark finning.

In 2013, the CITES (The Convention on the International Trade in Endangered Species of Wild Fauna and Flora) listed 5more shark species in Appendix II –list includes the species that are currently non-endangered but without regulating their trade these species may become endangered. Shark fin trade still allows in appendix II, the fishing is required to be more sustainable giving the species additional protection. Additionally, many individual countries including China are making their own protections. There has been a sustained lobbying over many years by the likes of Bite-Back Shark & Marine Conservation and Shark Guardian to ban shark-fin imports with run a number of successful campaigns including 'Hacked Off' and 'No Fin to Declare' as a result the charity was able to declare in 2018 that the number of British restaurants serving shark fin soup had reduced by 82 percent.

India banned shark fin trading but what about the sharks' lives:

India is second largest catcher of sharks after Indonesia and around 75000 tons of sharks are caught every year but India is not a big exporter of fins. The government of India in 2014 had banned on export of shark fining but still there was no ban on shark fining and the shark meat is consumed in coastal communities widely. In 2016, The Director-General of Foreign Trade prohibited the export of shark fins through notification which had inserted a new entry in 'Chapter 3 of Schedule 2 of ITC (HS) Classification of Export and Import Items and it resulted in the ban on exports of shark fins. The main aim of ban was to check the reckless destruction of shark populations for securing most valuable item i; e., the fins in the areas of South-East Asian countries which used the fins making soups as well as medicinal preparations. The government had restricted the catch of only 6 verities of shark out of 99 species had nothing to do with conservation of marine fishery. Additionally, at the same time, there were no curbs on the sale of shark products i; e., liver oil and other shark-based products. So we need to come up with stricter laws in India to save the marine shark species.

Smuggling of shark fins during Covid 19 proved taste of shark is still strong:

Seized of 28 tones of illegally smuggled shark fins in Hong Kong in May 2020 has been set a new record in the world of shark fin trade region which was worth more than $ 1.1 million. In Asian countries the smuggling of shark fin show that the growing appetite taking a toll on ocean ecosystem and communities of fisheries. Many of the people lost their work during pandemic have been forced back in industry globally. At the wildlife conservation society in

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New York, the director of shark and rays program Luke Warwick said during the height of Covid 19 probably shark fining is benefited but it is sure that the shark finning trade is increase again in the future.

Conclusion:

As sole predators, shark directly impact ecosystems and helps to keep coral reefs healthy by cycling nutrients, cleaning up the reefs by scavenging and removing invasive species. In a 2007 study, scientists found that in the absence of tiger sharks, the populations of *Dugong dugon* moved to the grasses which are more nutritionally superior at the interiors of the beds due to which these areas are putting at greatest risk of overgrazing. Globally Pupils are realizing how sharks are ecologically important and to protect these species beginning to protest against the killing of sharks for their fins. If this horrific industry is allowed to continue we will be wiped out theses unique apex predators from our blue oceans permanently. After banning on many countries including china and Japan still shark fin soup on table and smuggle continue. We need to require more detailed species stock assessment references points on shark fin trade. The lower productivity of other marine species common in fin trade, the major difference between the catch and trade estimation data to FAO adds to serious concern about the shark's exploitation.

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Application of Remote Sensing in Agriculture

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ARTICLE ID:082

Introduction

Remote sensing is defined as the art and science of gathering information about objects or areas from a distance without having physical contact with objects area being investigated. The principal behind remote sensing is the use of electromagnetic spectrum (visible, infrared and microwaves) for assessing the earth's features. The typical responses of the targets of these wavelength regions are different, so that they used for distinguishing the vegetation, bare soil, water and other similar features. They are generally two types of remote sensing are Passive remote sensing and active remote sensing. Passive remote sensing system which measure energy that is naturally available . For example: Sun, this can only take during the time when the sun is illuminating the earth. Active provide their own energy source for illumination. The sensor emits radiation which is directed towards the target to be investigated. The radiation reflected from that target is detected and measured by the sensor. They obtain measurements anytime, regardless of the time of day or season. For example: Laser, Radar.

Role of Remote Sensing in Agriculture

Agriculture resources are important renewable dynamic natural resources. In India, agriculture sector alone sustain the livelihood around 70 percent of the population and contributes nearly 35 percent of the net national product. Increasing agriculture productivity has been the main concern since scope for increasing area under agriculture is rather limited. This demands judicious and optimal management of both land and water resources. During the last two decades, remote sensing techniques are applied to explore agriculture application such as crop growth monitoring comprehensive and reliable information on land use\cover, forest area, soils, geological information, extent of wastelands, agriculture crops, water resources both surface and underground and hazard\natural calamities like drought and flood is required. Season-wise information on crops, their acreage, vigour and production enables the country to adopt suitable measures to meet shortages, if any, and implement proper support and procurement policies.

- Ground bases: Infrared thermometer, spectral radiometer, Pilot-Balloons and radars.
- Air Bases: Aircraft air based remote sensing tools.
- Satellite based: The digital image processing, using powerful computers, is the key tool for analysing and interpretation of remotely sensed data.

Since the ground based and air based platforms are very costly and have limited use, space based satellite technology has become handy for wider application of remote sensing techniques.

Remote Sensing technology provides many advantages over the traditional method in agriculture resources survey. The advantages include capability of synoptic view, potential for fast survey, capability of repetitive coverage to detect the changes, low cost involvement, higher accuracy and use of hyperspectral data for increasing information. As mentioned there are many application of remote sensing in the agriculture sectors. Below given the summary of these applications :

Crop Production Forecasting:

Remote sensing is used to forecast the expected crop production and yield over a given area and determine how much of the crop will be harvested under specific conditions. Researchers can be able to predict the quantity of crop in a given farmland over a given period.

Assessment of Crop Damage and Crop Progress:

In the event of crop damage or crop progress, remote sensing technology can be used to penetrate the farmland and determine exactly how much of a given crop has been damaged and the progress of the remaining crop in the farm.

Crop Identification:

Remote sensing has played an important role in crop identification especially in cases where the crop under observation shows some mysterious characteristics. The crop data collected will be taken to labs where various aspects of crop including the crop culture are studied.

Crop Acreage Estimation:

Remote sensing has also played a very important role in the estimation of the farmland on which a crop has been planted. This is usually a cumbersome procedure if it is carried out manually of the vast sizes of the land being estimated.

Crop yield Modelling and Estimation:

Remote sensing also allows farmers and experts to predict the expected crop yield from a given farmland by estimating the quality of the crop and the extent of the farmland. This is then used to determine the overall expected yield of the crop.

Identification of Pests and Disease Infestation:

Remote sensing technology a significant role in identification of pests in farmland and gives data on the right pests control mechanism to get rid of the pests and diseases on the farm.

Soil Mapping:

Soil mapping is one most important uses of remote sensing, through soil mapping, farmers are able to tell which soil are ideal for which crops and which soil require irrigation and which one do not. This information helps in precision agriculture.

Water Resources Mapping:

Remote sensing is instrumental in the mapping of water resources that can be used for agriculture over a given farmland. Through remote sensing, farmers can tell where water resources are available for use over a given land and whether the resources are adequate.

Monitoring of Droughts:

Remote sensing technology is used to monitor the weather pattern of given area. The technology also monitors drought pattern area too. The information can be used to predict the rainfall patterns of an area and also tell the time difference between the current rainfall and the next rainfall which helps track of the drought.

Conclusion

With increasing population pressure throughout the world and the need for increased agriculture production, there is a definite need for improved management of the world's agriculture resources. To make this happen, it is first necessary to obtain reliable data on not only the types of resources, but also the quality, quantity and location of the resources. Satellite-or aerial-based RS technologies will become important tools in improving the present system of agriculture and generating agricultural and natural resources data. Agriculture surveys are presently conducted throughout the world in order to gather empirical information on crop, rangeland, livestock and other agriculture resources. Such information is critical for effective management of depleting and scarce resources.

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Drip Irrigation Fros or Against Marginal Farmers

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ARTICLE ID: 083

Introduction

In the early 1960s, Blass developed, this method and the new dripper became the first outdoor irrigation sender. During the 1960's and 1965's, he set up drip irrigation systems and sold them in Israel and abroad.

Irrigation is a water supply system that greatly benefits the growing and healthy plants. It provides a good amount of water for plants. Irrigation is a small irrigation system that has the potential to conserve water and nutrients when applied to plants. It is the farmer's decision to provide nutrients and fertilizer with irrigation water to the plants. Irrigation irrigation provides water especially in the root zone at a certain amount at the right time. In this way each plant gets what it needs and how much it needs. Also known as "Trickle Irrigation". Water works evenly in the area of the plant roots. Water is used near the root zone of the plant. Irrigation should be used for crops such as: - vegetables, tress and soft fruit plants etc. Irrigation irritates water flow, evaporation and erosion. The efficiency of irrigation irrigation provides good yields and crop yields. It is the best way for farmers to save water, fertilizer and energy.

How it works: -

In drip irrigation water and mixed nutrients are delivered to the whole field through pipes called “Drip lines”. Each drip lines emits a number of water droplets containing water or compound water containing nutrients and fertilizers leading to the same use of water and nutrients in the root zone in the plant sector.

It is of two kinds

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- The Surface Irrigation system uses adjacent emitter spaces (12 ”-18”) and a small wall (8-10mil) drip line mounted 1 "to 6" below the surface. It is a temporary system because drip line is restored and reused every year. Submissions can therefore be permanent or temporary. This system is widely used in high value plant.
- Sub-Irrigation Drip irrigation is a work in the 20 ”-27” emitter space with a thick wall (13-15mil) embedded 8 "-14" under the surface. This system is permanent, making design and installation very important to ensure duration. Sub Surface irrigation is widely used in crop lines.

Benefits and Implications

The loss of fertilizer and nutrients is minimal due to the small amount of water supply to the plants. There is no field measurement and the unusual structure of the building is easily incorporated into irrigation. Proper water management of plant roots retains the moisture and volume of the soil field. There are no staff costs for irrigation because only driplines are used. Weed growth and soil erosion are also limited to drip irrigation due to the limited water supply to the soil. In this way the forage stays dry and reduces the risk of disease by preventing their growth in its favorable conditions. Fertilizer also occurs in irrigated irrigation by mixing water with fertilizer or nutrients and reducing wastage of nutrients and nutrients. 100% water consumption because water is still distributed evenly in the local study and soil type. And it is an energy-saving method that works at low pressure.

Drip irrigation is expensive due to its initial initial cost. It can also lead to moisture distribution. Drip irrigation management is necessary and appropriate skills. It can also lead to the prevention of drip lines if the water is not properly filtered. The sun also makes drip lines irrigation and shortens the life span of drip lines. The dedicated NABARD-funded irrigation fund has initially approved some Rs 5000 crore (Rs 2000 crore for 2018-19 and Rs 3000 crore for 2019-20) to encourage public and private investment in Micro irrigation. The main objective of the fund is to facilitate the provinces in consolidating resources to increase coverage for Micro irrigation.

The subsidy for drip irrigation comes through the Government program under the Farmer Welfare Program. It is to stop the irrigation system too much. If you plan to launch a program in your area, you will need to go with a 50% and 70% Government Grant on subsidy.

How to Get a Subsidy

• The farmer should have one hectare of land.

• The farmer must have o bore-well in the field.

Irrigation Schemes: -

- **PMKSY** Pradhan Mantri Krishi Sinchai Yogna was launched in 2015-2016, to expand the rapid irrigation system. Under this grant 90% subsidy is provided to farmers. The aim of the scheme is to expand the area under the minimum irrigation technology to increase WUE (water efficiency), increase crop production and farmers' income through water management.
- **PMKSY Soil and Water Conservation** is being introduced in all regions of the Punjab. The aim of the program was to integrate water resources, distribution and efficient use of water efficiencies through appropriate technology and practices. It is linked to tube-well / river lift irrigation projects with modern irrigation technology for energy efficiency.
- **Punjab irrigation project (NABARD-RIDF-20)** applies to all Punjab regions. Its purpose is to make better use of the irrigation water available in the farmer's fields.

Conclusion

The Drip Irrigation is a magnificent technique for farming. In this farming system we apply small amount of water to the plants or crops by which we can conserver the water, energy, fertilizers and nutrients. But its main concomitant is that it is not useful in all crops like cereals, woody crops. It is not beneficial for small / marginal farmers because of its more expenses, and it also needs proper technical knowledge to operate it properly. Most of the farmers are not aware about subsidy and Government Schemes for drip irrigation, so Government should provide vocational trainings to the farmers for the proper implementation of this Drip Irrigation process. So that, each and every farmer can take full benefits of these schemes or policies by which we can conserve our natural resources and improve production of the crops and yield.

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Fish on Your Attic: Scope of Urban Aquaculture

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ARTICLE ID: 084

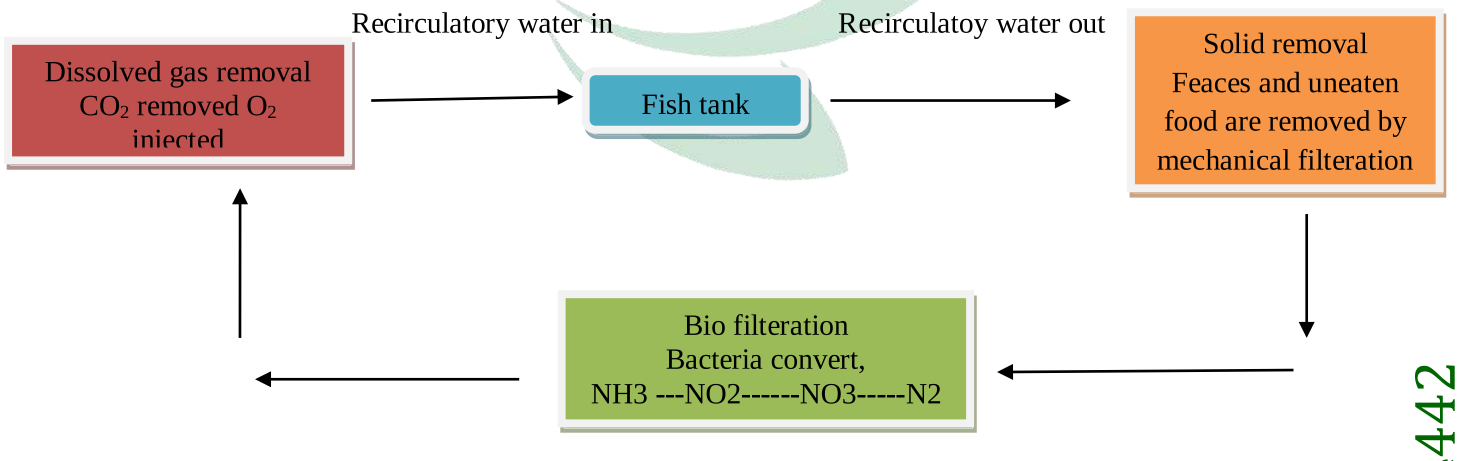
Urban aquaculture is the farming of aquatic organism such as fishes, aquatic plants etc, in an urbanized environment. Urban aquaculture aims with the production of using very limited resources. The systems utilizes very little space and water hereby resulting in large production. Aquaculture is a developing sector resulting in the production of fish and even job opportunities. The most promising candidate for aquaculture is tilapia, since it can withstand sudden change in water quality parameters. Other species cultured include cuttle fish, mussels, shrimp and even aquatic plants. The explosion in population and urbanization are the key factors leading to the demand of urban aquaculture. Population growth demands large quantity of food and urbanization results in lack of cultural lands, which creates demand for urban aquaculture.

Types of urban aquaculture

RAS (Recirculatory Aquaculture System)

Recirculatory Aquaculture System provides a system of series of mechanical and biological filters to reuse and recirculate the majority of water in the culture system. About 90% of water are being reused in this culture system.

Flowchart representing recirculatory aquaculture system



The mechanical filter removes the solid debris, followed by biofilters which space the nitrifying bacteria such as nitrosomonas and nitrococcus that convert ammonia (NH_3) to nitrate (NO_2^-) and nitrobacter that convert nitrate to nitrite (NO_3^-) and finally to nitrogen .Then the water is degassed to remove carbon dioxide and oxygen is injected into. The RAS shows its potential in current scenario as it demands less area and reuse of water resource since water is a very demandable resource in future. Species cultured mainly involves tilapia, trout, perch, bass, Artic char etc.

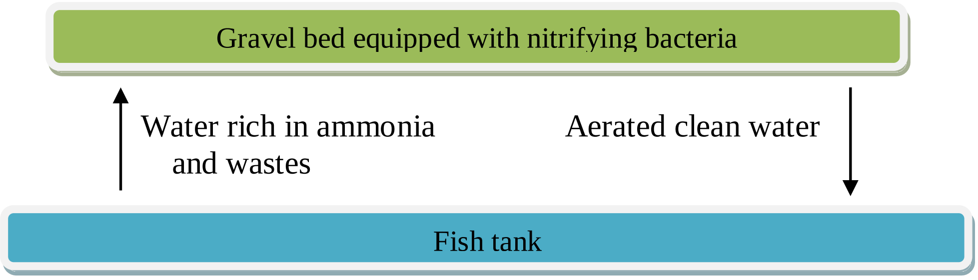
Aquaponics

It is the aqua cum agri integrated culture system where water from the aquaculture is used in the hydroponic production beds, which are equipped with nitrifying bacteria such as nitrosomonas. nitrococus and nitrobacter. The waste water from aquatic system is contaminated with fish manure ,uneaten feed etc ,this water act as liquid fertilizer to the gravel beds, which in turn act as bio-filter that converts ammonia to nitrite finally to nitrate. Plants absorb these nitrates for their growth .The excess aerated clean water from the bed is recalculated back to fish tank. This is a system which is widely used nowadays because of its limited area requirement and thereby causing no pollution to the environment. This culture system truly obeys the rule of nature as nothing is left unutilized. Frequent monitoring of the bio-filters are necessary to ensure the growth of bacteria, and also daily checking of the water pumbing system is mandatory. The culture ensures the production of sized species on harvesting and pesticide free vegetables form the gravel bed .

Recirculatory Aquaculture System in Fisheries College, Pusa Bihar

Aquaponic system in Thodupuzha, Kerala

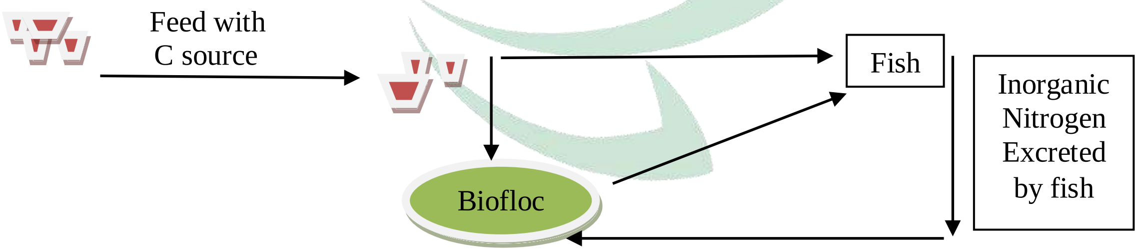
Flowchart showing aquaponic system



Biofloc technology

Bio floc technology is based on the principle of waste nutrient recycling, into microbial biomass floc. The biomass constitute bacteria, phytoplankton, unused feed, detritus etc., this floc balances the C:N ratio in the aquatic system. Maintaining C:N ratio through external addition of carbohydrates (molasses) to stimulate the growth of heterotrophic bacteria to allow decomposition of the organic material and nitrogen uptake (feaces) leading to production of microbial proteins. The biofloc acts as a bioreactor for controlling water quality and also as a protein food source for aquatic organisms. This technology is useful in maintaining optimum water quality, under zero water exchange system, thus prevents eutrophication and effluent discharge to the surrounding and hence most used in urban aquaculture. This method require continuous aeration as to keep the bio-floc in suspension rather allowing its settling and frequent monitoring of the water quality parameters .

Flowchart Showing Biofloc System



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Bio floc system in Ernakulam, Kerala

Scope in Future

These culture systems are in demand because they don't cause environmental pollution, the waste from one system itself act as source for another system. The tremendous explosion in population and urbanization are the key factors leading to demand for these culture systems and thereby resulting in much better production. The system also provide ambient job sectors in the society, thereby providing better sources of income, making the people self sustained, providing them with safe fish for good health and providing food security for the society. For a developing country like India, urban aquaculture provide an important source of food, employment and income and most importantly leads to the overall aquaculture production of the country.

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Reshaping Agriculture with Technology

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ARTICLE ID: 085

Abstract

Agriculture is defined as the cultivation and exploitation of animals, plants (including fungi) and other forms of organic life for human use including food, fiber, medicines, fuel and anything else. It is, and has been since there was an agricultural market, one of the largest employers of people; in the USA today, agriculture represents 20% of the US economy. Before organized agriculture, it is believed that the food supply could provide for just 4 million people globally Even as technology changes, agriculture adapts and could never become obsolete - even in a time when it might conceivably be vastly different from what it might have been at the dawn of agriculture. After all, we are always going to need to increase the number of crops we grow for food and for clothing, dyes and oils, seed development and engineering to cope with the growing needs of the world's population, even if the picture is not as bleak as the most conservative concerns might suggest**.** Today, agriculture is as much a science as an art. With a need to cope with the growing needs of the planet's population, and to find ways to keep producing food and other crops as we expand into marginal landscapes, and adapt to a changing climate, changes in agriculture practices, food technology and bio technology will continue to be a big part of human civilization.

Introduction

Modern farming began around the 18th century in what is generally referred to as “The British Agricultural Revolution” when several advances and changes were made to farming in a short space of time that saw massive increases in yield and a more efficient process. The three field crop rotation system was replaced with a four field system and sweeping enclosure acts regulated land management, selective cross-breeding began on an industrial scale to increase crop size as well as yields creating several cultivars in the process. Animal husbandry also improved, leading to a greater surplus than had been permissible under the old system. It is said that these changes permitted the industrial revolution and even greater

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concentration of urban development, fueling the empire. How so? More crops for fewer workers, better methods of keeping and replacing nutrients in the soil meant that more people could work in industry. When the Corn Laws in England were repealed, it began the global food economy; about the same time, Charles Darwin's Theory of Evolution put agriculture on the modern path of a science as we began to understand the development of crops.

Agriculture is continuously changing through innovation in science and technology. However, the agriculture industry continues to be called upon to produce more with finite resources. A major way to improve traceability, sustainability, and quality of goods from a farm is through the adoption of technology, including an integrated farm management platform. The concept of FMS (farm management solution) is an effective way to manage natural resources while keeping pace with modern technologies. Technology advancements on the farm, like an integrated FMS, extend a farmers' overall capacity, automate routine tasks normally done by people, and give farmers more time to do things computers can't. It's not a means to replace the personalized care farmers put into creating resources essential to human life, nor will the FMS determine the root cause of a problem in the field. A good FMS will include one-on-one expert support in farm management, crop marketing and agronomy.

Why Fms is an Important Concept To Discuss

- increase efficient farmer productivity
- Accurately apply chemicals and fertilizers by reducing over-application or under-application errors
- Reduce ground and surface water pollutions
- Decrease greenhouse gases emission and pollution
- Improve economic production
- Increase timeliness of operations
- Increase efficiency through accurate equipment communication
- Increase product quality.

It's believed that by 2050, the human population will reach almost 10 billion. As our current agricultural systems stand, we won't be able to generate enough food to feed this population without the use of technological innovations.

Several years ago, a group of advocates of smart farming technologies published a thesis on the application of such technologies in Brazil. "Technological development, such as the use of electronic systems and data transmission, has introduced radical changes to the agricultural working environment in recent years," the paper outlined, "Given the persistent food shortage and population growth around the world, it is estimated that a 70% increase in world food consumption must be achieved from 2009 to 2050. The technologies linked to smart farming will be important in meeting this challenge of increased food production in the face of constraints such as climate change and other environmental issues."

Some New Technologies In Agriculture

Innovation is more important in modern agriculture than ever before. The industry as a whole is facing huge challenges, from rising costs of supplies, a shortage of labor, and changes in consumer preferences for transparency and sustainability. There is increasing recognition from agriculture corporations that solutions are needed for these challenges. In the last 10 years, agriculture technology has seen a huge growth in investment, with in the last 5 years \$6.7 billion invested and \$1.9 billion in the last year alone. Major technology innovations in the space have focused around areas such as indoor vertical farming, automation and robotics, livestock technology, modern greenhouse practices, precision agriculture and artificial intelligence, and block chain.

Indoor Vertical Farming

Indoor vertical farming can increase crop yields, overcome limited land area, and even reduce farming's impact on the environment by cutting down distance travelled in the supply chain. Indoor vertical farming can be defined as the practice of growing produce stacked one above another in a closed and controlled environment. By using growing shelves mounted vertically, it significantly reduces the amount of land space needed to grow plants compared to traditional farming methods.

Farm Automation

IT is a technology that makes farms more efficient and automates the crop or livestock production cycle. An increasing number of companies are working on robotics innovation to develop drones, autonomous tractors, robotic harvesters, automatic watering, and seeding robots. Although these technologies are fairly new, the industry has seen an increasing number of traditional agriculture companies adopt farm automation into their processes.

New advancements in technologies ranging from robotics and drones to computer vision software have completely transformed modern agriculture. The primary goal of farm automation technology is to cover easier, mundane tasks. Some major technologies that are most commonly being utilized by farms include: harvest automation, autonomous tractors, seeding and weeding, and drones. Farm automation technology addresses major issues like a rising global population, farm labor shortages, and changing consumer preferences

Modern Green Houses

Greenhouses are framed or inflated structures covered with transparent or translucent material large enough to grow crops under partial or fully controlled environmental conditions to get optimum growth and productivity.

Advantages of greenhouses :

1. The yield may be 10-12 times higher than that of out door cultivation depending upon the type of greenhouse, type of crop, environmental control facilities.
2. Reliability of crop increases under greenhouse cultivation.
3. Ideally suited for vegetables and flower crops
4. Year round production of floricultural crops
5. Off-season production of vegetable and fruit crops.
6. Disease-free and genetically superior transplants can be produced continuously.
7. Efficient utilisation of chemicals, pesticides to control pest and diseases.
8. Water requirement of crops very limited and easy to control.
9. Maintenance of stock plants, cultivating grafted plant-lets.

The Greenhouse industry has been transforming from small scale facilities used primarily for research and aesthetic purposes (i.e., botanic gardens) to significantly more large-scale facilities that compete directly with land-based conventional food production. Combined, the entire global greenhouse market currently produces nearly US $350 billion in vegetables annually, of which U.S. production comprises less than one percent.

Blockchain

Blockchain's capability of tracking ownership records and tamper-resistance can be used to solve urgent issues such as food fraud, safety recalls, supply chain inefficiency and food traceability in the current food system. Blockchain's unique decentralized structure ensures verified products and practices to create a market for premium products with transparency.The structure of blockchain ensures that each player along the food value chain would generate and securely share data points to create an accountable and traceable system.

Digital Agriculture

Remote sensors, satellites, and UAVs can gather information 24 hours per day over an entire field. These can monitor plant health, soil condition, temperature, humidity, etc. The amount of data these sensors can generate is overwhelming, and the significance of the numbers is hidden in the avalanche of that data. Remote sensors enable algorithms to interpret a field's environment as statistical data that can be understood and useful to farmers for decision-making. Algorithms process the data, adapting and learning based on the data received