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Farm Bill : Bills of Contention ?

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Agriculture Updates

Total procurement of paddy across India increased by 35%

The current paddy crop is being bought on MSP basis; there have been a record buying by Government agencies this season. As n 11th Oct 2020, total procurement of Paddy across all States in India increased by 35% from 31.7 LMT last year to 42.5 LMT this year. In the last 5 years, 3,069 LMT of Paddy was procured at MSP for Rs.4,95,043 crores compared to 1,768 LMT between 2009-14 for just Rs. 2,06,059. A 2.40 times increase can be seen in MSP value. Similarly, in the last 5 years, 1,627 LMT of Wheat was procured at MSP for Rs. 2,97,023 compared to 1,395 LMT between 2009-14 for Rs. 1,68,202. A 1.77 times increase in MSP value is seen.

Number of procurement centers for Wheat in Rabi season went up to 21,869 during 2020-21.

The number of procurement centers for Wheat in Rabi Season went up to 21,869 for the year 2020-21. Nearly a 50% increase on previous year's 14,838 procurement centers. The number of procurement centers planned for Kharif Season 2020-21 have increased from 30,549 (2019-20) to 39,130. Nearly a 30% increase in of procurement centers. Total number of procurement Centers (Rabi & Kharif seasons combined) have gone up from 48,550 in 2016-17 to 64,515 in 2019-20. An increase of nearly 33% over just 4 years. The number of farmers who have benefited from Paddy procurement at MSP has increased by 72% between 2017-18 to 2019-20.

Export of essential agri commodities for the period April-September, 2020

The consistent and concerted efforts of the Government to boost agricultural exports are bearing fruit as despite of the on-going Covid-19 crisis, the export of essential agri commodities for the cumulative period of April-September, 2020 has increased by 43.4% to Rs 53626.6 crore as compared to Rs 37397.3 crore in the same period last year. Major commodity

groups which have recorded positive export growth during April-Sept, 2020-21 vis-à-vis April-Sept, 2019-20 are Groundnut (35%), Refined Sugar (104%), wheat (206%), Basmati Rice (13%) and Non-Basmati Rice (105%) etc.

Two-day India-Canada Agri-Tech Seminar inaugurated

In his inaugural address at the two-day India-Canada Agri-Tech Virtual Seminar organized by the Indo-Canadian Business Chamber (ICBC) in collaboration with the Confederation of Indian Industry (CII) and the Ministry of External Affairs of India, Shri Tomar said that India, in particular, during the last six months of the global pandemic crisis has made considerable progressive reforms in the agricultural sector. These include policy reforms for the establishment of One Nation-One market, contract farming along with appropriate measures for the safety and freedom of farmers. India has over 450 start-ups in the agri-tech sector, which means that every 9th start-up in the world is Indian. Public-private partnerships are increasing due to investment in line with this sector.

Vaibhav Summit session on "Sensor and Sensing for Precision Agriculture" held by ICAR- IARI

A session on "*Sensors and Sensing for Precision Agriculture"* was organized under "**Precision Agriculture**" by ICAR-Indian Agricultural Research Institute with total participation of 1019 including 38 panellists on 05th October 2020, as part of the Vaishwik Bhartiya Vaigyanik (VAIBHAV) Summit 2020. This is a Government of India initiative to bring together the thought process, practices, R&D culture of Overseas and Indian scientists/academicians through a series of structured deliberations and constructive dialogue, and develop a road map for translational research/academic culture for tangible output and strengthening the S&T base for providing the impetus to endeavour of Aatma Nirbhar Bharat.

ICAR-IARI organizes one week long programme to commemorate birth anniversary of Father of the Nation Mahatma Gandhi

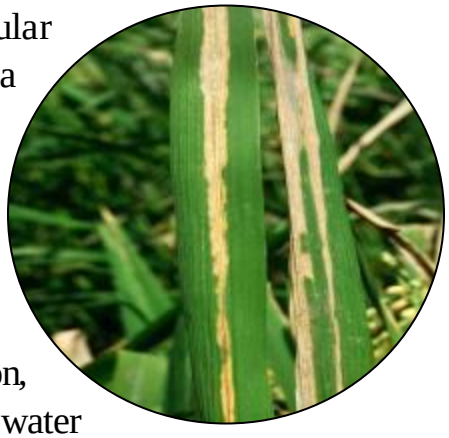
The seven days long programme started with cleanliness drive (Swachhta Abhiyaan) on 26th September from 9.30 am to 11.30 am which was led by Dr. A. K. Singh, Director, ICAR-IARI at Directorate campus. All Heads of Divisions along with scientists, staff and

students participated voluntarily and different Divisions of the institute premises could be cleaned on this special occasion of Swachhta Abhiyan by adopting all measures of social distancing and best hygiene practices. The valedictory function of the week long programme was organized today on 2nd October from 2.30 pm in virtual mode in presence of Dr, Trilochan Mohapatra, Secretary, DARE & DG ICAR and renowned Gandhian Philosopher Padmashree Dr. Ravindra Kumar.

Three new farm laws were passed by the parliament

Recently, three new farm laws were passed by the parliament to increase the relative role of markets without dismantling the MSP (Minimum Support Prices) system. These laws meet widespread protest from the farming community, especially in Punjab and Haryana. Fearing the government will do away with the MSP is the bone of contention behind these protests. Farmers want higher and assured income through effective MSP, while the government is offering greater choices to farmers through markets, without demolishing the existing MSP system.

A new bacterial disease Xoo identified in paddy



Recently, scientists from the Centre for Plant Molecular Biology (CPMB) have uncovered the mechanism by which a bacterium called Xoo interacts with rice plants and causes disease. Scientists from Centre for Plant Molecular Biology (CPMB), Osmania University, Hyderabad are working to identify and develop few molecules which are derived either from the Xoo bacterium or from the infected rice cell walls. Since rice paddies are flooded throughout most of the growing season, Xoo may easily spread among crops; bacteria travel through the water from infected plants to the roots and leaves of neighbouring rice plants. Wind may also help spread the Xoo bacteria to other crops and rice paddies.

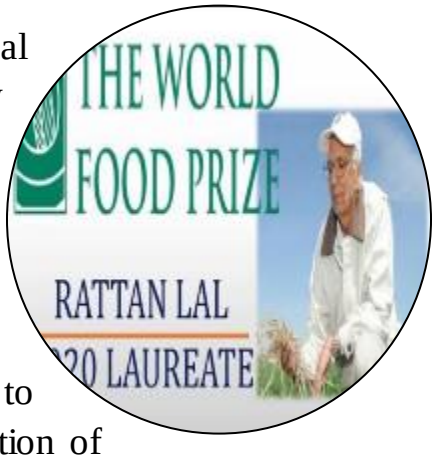
Now, UAVs make a statement in Kerala farms too

The dearth of skilled workers following the lockdown restrictions, especially deploying manpower, has affected farming operations and put the farm community in a fix. However, the Krishi Vigyan Kendra (KVK) at Ambala vayal under the Kerala Agricultural University (KAU) has found a solution in unmanned aerial vehicles (UAV). The KVK conducted a UAV-based demonstration of fertilizer application for farmers at the Kolavally Padashekharam in Mullankolly grama panchayat in Wayanad. The application of 'Sampoorna', a micronutrient for rice cultivation, using an UAV was first of its kind in Wayanad.

Fertilizers to be delivered at the doorstep of farmers

Farmers now can get the fertilizers purchased from their nearest Rythu Bharosa Kendras (RBKs) by sending SMS[es] delivered at their doorsteps as Chief Minister Y.S. Jagan Mohan Reddy, along with Union Minister for Fertilizers Sadananda Gowda and Agriculture Minister K. Kanna Babu, launched the initiative in virtual mode. A Point of Sale (POS) 3.1 software and an SMS Gateway were also launched on the occasion. "Farmer can place orders for seeds, fertilizers by sending SMSes to their nearest RBKs through digital kiosks. The fertilizers will be delivered at the doorsteps of farmers within 24 to 48 hours," said the Chief Minister after launching the initiatives.

CGIAR World Food Prize International Symposium underway



The World Food Prize Norman E. Borlaug International Symposium has commenced from October 12, 2020. The five day virtual event is one of the world's premier conferences on global agriculture. This year's theme, 'Breaking new ground: Building resilience today for improved global food systems tomorrow,' recognizes the urgent need for equity, sustainability and improved nutrition in our food systems. Consultative Group on International Agricultural Research (CGIAR) science and innovation are crucial to improving global food systems. This is underscored by the selection of CGIAR alumnus Dr Rattan Lal as the 2020 World Food Prize Laureate. Dr Lal has spent 18 years at the International Institute of Tropical Agriculture (IITA), a CGIAR Research Center,

where he spearheaded research demonstrating that soil organic matter and carbon are crucial to sustaining and enhancing the quantity and quality of food production.

Fisheries minister releases beneficiary booklet on Pradhan Mantri Matsya Sampada Yojana

Indian fisheries minister Giriraj Singh has released the 2nd edition of the newsletter 'Matsya Sampada' and a Beneficiary Booklet on Pradhan Mantri Matsya Sampada Yojana (PMMSY) which provides a comprehensive outline of the different components/activities of the PMMSY scheme and modalities of submission of the proposals, which would be a valuable resource for fishermen and other stakeholders in the sector.

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Farm Bills: Bills of Contention ??

Farmers in Punjab and Haryana have been protesting against 3 ordinances promulgated by the Centre back in June this year. After the Monsoon Session of Parliament began this week, the government has introduced three Bills to replace these ordinances.

1- The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020

- **Trade of farmers' produce:** The Ordinance allows intra-state and inter-state trade of farmers' produce outside: (i) the physical premises of market yards run by market committees formed under the state APMC Acts and (ii) other markets notified under the state APMC Acts. Such trade can be conducted in an 'outside trade area', i.e., any place of production, collection, and aggregation of farmers' produce including (i) farm gates, (ii) factory premises, (iii) warehouses, (iv) silos, and (v) cold storages.
- **Electronic trading:** The Ordinance permits the electronic trading of scheduled farmers' produce (agricultural produce regulated under any state APMC Act) in the specified trade area. The following entities may establish and operate such platforms: (i) companies, partnership firms, or registered societies, having permanent account number under the Income Tax Act, 1961 or any other document notified by the central government, and (ii) a farmer producer organization or agricultural cooperative society.
- **Market fee abolished:** The Ordinance prohibits state governments from levying any market fee, cess or levy on farmers, traders, and electronic trading platforms for the trade of farmers' produce conducted in an 'outside trade area'.

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

- **Farming agreement:** The Ordinance provides for a farming agreement between a farmer and a buyer prior to the production or rearing of any farm produce. The minimum period of an agreement will be one crop season, or one production cycle of livestock. The maximum period is five years, unless the production cycle is more than five years.

- **Pricing of farming produce:** The price of farming produce should be mentioned in the agreement. For prices subjected to variation, a guaranteed price for the produce and a clear reference for any additional amount above the guaranteed price must be specified in the agreement. Further, the process of price determination must be mentioned in the agreement.

- **Dispute Settlement:** A farming agreement must provide for a conciliation Board as well as a conciliation process for settlement of disputes. If the dispute remains unresolved by the Board after thirty days, parties may approach the Sub-divisional Magistrate for resolution. Parties will have a right to appeal to an Appellate Authority (presided by collector or additional collector) against decisions of the Magistrate. Both the Magistrate and Appellate Authority will be required to dispose of a dispute within thirty days from the receipt of application. They may impose certain penalties on the party contravening the agreement.

3- The Essential Commodities (Amendment) Ordinance, 2020

- **Regulation of food items:** The Essential Commodities Act, 1955 empowers the central government to designate certain commodities (such as food items, fertilizers, and petroleum products) as essential commodities. The Ordinance provides that the central government may regulate the supply of certain food items including cereals, pulses, potatoes, onions, edible oilseeds, and oils, only under extraordinary circumstances. These include (i) war, (ii) famine, (iii) extraordinary price rise and (iv) natural calamity of grave nature.

- Stock limit: The Ordinance requires that the imposition of any stock limit on agricultural produce must be based on price rise. A stock limit may be imposed only if there is: (i) a 100% increase in the retail price of horticultural produce; and (ii) a 50% increase in the retail price of non-perishable agricultural food items.

A Backgrounder: Long awaited APMC reforms

- Agricultural markets in India are mainly regulated by state Agriculture Produce Marketing Committee (APMC) laws. APMCs were set up with the objective of ensuring fair trade between buyers and sellers for effective price discovery of farmers' produce.
- APMCs can:
- regulate the trade of farmers' produce by providing licenses to buyers, commission agents, and private markets,
- levy market fees or any other charges on such trade, and
- provide necessary infrastructure within their markets to facilitate the trade

Issues with the APMCs

- The Standing Committee on Agriculture (2018-19) identified some issues includes: (i) most APMCs have a limited number of traders operating, which leads to cartelization and reduces competition, and (ii) undue deductions in the form of commission charges and market fees.

- Traders, commission agents, and other functionaries organize themselves into associations, which do not allow easy entry of new persons into market yards, stifling competition.

- The Acts are highly restrictive in promotion of multiple channels of marketing (such as more buyers, private markets, direct sale to businesses and retail consumers, and online transactions) and competition in the system.

- During 2017-18, the central government released the model APMC and contract farming Acts to allow restriction-free trade of farmers' produce, promote competition through multiple marketing channels, and promote farming under pre-agreed contracts.

Why were the ordinances promulgated?

- The Ordinances collectively seek to-
- facilitate barrier-free trade of farmers' produce outside the markets notified under the various state APMC laws
- define a framework for contract farming and
-

- impose stock limits on agricultural produce only if there is a sharp increase in retail prices
- The three Ordinances together aim to increase opportunities for farmers to enter long term sale contracts, increase the availability of buyers, and permits buyers to purchase farm produce in bulk.

Causes of nationwide dissent

(1) No consultation with stakeholders

- The attempt to pass the Bills without proper consultation adds to the mistrust among various stakeholders including State governments.
- The ruling government could have waited for the Parliament session, held discussions with all political parties before arriving at a decision.
- Farmer organisations see these Bills as an attempt to weaken the APMCs and eventual withdrawal of the Minimum Support Prices (MSP).

(2) Issue over trade and MSP guarantee

- While farmers are protesting against all three ordinances, their objections are mostly against the provisions of the first.
- Their concerns are mainly about sections relating to "trade area", "trader", "dispute resolution" and "market fee" in the first ordinance.
- In effect, existing mandis established under APMC Acts have been excluded from the definition of trade area under the new legislation.
- According to the ordinance, any trader with a PAN card can buy the farmers' produce in the trade area.

- In the present mandi system, arhatiyas (commission agents) have to get a licence to trade in a mandi.
- Critics view the dismantling of the monopoly of the APMCs as a sign of ending the assured procurement of food grains at minimum support prices (MSP). To the Centre's 'one nation, one market' call, critics have sought 'one nation, one MSP'.

(3) Legacy concerns

- The Bills gives no assurance to the poor, small and marginal farmers of India (constituting over 85 per cent of India's farmers) of protection of their interests, their livelihoods, and their future.
- Critics argue that such legislation will let the farmers falling into the clutches of the monopolistic big corporates.
- Lofty recommendations have been made several times in the past, including by the Swaminathan Committee, which suggested the removal of the mandi tax, creation of a single market and facilitating contract farming
- However, no efforts have taken place for implementing these basic reforms over the years.

(4) Fear of food insecurity

- Punjab CM, on the easing of regulation of food items, said, it would lead to exporters, processors and traders hoarding farm produce during the harvest season, when prices are generally lower, and releasing it later when prices increase.
- This could undermine food security since the States would have no information about the availability of stocks within the State.

(5) Constitutional issues raised

- Since agriculture and markets are State subjects – entry 14 and 28 respectively in List II – the ordinances are being seen as a direct encroachment upon the functions of the States and against the spirit of cooperative federalism enshrined in the Constitution.
- The Centre, however, argued that trade and commerce in food items is part of the concurrent list, thus giving it constitutional propriety.
- The bills invite valid opposition: one, infraction of the states' right to decide on intra-state commerce in agriculture, and two, officer-led dispute settlement outside the ambit of judicial review.

What are the promising features of these bills?

- The new legislations would create an ecosystem where farmers and traders would enjoy the freedom of choice in the sale and purchase of agri-produce.
- It would also promote barrier-free interstate or intrastate trade and commerce outside the physical premises of markets notified under the state agricultural produce marketing legislations.
- The bills would also open up more choices for farmers, reduce marketing costs and help them in getting better prices.
- At the same time, it would also help farmers of regions with surplus produce to get better prices and consumers of regions with shortages, lower prices.
- The bill has also proposed an Electronic Trading Transaction Platform to ensure seamless electronic trade and the farmers will not be charged any cess or levy for sale of their products under this Act.
- Interestingly, the bill aims for 'One India, One Agriculture Market' and also creates additional trading opportunities outside the APMC market yards to help farmers get remunerative prices due to the additional competition.
- The new laws are not shutting down APMC mandis, nor are they implying that MSPs will not be functional.
- This would supplement the existing Minimum Support Price (MSP) procurement system, which also provides a stable income to farmers.

What lies ahead

- Accelerating research and academic excellence can bring in the 'best in class' technologies and can multiply farmers' incomes.
- As far as the commission agents are concerned, the governments should work on a clear roadmap to modernize them by facilitating them in providing value-added services. They could be leveraged to set-up grading and sorting, warehousing, cold chains and food processing infrastructure. This way, it is a win-win-win for the state government, farmers and the commission agents.
- Soil health improvement and water conservation measures should be the top priority for the governments to enhance farm productivity.
- Similarly, by diversifying into high-value crops such as vegetables and fruit, India could become the food- processing hub for the world. Farmers have to be made part of the entrepreneurial ecosystem (FaME—Farmers as Micro-Entrepreneurs).

Conclusion

- A lot of the success of these bills depends on trust and consensus. In the end, what will determine the results of this latest set of reforms will be their implementation?
- There is genuine uncertainty over what private procurement will mean. Will it mean greater corporate power over farmers, possibly unhealthy monopolies or duopolies? Will they be harder to negotiate with than a state monopoly?
- Leveraging the reforms and moving forward rather is the most feasible solution than to protest amid the pandemic.
- What farmers need and are asking for is legally guaranteed remunerative prices. If the Bills are perceived of good intent, then the government should not shy away from a proper parliamentary scrutiny of all its details.
- Political parties that are opposing these Bills should coordinate better keeping farmers' interests in the forefront, and not their party politics.

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FARM BILL: GAIN OR LOSS TO FARMERS ?

Prerna Chib
Student
Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu

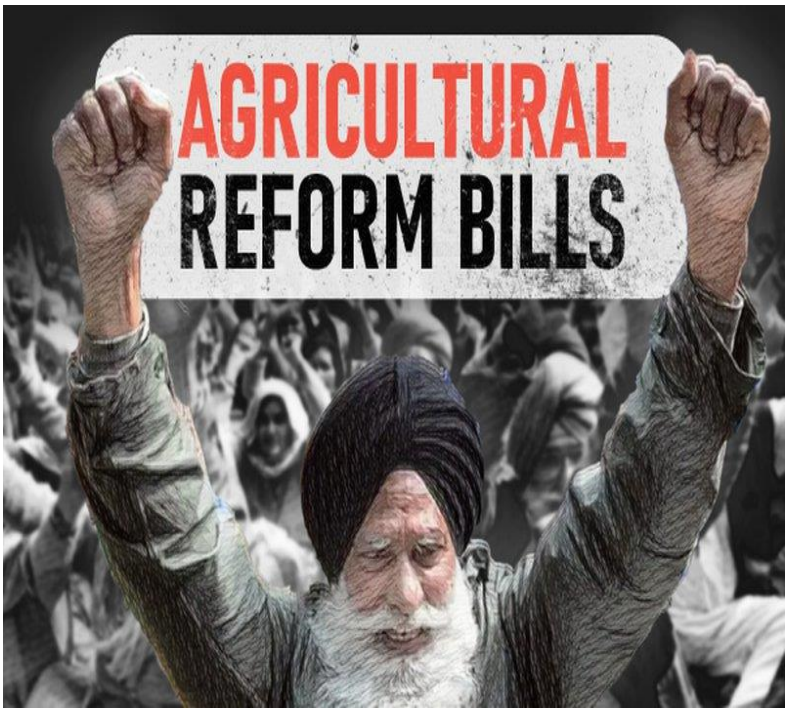
"The newly passed farm bills will give farmers the freedom to trade across states and empower them to turn into traders of their own produce and be in control of the process. The intent behind these three bills is that the new regulation will create an ecosystem where the farmers and traders will enjoy the freedom of choice of sale and purchase of agri-produce and promote barrier-free inter and intra-state trade and commerce outside the physical premises of markets notified under State Agricultural Produce Marketing legislations. There has been an uproar after the Parliament passed three agriculture related bills"

The problem with the existing system was that the farmers had been facing several problems. These problems included overproduction, low crop prices, high transportation costs, high-interest rates, and growing debt.

To overcome this problems, parliament gave its nod to the contentious Agricultural bills. Amid the stiff opposition, there have also been voices that have come out in support of the bills with some stating that they would unshackle the workforce engaged in Agricultural sector.

To cut through the noise, let's move towards the Bills that are passed by the Government.

What are the three Bills in Contention?



Lok sabha, through voice note passed the farmers produce Trade and Commerce Bill 2020 and Farmers Agreement of Price assurance and Farm service bill 2020 and Essential commodities bill 2020. Agricultural Minister, Narinder Singh Tomar, said the bills are not going to override the MSP (minimum support price mechanism).

As we know, these three bills were introduced in the parliament on September 14 to replace the ordinance issued during the lockdown. Opposition members in the Lok sabha plan to move a resolution against the Trade and commerce ordinance and the Price assurance ordinance. Farmers and farmer associations across the country have protested against the ordinance.

After this, there was lot of controversy, here are Pros and Cons of New bill that explain the changes proposed by them to the existing laws in the country.

Pros of the new farm bill:

The farmers had moved towards freer and more flexible system.

Selling produce outside the physical territory of the mandis will be an additional Marketing channels for farmers.

The new bill has not brought any major drastic changes only a parallel system working with existing system. Prior to these bills, farmers can sell their produce to the whole world but via the e- NAM system.

The amendment of the Essential commodities act which is one of the three bills under protest removes the scarce or fear of farmers that traders who buy from farmers would be punished.

This bills ensures that the farmer or the producer is given the same attention as production and farmer gets the best price for crops, so that the farming survives.

The Prime minister" Narendra Modi" tweeted on 20th September that MSP will remain and government will continue procurement.

Cons of the new farm bill:

The farm bill hampers the monopoly of APMC, allowing sales and purchase of crops outside the state government- regulated market yards.

The government declares MSPs for crops, but there is no law mandating the implementation.

The only crop where MSP payment has statutory implementation is sugarcane for which FRP is determined. This is due to its pricing being governed by the sugarcane (control) order, 1966 issued under the Essential commodities act.

After discussing the Pros and cons of the farm bills, let's discuss who is protesting?

Farmers in Punjab have organized three days protest against the bills. Opposition parties including TMC, Congress and BSP opposed the Agriculture sector reform bill saying they were against the interest of small and marginal farmers. Slamming the government, Congress leader "Gaurav Gogoi" said, this government has been eyeing how they can take the Farmers land to benefit their capitalist friends, whether is the land acquisition act whether in the industrial system and now this three pronged attack Indian Agricultural system through the two bills on farming. One related to APMC, other related to contract farming (contract Farming is not something new in our country) and the third which is essential commodities act– a three pronged attack to Indian farmers.

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FARMERS BILL 2020
(EMPOWERMENT AND PROTECTION)

Ankit Moharana
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"This Bill replaces the Farmers (Empowerment and Protection) Agreement of Price Assurance and Farm Services Ordinance, 2020.Thusly please insinuate our administrative brief on the Agriculture Ordinances, 2020"

Principle arrangements

The new establishment will empower farmers for attracting with processors, wholesalers, aggregators, wholesalers, big retailers, exporters, etc., on a level milestone. Worth affirmation to farmers even before planting of yields. If there should be an occurrence of higher market value, farmers will be qualified for this cost far beyond the base cost. It will move the danger of market unconventionality from the farmer to the support. Due to earlier value assurance, farmers will be protected from the ascent and fall of market costs. It will likewise empower the farmer to get to present day innovation, better seed, and different data sources. It will lessen the expense of promoting and improve the income of farmers. A powerful question

goal system has been furnished with clear courses of events for redressal. The driving force to investigate and new innovation in the farming segment.

Doubts

1. Under contract cultivating, farmers will be feeling the squeeze and they won't have the option to decide costs How will little farmers have the option to rehearse contract cultivating, patrons will avoid them
2. The new framework will be an issue for farmers
3. In instance of contest, large organizations will be at a bit of leeway

Explanation

1. The farmer will have full force in the agreement to fix his preferred deal cost for the produce. They will get an installment inside a limit of 3 days.
2. 10000 Farmer Producer associations are being framed all through the nation. These FPOs will unite little farmers and work to guarantee gainful estimating for ranch produce
3. After marking the agreement, the farmer won't need to search out dealers. The buying customer will get the item straightforwardly from the homestead
4. In instance of debate, there will be no compelling reason to go to court over and over. There will be a neighborhood question redressal instrument.

Features of the Ordinance

1. The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Ordinance, 2020 permits intra-state and between state exchange of farmers' produce past the physical premises of APMC markets. State governments are denied from collecting any market charge, cess, or demand outside APMC regions.
2. The Farmers Agreement Ordinance makes a structure for contract cultivating through an understanding between a farmer and a purchaser preceding the creation or raising of any homestead produce. It accommodates a three-level question settlement system: the pacification board, Sub-Divisional Magistrate and Appellate Authority.
3. The Essential Commodities (Amendment) Ordinance, 2020 permits the focal government to direct the flexibly of certain food things just under phenomenal conditions, (for example, war and starvation). Stock cutoff points might be forced on agricultural produce just if there is a lofty value rise.

Main points of interest and Analysis

1. The three Ordinances expect to expand the accessibility of purchasers for farmers' produce, by permitting them to exchange uninhibitedly with no permit or stock breaking point, so an expansion in rivalry among them brings about better costs for farmers. While the Ordinances intend to change exchange and increment the quantity of purchasers, de-guideline alone may not be adequate to draw in more purchasers.
2. The Standing Committee on Agriculture (2018-19) noticed that the accessibility of a straightforward, effectively open, and proficient promoting stage is a pre-essential to guarantee profitable costs for farmers. Most farmers need admittance to government obtainment offices and APMC markets. It noticed that little provincial business sectors can rise as a suitable option for rural promoting in the event that they are given sufficient framework offices.
3. The Standing Committee additionally suggested that the Gramin Agricultural Markets conspire (which intends to improve foundation and community offices in 22,000 Gramin Haats the nation over) ought to be made a completely subsidized focal plan and scaled to guarantee the presence of a Haat in every panchayat of the nation.

Key Features

The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Ordinance, 2020

1. **Cultivating understanding**

   The Ordinance obliges a developing game plan between a farmer and a buyer before the creation or raising of any property produce. The base season of a plan will be one gather season or one creation example of creatures. The most outrageous time span is five years aside from if the creation cycle is more than five years.

2. **Pricing of cultivating produces**

   The cost of cultivating produce ought to be referenced in the arrangement. At costs exposed to variety, an ensured cost for the item, and a reasonable reference for any extra sum over the ensured cost must be determined in the arrangement. Further, the cycle of value assurance must be referenced in the arrangement.

3. **Dispute Settlement**

   A cultivating arrangement must accommodate an appeasement board just as a pacification cycle for settlement of debates. The Board ought to have a reasonable and adjusted portrayal of gatherings to the arrangement. From the start, all questions must be

alluded to the board for goal. In the event that the question stays uncertain by the Board following thirty days, gatherings may move toward the Sub-divisional Magistrate for goal. Gatherings will reserve a privilege to engage an Appellate Authority (directed by gatherer or extra authority) against choices of the Magistrate. Both the Magistrate and Appellate Authority will be needed to discard a debate inside thirty days from the receipt of the application. The Magistrate or the Appellate Authority may force certain punishments on the gathering repudiating the arrangement. Be that as it may, no move can be made against the rural place where there is the farmer for recuperation of any levy.

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E-GOPALA AND MATSYA SAMPADA YOJANA

Kevin Christopher[1], Dr. Anil paswan[2]

[1]PhD research scholar, [2]Associat professor, Bihar Agriculture University, Sabour

> "Prime Minister (PM) Narendra Modi on 10 September inaugurated PM Matsya Sampada Yojana (PMMSY), a flagship scheme for the sustainable development of India's fisheries sector. The PM also launched e-Gopala App, a comprehensive breed improvement marketplace and information portal that can be directly used by farmers."

Prime Minister (PM) Narendra Modi on 10 September inaugurated PM Matsya Sampada Yojana (PMMSY), a flagship scheme for the sustainable development of India's fisheries sector.

The PM also launched e-Gopala App, a comprehensive breed improvement marketplace and information portal that can be directly used by farmers. During the virtual inauguration ceremony, the Prime Minister spoke to several farmers and people engaged in animal husbandry and fisheries sector.

Speaking on the occasion the Prime Minister said, "India is inching towards a goal where in the village itself there will be food processing clusters and research units." He said the target in 'Blue Revolution' is to double the export of fish products and Ganga rejuvenation plan will help the people involved in the profession.

"The project has been started in 21 states and Rs 20,000 crore will be spend in the next four-five years. An amount of Rs 1,700 cr has been initiated to start the project," said the Prime Minister. As of now, the Department of Fisheries has approved Rs 1,723 crore worth of proposals for 21 states and Union Territories in phase-I under the PMMSY. Priority has been accorded for income-generating activities under the scheme.

The Prime Minister also interacted with farmers and producers involved in dairy farming and other professions, and told them that the government will arrange a tour to the Amul facility in Gujarat for the farmers to get more experience to increase production. The Prime Minister emphasized that a lot of effort is being put in to reach the beneficiaries of PMKGY and especially to the migrant laborers who have returned to their native places.

The Prime Minister said that under the Pradhan Mantri Kisan Samman Nidhi (PMKSN) 10 crore farmers have benefited out of which 75 lakh farmers are from Bihar and Rs. 6,000 crore has been deposited in their accounts.

The PMMSY is a flagship scheme for focused and sustainable development of the fisheries sector with an estimated investment of Rs 20,050 crore, as a part of the 'Atmanirbhar Bharat' package. This is the highest-ever investment in the fisheries sector. Of this, an investment of about Rs. 12,340 crore is proposed for beneficiary-oriented activities in Marine, Inland fisheries and Aquaculture while about Rs 7,710 crore are proposed for Fisheries Infrastructure.

The PMMSY aims at enhancing fish production by an additional 70 lakh tonnes by 2024-25, increasing fisheries export earnings to Rs. 1,00,000 crore by 2024-25, doubling the income of fisheries and fish farmers, reducing post-harvest losses from 20-25 per cent to about 10 per cent and generation of additional 55 lakh direct and indirect gainful employment opportunities in the fisheries sector and allied activities, said the government in a release on Wednesday.

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SOLAR ENERGY TECHNOLOGY IN AGRICULTURE- NEW WAY OF SAVING OF LIGHT ENERGY

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"Agriculture technology is changing and improves rapidly. Farm machinery, farm building, production facilities and productivity are constantly being improved. The solar resource is enormous. Agriculture need as energy important input production. Solar energy can be used directly for heating, lighting homes for generating electricity, hot water heating for diary operations, solar cooking, industrial and commercial uses. Solar energy technology increases farmer's income and improving the living conditions of peoples by reducing labour intensity and reducing poverty. Solar energy can be used in agriculture in a number of ways, saving money, increasing self-reliance, and reducing pollution, cut a farm's electricity bills, low maintenance cost, diverse application and technology development. The costs of solar energy are lower than other electrical or mechanical power. However, this is one of the cleanest, environment friendly and reliable sources of energy"

Introduction

The sun produces solar energy in the form of solar radiation. The country's solar energy installed capacity was 35,122 MW as of 30 June 2020. India is scheduling to produce 100 GW of solar power by 2022. In India the major solar energy producing state is Karnataka (5,328 MW). Bhadla solar park is the world largest solar park in India. It is spread over a total area of 10,000 acres (40 m^2) with total installed capacity. Photovoltaic capacity of Rajasthan has reached 2289 MW making it India one of the most solar development state because average day light varies from 10.5 (December) to 13.8 hours (July). Solar technology can be mainly classified as:

Active solar technology

Active solar technology included the use of photovoltaic systems, concentrated solar power and solar water heating to utilize the energy. Active solar energy is directly consumed in such as drying clothes and warming of air.

Passive solar technology

Passive solar technology refers to the harnessing of the sun energy without the use of mechanical devices. Using south facing windows to provided natural lighting and heating for your house.

Types of solar energy technology

There are the two main types of solar energy technology:

1. Photovoltaic solar energy (PV) directly converted sunlight into electricity, using a solar technology based on the photovoltaic effect, by which certain material are able to absorb light particles (photons) and release electrons that generating an electric current.

2. Concentrating Solar Thermal Power (CSP) system use mirrors to reflected & concentrates sunlight onto receivers that collected solar radiation & convert it to heat, which can then be used to produce electricity & store for later use. Concentrating solar thermal power is used primarily in very large power plants.

Composition

The sunlight that reached the ground consists of nearly 50 % visible light, 45 % infrared radiation and minor amounts of ultraviolet light and other forms of electromagnetic radiation (EMR). This radiation can be converted either into the thermal and electrical energy. Mainly two types of devices are used to receive solar energy and convert it into thermal energy.

1. **Flat- plate collectors:** This device is used to hot water heating and house heating.

2. **Concentrating collectors:** Concentrating collectors are used when higher temperatures are need (Fresnel type solar energy). That is, where they reflect and concentrate sunlight from a wide area.

Solar energy can be converted to electricity using photovoltaic solar cell. This converted energy is used to provide electricity for cameras, water pumps lighting etc.

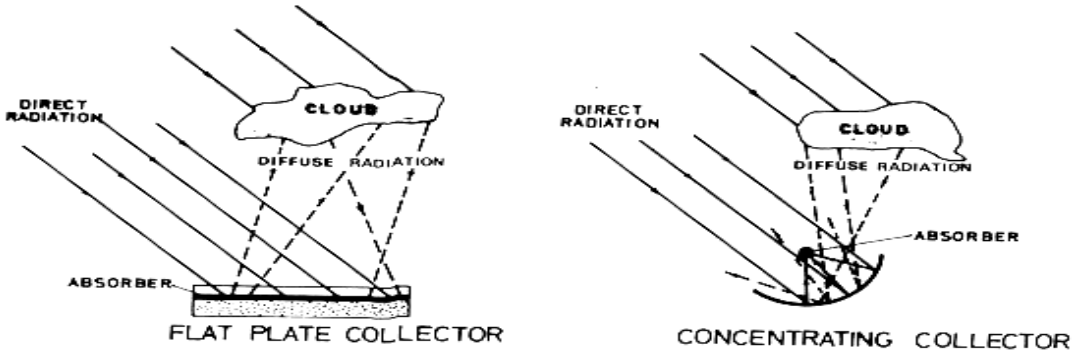


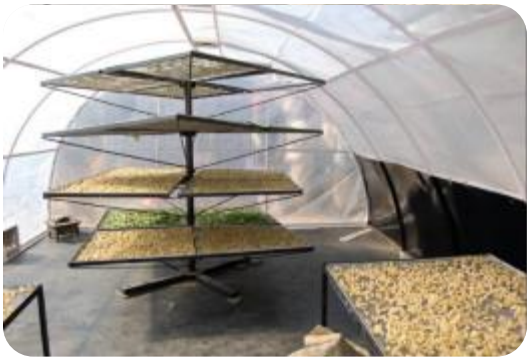
Fig: 2. The use of solar radiation by flat plate and concentrating collectors
Sources: www.fao.org

Solar panel subsidy cost

The central government pays a 30 % subsidy for the system to states in general categories and according to ministry of new and renewable energy (MNRE) 30 to 90 % subsidy on benchmark capital cost is available for all consumers. For special state like such as Uttarakhand, Sikkim, Himachal Pradesh, Jammu & Kashmir subsidy of up to 70 %is given by the central government.

The Himachal Pradesh government has approved its "Saur Sinchayee Yojana" programme, worth Rs. 2.24 billion to provide agricultural solar pumping sets to farmers in the state. The programme, which is aimed at promoting renewable energy and expanding the usage of solar power in irrigation, is expected to provide around 5,850 solar pumps to the farmers.

Importance of solar energy in agriculture



Solar Energy using in different ways

- **Crop and grain drying**

Using the sun dry crops and grains is one of the oldest and most widely used applications of solar energy

technology in agriculture. The different types of solar dryers- Natural open air dryers, Direct & indirect solar dryers.

- **Solar cooker & solar oven**

It is a device which uses the energy of sunlight to heat drink and foods to cook.

- **Solar water heating**

Solar water heating system can be used in livestock, dairy and other agriculture operations that have significant water heating requirement.

- **Greenhouse heating**

Agriculture application of solar energy is greenhouse heating. A solar green house has thermal mass to collect and store solar heat energy and insulation to retain this heat for using during the night and on clouding days.

- **Sole water pumping**

Photovoltaic system must be the most cost effective and income generating option in locations where there is no existing power line.

Conclusion

Solar is a safe alternative:

- Importance to environment protection
- Solar is clean and safe
- Prevents destruction of habitats
- Combats climate change
- Social and economic benefits
- Small & decentralized electricity sources
- Cheap and reliable energy sources

  In agriculture uses energy lighting on the farm, low maintenance costs, production, as well as irrigation and post-harvest strategies. Adoptions of solar energy technology are beneficiary to the farmers.

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REJUVENATION: A TECHNIQUE FOR REVIVING OLD DECLINING ALMOND ORCHARDS

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"Trees with uneven shape and size are difficult to manage which results in poor yield in following years, as the lower branches in phased manner are progressively converted in to infertile regions and also causes marked decline in quality and quantity of produce. This results in economically non-viable and non-remunerative orchards."

Introduction

Canopy management especially in perennial fruit crops has both seasonal and lifelong developmental patterns. Trees with uneven shape and size are difficult to manage which results in poor yield in following years, as the lower branches in phased manner are progressively converted in to infertile regions and also causes marked decline in quality and quantity of produce. This results in economically non-viable and non-remunerative orchards. Research findings in recent past has shown rapidly declining productivity of old orchards present in abundance has become a serious problem for orchardists, traders as well as scientists. In fruit crop presently 30-35 per cent of old plantations are derived from seedling origin, non-descript

material of poor genetic potential which has made orchard senile. Major causes are overcrowded, intermingling of large branches with meagre foliage, cause poor light interception and utilization by photosynthetic surface to the growing shoots within the canopy.

To minimize this burning problem of unproductive/uneconomic orchards is increasing, subsequently large scale uprooting and replacement with new plantations is a long term and expensive way. These senile/exhausted trees can be successfully rejuvenated by severe heading back to initiate new growth of shoots that began to bear good crops in following years.

Almond is an important temperate nut regarded as a, low volume and high value crop, fruit mostly cultivated in the temperate and Mediterranean areas of the world, a rich source of protein (21.0 g/100g), vitamin E (24.0 g/100g) and fatty acids (Chen *et al.* 2006). This prime nut crop has also been in cultivation in India for very long, but both production and productivity are very low (0.73t/ha&3.0 t/ha in advance countries) by Varma and Ahemad (2009). Research findings have revealed that domestic demand of nut is rapidly increasing every year as general population has become more aware about the high nutritive value from health consciousness point of view and increased purchase power. Consequently, India is importing large amounts of almonds from United States, Australia, Hong Kong, Italy, Germany, Turkey and Afghanistan (International Trade Centre, 2020) to fulfill local demands.

In present day context, Jammu and Kashmir, Himachal Pradesh and Uttarakhand are the prime almond producing area in India and the cultivation has also began in Arunachal Pradesh. India has wide range of agro-ecological conditions which allowed cultivation of several fruit types, same is true for almond cultivation for production of quality almonds at low cost, old, unproductive genetic stock are few factors responsible for low productivity. With these limiting factors India has failed to meet its domestic demand so compelled to imports large quantities of almond from foreign countries in exchange of substantial amount of Indian currency. Numerous factors contribute to low productivity are summarized briefly as majority of the plantations are of non-descript type (seedlings),low yield potential usually with poor genetic potential, very old and senile plantations all achieved and surpassed their economic bearing time, grown on marginal areas, very poor orchard and soil management, abiotic stresses and lack of proper irrigation, poor nutrition and canopy management, no standard plantation, dense and overcrowding of trees and inadequate floor management have lead to low yield and poor quality of nuts.. A survey work in almond growing areas of Kashmir indicated lack of irrigation in the orchards, inappropriate fertilization, no canopy management in old trees, majority of them infested with various diseases and insect pest,

also improper or no pruning and training for extended time period has resulted in low yield of poor quality nuts. To overcome this problem there is need of efficient rejuvenatio n through top working with high yielding cultivars and a complete package of orchard management scheme to rejuvenate orchards.

Light limb removal

Second level limb removal

Pasting of cut portion

Sprouting in cut plants

Need of Rejuvenation

The productivity of almond in India is much below its expected potential, which understands ably attributed to the prevalence of old and unproductive orchards of seedling origin with no varietal identity. To overcome poor yield and quality of almond though large potential for its production exits, urgent need to initiate fresh plantations with new elite cultivars plantation mainly in the non -traditional areas suitable for its plantation would take 8-10 years to accomplish commercial bearing, other approach is to revive orchards through rejuvenation, is more effective horticultural technique to improve yield potential of the old senile orchards. This technique has potential to reduce production gap in very short time compared to production from fresh plantations. Rejuvenation is promising technique to revitalize old and senile type sand transform them into productive, with the advantage that rejuvenated trees commence commercial bearing earlier as the old trees are well established in the soil condition and developed resistance could be made by effective use of this technique. Trees of tribe Pruneae, almond and peach in particular respond to rejuvenation. Though almond has relatively long juvenile period than other stone fruits, replantation may affect socio-economic conditions and cause varying land use plans could adversely influence the environment as well as acreage. Almond has strong renewable potential, if

done carefully and skillfully fruitful results are accomplished with high degree of greater magnitude. Hence rejuvenation is carried out with the following objectives:

1. To remodify low yielding and inferior quality old trees into better and high yielding types.
2. Improved inter row light interception.
3. Promote plants survival under limiting soil and climatic condition.
4. Reduce/restrict damage to plant parts and high disease(s) impact.
5. Enhance tree vigor and economic age of old tree.
6. Finally enhance orchard income with reduced costs.

Ways to rejuvenate senile orchards

In nut shell objective is accomplished in three major steps, pruning, top working and after care of pruned trees.

A. Pruning Technique

Precise removal of unproductive plant parts to establish good balance between vegetative and reproductive growth, helps in invigoration of plants and make trees free of pests and diseases. Pruning comprise of severe heading back especially of uneconomical old dying (almond, stone fruit trees) trees with only major scaffold branches during dormant period(January/February) to enhance production of new shoots from below or at cut portion permit development of new tree crown. A well-formed open tree top (umbrella like) frame works with laterals 4-5 well developed on main branches growing outward must form the basic tree frame work. Further first order branches are headed about 70-80 cm from base, all crisscrossing, intermingling, overcrowding, dried and diseased branches are totally removed during January and February. New growth is then subjected to selective pruning and trained in specific defined way.

Top grafting must be done in February-March with scions of desired variety from one year old water shoots growing on scaffold branch. For tree openness select three/four shoots per branch allow them to grow unhindered especially those growing outwards, all other shoots removed. Carefully, remove shoots from inner regions and re-establish a well-developed open and strong canopy. New shoots when 50- 70 cm, budding is done with these buds (July-August) obtained from (5-6 months old shoots) rejuvenated pruning.

B. Top working

Replacement of inferior cultivar with superior type usually done by top budding/ grafting. Orchards without pollinizers are provided with cross compatible cultivars which are either budded/grafted on senile trees (commercial cvs. Non Pareil, IXL, Pranyaj and Drake or a cultivar of stone fruits) carry the role of good pollinizers, ultimately assist in high

orchard yield efficiency associated with better quality. To limit the problem of low produce few selected types with no incompatibility phenomena are top grafted on pruned trees, done by whip/ tongue grafting in month of February- March on shoots or top budding using 'T' or shield budding method on new shoots in July- August. Frequent and timely de-shooting in budded/grafted parts is necessary to force scion bud/ shoot. New scion growth must be strong to avoid their breakage at union point by any source wind or animals.

C. Aftercare

i. Manuring

Trees when effectively pruned need high level of orchard management to initiate new growth, survival and formation of open form i.e., ideal canopy. Fertigation above standard doses is given to each pruned tree, half dose of nitrogen, full dose of DAP and MOP given in January-February and remaining half of nitrogen in May end. For efficient water use, provisions of water harvesting structures, cup and saucer, trench, full moon or half-moon types are prepared for rain water harvesting. Mulches are used to conservation soil moisture in tree basin. Black polythene or straw mulch structures are very effective. To avoid infections, cut portions are covered with Chaubattia paste (Give composition).Numerous experimentation on rejuvenation have given positive results by converting senile orchards into productive forms. In a short time of 2-3 years trees are converted into productive and superior types, and produce effectively for about for a period of another 10 to 15years.

ii. Inter Cropping

Tree(s) pruning give large open space and higher availability of sunlight, inter space used to grow different crops saffron, pulse crops or vegetables etc. provide additional income to the farmer effectively compensate yield loss following moderate to severe pruning.

iii. Cultivation

Eliminate wild shrubs and grasses from the land between the trees, helps to prevent surface soil becoming crust like which interferes with irrigation and growth of roots. Manures, fertilizers, green manure and other organic matter must be mixed well with the soil by means by regular cultivation. This facilitates soil aeration which kills number of insect pests and other harmful organisms present in the soil.

iv. Irrigation

Very important component both for vegetative and fruit production. Irregular irrigations cause fruit drop, splitting and other several disorders. Manure application is followed by irrigation so that nutrients are readily absorbed. Raise soil at tree base restrict

water contacted with bark. Areas with limited rainfall or water supply effort should be made to conserve available moisture conservation by mulching the tree basins.

v. Drainage

Prolonged standing of water creates poor soil aeration and led roots to die which are not be replaced by new ones. Under such conditions make effective steps of drains etc. to avoid interruption in the physiological processes of the plants.

vi. Thinning and filling of gaps

Overcrowded trees should be thinned to proper distance. Though it might create a loss of some trees, but greatly benefit those plants that are left behind, but not useful to see many trees missing. Gaps after removal of old dying plants must be filled by trees of superior types. Plant new types in a specific system of planting.

vii. Control of pests, diseases and parasites

Unhealthy, diseased parts are cut off and parts suitably disposed. Bark caterpillars are cleaned, mixture of carbon bisulphide and chloroform (2:1) injected in it to make plant free of pests. Nematodes seriously affected several fruit trees. Hence application of nematicides should be done immediately. Insects and pests controlled by killing weeds, disinfecting basin soil, spraying trees with insecticides and fungicides as a normal practice.

viii. Adventitious method of feeding

Old trees with weak growth can be invigorated by infusing the sap of younger seedlings into them. To have satisfactory growth of old trees many seedlings are grown near tree trunk, when two/ three years old, are headed back at 2′ to 3′ from the ground, cut ends made as a wedge, 2″ forced into the bark of the tree. Both surfaces nailed covered by grafting material. In few days, seedlings are united to the tree serve as a feeder. Practiced successfully in mango, citrus, apple also in other fruit plants, use when collar region has damaged.

ix. Repairing of wounds

Any wound on the tree if allowed to remain exposed may attract the organisms of diseases from the surrounding atmosphere. So they should be properly treated to encourage healing. If wound is small, simply painting with colour or any other disinfectant. If wounds is big on the trunk, grafting called- 'bridge grafting' is done.

x. Wind breaks and fencing

Wind breaks are necessary to limit adverse effect of winds. Best and most effective system is double rows of tall trees, placed alternatively. Tree species sheesham (*Dalbergia sissoo*), carambola (*Averrhoa carambola*), jamun (*Syzygium cumini*), samal (*Bombax*

ceiba), mulberry (*Morus alba*) and *Terminalis arjuna* are highly effective. Orchard area should be fenced with barbed wire along with suitable protective and economical hedge.

Conclusion

In horticulture orchard establishment is a very long venture yields when reduced drastically rejuvenation is needed:

- Helps to restore production level of old unproductive, diseased orchards in shortest possible time than any other techniques.
- Helps to restore production potential and tree canopy architecture.
- Sustaining the life of farmer without affecting his economy to a great extent.

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CLIMATE CHANGE AND FOOD SAFETY: A REVIEW

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"Climate is the average weather conditions over a long period of time and is rapidly changing which causes unprecedented impacts on our ecosystems, and that change is progressing faster than any seen in the countless amount of time. The climate record also includes extreme values such as record high temperatures or record amounts of rainfall. Impact of climate change does not only seen in social and environmental determinants of health such as clean air, safe drinking water, nutrition and food security, but also effect upon the food production systems and food safety."

According to the Intergovernmental Panel for climate change (IPCC) 4th assessment report, climate is altering disaster risk patterns in three main ways:

a. The intensity and ferocity of the extreme events is increasing be it extreme temperatures, sudden heavy rainfall, increased frequency and intensity of droughts and floods.

b. The areas affected by natural hazards are increasing.

c. Increase in the threat of certain groups and certain economic activities due to extreme climatic events.

Climate change has an intense impact on the availability and the safety of the food we consume which is expected to be result in a significant increase in risk to public health by its effects on bacteria, viruses, parasites, and chemicals & toxins linked to food borne diseases. Other potential impacts of climate change includes emergence of new microbial hazards due to changes in the types of crop cultivated and the associated agricultural practices for crops as well as increase in antibiotic-resistant pathogens due to greater use of veterinary medicines in farm animals. Climate change and its variability may have an impact on the occurrence of food safety hazards at various stages of the food chain.

India is likely to bear the worst of the warming planet as it is in tropical location and having lower level of income. Climate change affected the agriculture and food production results declining of major crops by up to 25 per cent. According to IPCC report, in coming year food security will stand threatened due to climate change coupled with increasing demands of the rising population in the country. The global population is expected to increase up to 8.5 billion by 2030 and 9.7 billion by 2050. According to United Nation's World Population Prospects (June 2019), the population of India is projected to increase from 1.39 billion in 2019 to 1.5 billion by 2030 and 1.64 billion by 2050 (Siraj Hussain, June 2019).

There are multiple pathways through which climate related factors may impact food safety such as changes in temperature and precipitation patterns, increased frequency and intensity of extreme weather events, ocean warming and acidification, and changes in contaminants' transport pathways among others. Such incidents are more likely to occur in countries where food monitoring and surveillance systems are less substantial, therefore unable to detect environmental and chemical contamination, further increasing the risk to public health through the acute and chronic exposure to contaminants.

According to World Health Organization, 2018 report, an estimated 600 million – almost 1 in 10 people in the world – fall ill after eating contaminated food and 420,000 die every year that is expected to grow due to climate change which alter the agricultural and environment, as well as influence human, animal and pest behaviors. Climate change impact on food safety contributes to increased malnutrition, particularly in developing countries. Food safety is ensured through the implementation of adequate control measures at every step along the food chain i.e., from farm to fork. To ensure consumers play their role, it is important they are aware of the hazards associated with food and the relevant control measures.

WHO plays an important role in combating the impact of climate change on food safety by taking appropriate actions through the collaborative approach of both domestically and internationally (FAO, 2018). According to WHO, different issues require immediate attention such as preventive measures to assure food safety, inspecting and salvaging, provision for safe food and water, recognition and response to outbreaks of foodborne disease and food safety education as well as information provided to the affected populations. To prevent the countries from these impacts, safe and wholesome food is crucial for addressing widespread malnutrition as well as aspects of food safety and malnutrition is need to be considered and addressed in an effective manner.

The European Food Safety Authority (EFSA) is going to host a virtual meeting on climate change in October in which scientists have developed the way to judge possible effects of climate change on emerging risks for food safety which includes scoresheets that characterize potential impacts of climate change on food safety related issues.

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HOME REMEDY FOR IMMUNITY BOOSTING DURING CORONA TIME

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> "Home remedies have become increasingly popular as the expense and hassle of conventional medicine continues to rise. Today herbs are catching a lot of attention due to their very nature of cure: simple, no side effects, no chemicals, inexpensive, plus the ability of being able to cure yourself. This trend for resorting to home remedies is not new. In fact, they have their origin in ancient times. Traditionally, in India, plants with medicinal value, were grown in home gardens"

Immunity refers to the body's ability to prevent the invasion of pathogens. Pathogens are foreign disease-causing substances, such as bacteria and viruses, and people are exposed to them every day. Antigens are attached to the surface of pathogens and stimulate an immune response in the body. An immune response is the body's defense system to fight against antigens and protect the body.

The best part about these immunity boosting foods is that they are easily available within the premises of your kitchen. Thus, there is no need to venture out and specially purchase foods that will boost your immunity.

Citrus Fruits

Most people turn straight to vitamin C after they've caught a cold. That's because it helps build up your immune system. Vitamin C is thought to increase the production of white blood cells, which are key to fighting infections. Almost all citrus fruits are high in vitamin C. With such a variety to choose from, it's easy to add a squeeze of this vitamin to any meal. Popular citrus fruits include: Grapefruit, Oranges, Tangerines, Lemons, Limes.

Red bell peppers

Contain almost 3 times as much vitamin C as a Florida orange. They're also a rich source of beta carotene. Besides boosting your immune system, vitamin C may help you maintain healthy skin. Beta carotene, which your body converts into vitamin A, helps keep your eyes and skin healthy.

Broccoli

It is supercharged with vitamins and minerals. Packed with vitamins A, C, and E, as well as fiber and many other antioxidants, broccoli is one of the healthiest vegetables you can put on your plate.

Garlic

It is found in almost every cuisine in the world. It adds a little zing to food and it's a must-have for your health. Early civilizations recognized its value in fighting infections. Garlic may also slow down hardening of the arteries, and there's weak evidence that it helps lower blood pressure. Garlic's immune-boosting properties seem to come from a heavy concentration of sulfur-containing compounds, such as allicin.

Ginger

It is another ingredient many turn to after getting sick. Ginger may help decrease inflammation, which can help reduce a sore throat and inflammatory illnesses. Ginger may help with nausea as well. It used in many sweet desserts, ginger packs some heat in the form

of gingerol, a relative of capsaicin. Ginger may also decrease chronic pain and might even possess cholesterol lowering properties.

Spinach

It is rich in vitamin C and also packed with numerous antioxidants and beta carotene, which may both increase the infection-fighting ability of our immune systems. Similar to broccoli, spinach is healthiest when it's cooked as little as possible so that it retains its nutrients.

Yogurts

Yogurts stimulate your immune system to help fight diseases. Try to get plain yogurts rather than the kind that are flavored and loaded with sugar. You can sweeten plain yogurt yourself with healthy fruits and a drizzle of honey instead .Yogurt can also be a great source of vitamin D, so try toselect brands fortified with this vitamin. Vitamin D helps regulate the immune system and is thought to boost our body's natural defenses against diseases.

Almonds

It comes to preventing and fighting off colds, vitamin E tends to take a backseat to vitamin C. However, this powerful antioxidant is key to a healthy immune system. It's a fat-soluble vitamin, which means it requires the presence of fat to be absorbed properly. Nuts, such as almonds, are packed with the vitamin and also have healthy fats. Adults only need about 15 mg of vitamin E each day. A half-cup serving of almond.

Sunflower seeds

Sunflower seeds are full of nutrients, including phosphorous, magnesium, and vitamins B-6 and E. Vitamin E is important in regulating and maintaining immune system function. Other foods with high amounts of vitamin E include avocados and dark leafy greens. Sunflower seeds are also incredibly high in selenium. Just 1 ounce contains selenium that the average adult needs daily. Mostly performed on animals, have looked at potential to combat viral infections such as swine flu (H1N1).

Turmeric

Turmeric as a key ingredient in many curries. This bright yellow, bitter spice has also been used for years as an anti-inflammatory in treating both osteoarthritis and rheumatoid arthritis. High

concentrations of curcumin, which gives turmeric its distinctive color, can help decrease exercise-induced muscle damage. Curcumin has promise as an immune booster and an antiviral.

Green

Green and black teas are packed with flavonoids, a type of antioxidant. Green tea really excels is in its levels of epigallocatechin gallate (EGCG), another powerful antioxidant. EGCG has been shown to enhance immune function. The fermentation process black tea goes through destroys a lot of the EGCG. Green tea, on the other hand, is steamed and not fermented, so the EGCG is preserved. Green tea is also a good source of the amino acid L-theanine. It may aid in the production of germ-fighting compounds in your T cells.

Papaya

It is another fruit loaded with vitamin C. Papayas also have a digestive enzyme called papain that has anti-inflammatory effects. Papayas have decent amounts of potassium, magnesium, and folate, all of which are beneficial to your overall health.

Kiwis

Kiwis are naturally full of a ton of essential nutrients, including folate, potassium, vitamin K, and vitamin C. Vitamin C boosts the white blood cells to fight infection, while kiwi's other nutrients keep the rest of your body functioning properly.

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NANOTECHNOLOGY IN AGRICULTURE FIELD FOR BETTER PRODUCTIVITY AND YIELD OF THE CROP

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"Nanotechnology is widely used in agriculture product that protect plants and monitor plant growth and detect diseases and also increased the efficiency of plants to use water, pesticides and fertilizers. Agriculture played vital role in the economy of many countries and the only provider of human food. So there is necessity to take a nanotech knowledge in agriculture."

Introduction

From the past few decades the world has substantially seen an exponential increase in the population. This has increased productivity and manufacturing demands and ultimately has affected the up rise one of the agriculture sector of the entire globe. The U.N. analysis has estimated that there shall be a rise to 8.5 billion people by 2050. Agriculture region faces a lots of challenges such as Crop yield stagnation, Declining organic matter, Multi nutrient deficiencies, Climate change, Shrinking arable land unit and water availability, Resistance to GMOs. The economic forum has stated that the resources on the earth are limited, an optimum use of available technology and new modifications will enhance the productivity

to three folds, and this has popularized the Nanotechnology in sectors of livelihood and agriculture. Due to its miniature dimension (1-100nm) and unique properties such as high surface area, high reactivity, tunable pore size and particle morphology, Nanotechnology enables a wide spectrum of novel application in the field of biotechnology and agriculture industries. With this employing new technology interventions which transform the agriculture sector with dealing with molecular management of diseases, rapid disease detection, nutrient absorbent and enhance the efficiency with low cost and improve the agriculture crop quality.

Applications

Nanotechnology has shown various applicability in the field of agriculture are as follows:

1. Nano fertilizer

For the production upto 35 to 40 % of production of crop improvement Nanofertilizer played a key role in the agriculture sector .To avoid the problem of eutrophication and increase the nutrient use efficiency Nano fertilizer is the best tool for agriculture region. It also fulfills the requirements of the crop by releasing the adequate amount of nutrients which is required by the crop. When we differentiate the cost and efficiency and time consuming activity the reports state that is better than ordinary fertilizer

2. Nano food

During cultivation, production or packaging of food, Nanotechnology tools are used which ensure the safety of food products and creates a healthy food culture. Through selected additives it enhance the nutrient quality.

3. Crop improvement

For the crop improvement, Gene therapy is used for plants: use of 3-nm of nanomaterial i.e. mesoporous sicica which, incorporates foreign DNA into cells, for better crop product and yield.

4. Seed technology

Seed is most important input determining. For the productivity of any crop seed is considered as important determine product. For sowing seeds are tested for germination and distributed to farmers. Due to rainfed conditions seed is hardly reproduced in the field. For improving the germination of rainfed crops, carbon nanotube is used for improving the germination of tomato seeds through better permeation of moisture.

5. Water management

For the treatment of surface water, groundwater and wastewater contaminated which get toxicated by metal ions organ by toxic metal ions, organic and inorganic solutes and

microorganisms. For this nanotechnology is used in this technique through nanofibre membrane. It also helps in determining pathogens in water rapidly and reliable.

6. Nano-pesticide

Present of pesticides in the initial phase of crop growth helps in lowering down the pest population for longer period of time. For the control of pest and to prevents accumulation of residues in soil. Nano encapsulation is the effective mechanism which helps in producing a formulation of insecticides, fungicides or nematicides which helps for enhancing the better quality and yield of crop.

7. Nano-scale carriers

For the efficient delivery of fertilizers, pesticides, herbicides and plant growth regulators nanoscale carriers are used which include encapsulation, entrapment, polymers and Dendrimers and these mechanisms are efficient in delivery and better storage.

8. Biosensors to detect nutrients and contaminants

For the Protection of the soil health the environment requires rapid, sensitive detection of pollutants and pathogens with molecular precision, for this Nano biosensors tool is used to detect nutrient and contaminants in the soil which improves soil quality.

Conclusions

Nanotechnology is widely used in agriculture product that protect plants and monitor plant growth and detect diseases. It is also increased the efficiency of plants to use water, pesticides and fertilizers. Agriculture played vital role in the economy of many countries and the only provider of human food. So there is necessity to take a nanotech knowledge in agriculture. Collaborative research among scientist explore the use of nanomaterial which is crucial for developing more efficiency, low-cost and environment friendly products. More knowledge at the field level will proportionally increases the large scale implementation of nano-tool strategies.

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FARMER PRODUCER ORGANIZATIONS: INNOVATIVE INSTITUTIONS FOR UPLIFTMENT OF SMALL FARMERS

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> "There are different forms of business organizations. The company form of business organization is one of them. A producer company is one of the said company form of business organization. These types of companies work like co-operative societies and are mainly registered in rural areas by the producers. These companies are incorporated to develop the rural economies and bridge the gap between industry and agriculture, rural and urban area and industry and labour, etc. These companies are basically for the promotion of rural economies."

Farmers Producer Organizations (FPO) are groups of farmers coming together on the basis of principle of membership, to pursue specific common goal and developing farming as economic activities that benefit their members and maintaining relations with partners working with them. The main aim of FPO is to ensure better income for the farmers through an organization of their own. Small and marginal farmers do not have the volume individually

(both inputs and produce) to get the benefit of economies of scale. Besides, in agricultural marketing, there is a long chain of intermediaries who very often work non-transparently leading to the situation where the producer receives only a small part of the value that the ultimate consumer pays. Through group formation, the farmers can avail the benefit of economies of scale. They will also have better bargaining power vis-à-vis the bulk buyers of produce and bulk suppliers of inputs.

Essential Features of FPO

1. It is formed by a group of farmers for farm activities.
2. It is a registered body and a legal entity.
3. Farmers are shareholders in the organization.
4. It deals with business activities related to the agricultural produce/product.
5. It works for the benefit of the member farmers.
6. A part of the profit is shared amongst the farmers.
7. Rest of the surplus is added to its owned funds for business expansion.

Ownership of FPO

The ownership of the FPO is with its members. It is an organization of the farmers, by the farmers and for the farmers. One or more institutions and/or individuals may have promoted the FPO by way of assisting in mobilization, registration, business planning and operations. However, ownership control is always with members and management is through the representatives of the members.

Important Activities of FPO

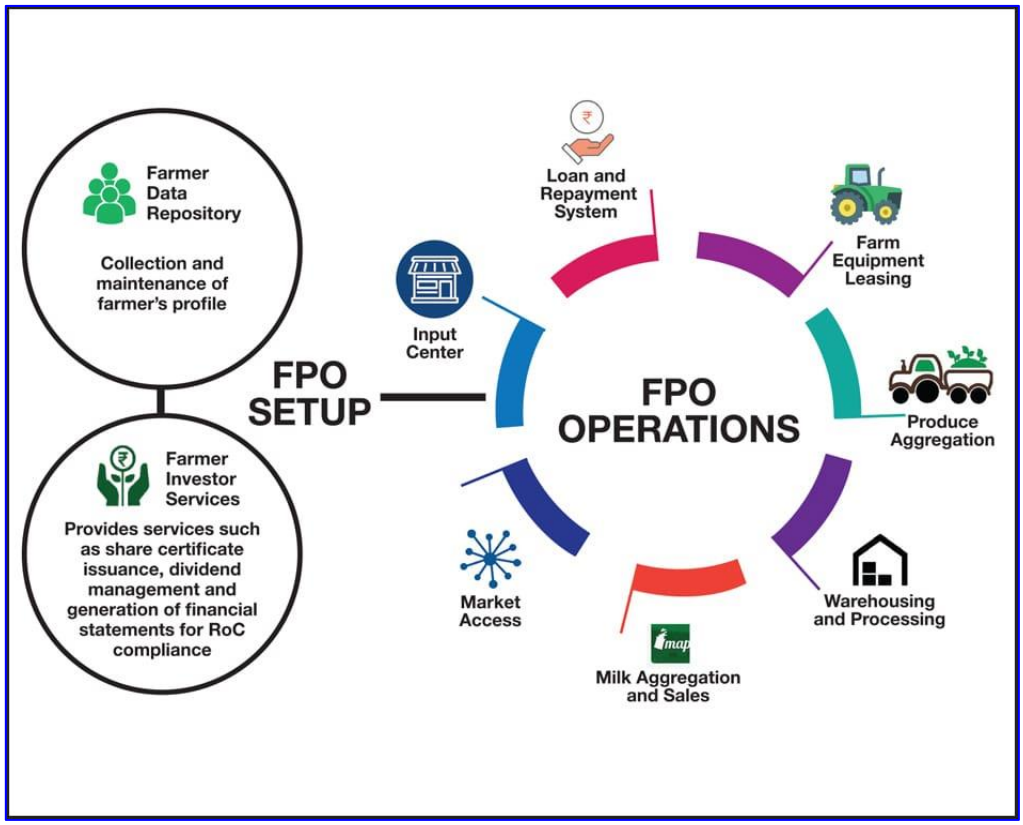
The farmers have skill and expertise in producing farm produce. However, they generally need support for marketing of what they produce. The FPO will basically bridge this gap. The FPO will take over the responsibility of any one or more activities in the value chain of the produce right from procurement of raw material to delivery of the final product at the ultimate consumers' doorstep.

In brief, the FPO could undertake the following activities:

1. Procurement of inputs.
2. Disseminating market information.
3. Dissemination of technology and innovations.
4. Facilitating finance for inputs.
5. Aggregation and storage of produce.
6. Primary processing like drying, cleaning and grading.

7. Brand building, Packaging, Labelling and Standardization.
8. Quality control.
9. Marketing to institutional buyers.
10. Participation in commodity exchanges.
11. Export.

Advantages of FPO



FPO will support the members in getting more income by undertaking any/many/all of the activities listed above. By aggregating the demand for inputs, the FPO can buy in bulk, thus procuring at cheaper price compared to individual purchase. Besides, by transporting in bulk, cost of transportation is reduced. Thus, reducing the overall cost of production. Similarly, the FPO may aggregate the produce of all members and market in bulk, thus, fetching better price per unit of produce. The FPO can also provide market information to the producers to enable them hold on to their produce till the market price become favourable. All these interventions will result in more income to the farmers.

Support for Promotion of FPO

NABARD, SFAC, Government Departments, Corporates and Domestic & International Aid Agencies provide financial and/or technical support to the Producer Organization Promoting Institution (POPI) for promotion of the FPO. Each agency has its own criteria for selecting the project/promoting institution to support.

Steps in Establishing FPO

1. Understanding the village community
2. Identifying potential leaders in the community

3. Talking to the identified leaders and seeking cooperation from other agencies
4. Helping community leaders to call community meetings
5. Nominating core group leaders to develop the FPO
6. Developing an organizational structure and management for the FPO
7. Motivating groups for action
8. Implementing selected programmes
9. Regular follow up through monitoring and evaluating the progress of FPO

The Government of India has approved formation of ten thousand new FPOs during 2019-20 to 2023-24 and granted Rs.5000crores for promoting these organizations. These FPOs will be registered under Indian Company Act. FPOs working in plain areas should have at least 300 farmers as member to get benefit of above mentioned granted funds. Similarly, FPOs in hilly areas should have at least 100 members for realizing this benefit.

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BEE PRODUCTS AND THEIR USES

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"Besides providing the treasured pollination services, honeybees gift some valuable merchandises to the mankind. As the name indicates, the first and foremost gift by honey bee is honey; other products which the honey bee provides include beeswax, pollen, royal jelly, propolis and bee venom."

i) Honey

This is the sweet viscous juice collected from beehives. It is found in the cells of the honeybee comb. Ripe honey is usually found in sealed combs and can be kept indefinitely. Unsealed honey is not mature (ripe) and therefore ferments shortly after it is harvested.

ii) Beeswax

This is produced from the bee's own body during the warm period of the day. The bee uses wax to build the comb cells in which their broods are reared. Honey and pollen are also stored in the cells. A bee consumes 8 to 15 kilograms of honey in order to produce one kilogram of bee wax. In most countries beeswax collection is not known because people do not know that local bee wax is useful.

iii) Propolis

This is a resinous material collected by bees from leaves and buds of certain trees. It is greenish black in colour and gummy in consistence. Bees use propolis in the following ways:

- To fill cracks in their hives.
- To make the hive waterproof.
- To glue the top bars to the hive body.
- To strengthen the thin borders of their comb.
- Propilis is an embalming material used to cover any dead hive intruder that bees cannot remove from the hive.
- Propolis has several pharmacological properties, for example it is used in preparations to treat some skin diseases.
- Propolis is also marketable abroad.

iv) Pollen

This is collected by bees and sorted in comb cells. It is fed to the brood in the larval stage. Pollen can be collected from beehives by the use of pollen traps that remove the pollen pellets from the pollen baskets (Corbucular) on the hind legs of the foraging bees. Pollen can be collected from beehives by beekeepers and saved for feeding to the bees when there are no plants in flower to produce pollen for the bees. In developed countries, pollen is used in some expensive dietary supplements because of its medicinal properties.

v) Royal Jelly (Bee milk)

This is used by bees to feed the queen bee and the young larvae less than three days old. It is secreted from the glands

of the 5 – 1 day old worker bees. Studies show that royal jelly is a good source of vitamin B. It is also thought to have medicinal value like pollen. It is therefore used in certain expensive preparations.

vi) Bee venom

This is used by bees as a defensive weapon to protect their territory. Bees are naturally embraced with this venom. The venom has two medical uses, namely:

- As a desensitizer for those who are allergic to bee stings.
- In the treatment of arthritis. It is applied directly or by injection.

vii) Pollination

The most important service bees render to mankind is the pollination of fruit crops. It has been stated that the value of the bees in pollination exceeds by 10 – 20% times their value in the production of honey and beeswax.

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WHAT IS FALL ARMYWORM (FAW) ??

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"It is causing significant damage to maize crops and has great potential for further spread and economic damage. The fall armyworm is a strong flier, and disperses long distances annually during the summer months"

Introduction

Fall armyworm is native to tropical and subtropical regions of the Americas. In 2016 it was reported for the first time in Africa, where it is causing significant damage to maize crops and has great potential for further spread and economic damage. It normally overwinters successfully in the United States only in southern Florida and southern Texas. The fall armyworm is a strong flier, and disperses long distances annually during the summer months. It is recorded from virtually all states east of the Rocky Mountains; however, as a regular and serious pest, its range tends to be mostly the southeastern states.

In 2016 it was reported for the first time in West and Central Africa, so it now threatens Africa and Europe. In India first reported in maize fields of Gujarat.

In Maharashtra, FAW was first detected on August 29, 2018, in a maize field at Tandulwadi village in Solapur district by farmer Ganesh Babar.

In Tamil Nadu, FAW has been confirmed in sugarcane crops in two districts, entomologists visited Erode and Karur districts and have confirmed the presence of *Spodopetra frugiperda*. They also assessed the levels of damage to crop. Bakshi Ram, director of the Coimbatore-based ICAR-Sugarcane Breeding Institute, stated in his letter to the State Directorate of Agriculture in December 2018.

In January 2019, Chhattisgarh became the latest state to report the infestation of Fall Armyworm (FAW). As *Down To Earth* (DTE) reporter travelled across Bastar, a district ravaged by the decades old bloodbath between the Maoists and the security forces, the insect emerged as the focal point of most conversations. In Palari village, the American keeda has damaged the entire maize crop.

FAW infestation has spread from Karnataka to all southern states; then to western Maharashtra and Gujarat; and now to eastern states. Besides advancing fast, the pest is also attacking new crops. Though it is being detected mostly in maize crops a preliminary calculation estimates it has affected nearly 170,000 hectares (ha) of maize crops there have been reports from states where it has infested paddy, sugarcane and sweet corn. Maize is the third most important cereal crop in India after rice and wheat.

Life Cycle

The life cycle is completed in about 30 days during the summer, but 60 days in the spring and autumn, and 80 to 90 days during the winter. The number of generations occurring in an area varies with the appearance of the dispersing adults. The ability to diapause is not present in this species.

Egg

The egg is dome shaped; the base is flattened and the egg curves upward to a broadly rounded point at the apex. The number of eggs production per female averages about 1500 with a maximum of over 2000.

Figure. Egg mass of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

Larvae

There usually are six instars in fall armyworm. Young larvae are greenish with a black head, the head turning orangish in the second instar. In the second, but particularly the third instar, the dorsal surface of the body becomes brownish, and lateral white lines begin to form. In the fourth to the sixth instars the head is reddish brown, mottled with white, and the brownish body bears white subdorsal and lateral lines. Elevated spots occur dorsally on the body, they are usually dark in color, and bear spines. Duration of the larval stage tends to be about 14 days during the summer and 30 days during cool weather.

Figure. Newly hatched larva of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

Figure. Mature larva of the fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

Pupa

Pupation normally takes place in the soil, at a depth 2 to 8 cm. If the soil is too hard, larvae may web together leaf debris and other material to form a cocoon on the soil surface. The pupa is reddish brown in color, and measures 14 to 18 mm in length and about 4.5 mm in width.

Adult

The moths have a wingspan of 32 to 40 mm. In the male moth, the forewing generally is shaded gray and brown, with triangular white spots at the tip and near the center of the wing. The forewings of females are less distinctly marked, ranging from a uniform grayish brown to a fine mottling of gray and brown. The hind wing is iridescent silver-white with

Figure. Typical adult male fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

Figure. Typical adult female fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

a narrow dark border in both sexes. Adults are nocturnal, and are most active during warm, humid evenings.

Host Plants

This species have a very wide host range, with over 80 plants recorded, but clearly prefers grasses. The most frequently consumed plants are field corn and sweet corn, sorghum, Bermuda grass, and grass weeds. Larvae are defoliate the preferred plants, acquire an "armyworm" habit and disperse in large numbers, consuming nearly all vegetation in their path. Field crops are frequently injured, including alfalfa, barley, Bermuda grass, buckwheat, cotton, clover, corn, oat, millet, peanut, rice, ryegrass, sorghum, sugarbeet, Sudan grass, soybean, sugarcane, timothy, tobacco, and wheat. Among vegetable crops, only sweet corn is regularly damaged, but others are attacked occasionally. Other crops sometimes injured are apple, grape, orange, papaya, peach, strawberry and a number of flowers.

Nature of Damage

Figure. Corn leaf damage caused by the fall armyworm, *Spodoptera frugiperda* (J.E. Smith).

Larvae cause damage by consuming foliage. Young larvae initially consume leaf tissue from one side, leaving the opposite epidermal layer intact. By the second or third instar, larvae begin to make holes in leaves, and eat from the edge of the leaves inward. Feeding in the whorl of corn often produces a characteristic row of perforations in the leaves. Larval densities are usually reduced to one to two per plant when larvae feed in close proximity to one another, due to cannibalistic behavior. Older larvae cause extensive defoliation, often leaving only the ribs and stalks of corn plants, or a ragged, torn appearance. Larvae also will burrow into the growing point (bud, whorl, etc.) destroying the growth potential of plants or clipping the leaves.

Management

Farmers need significant support to manage FAW sustainably in their cropping systems through Integrated Pest Management (IPM) activities.

Sampling: Moth populations can be sampled with blacklight traps and pheromone traps. Pheromone traps should be suspended at canopy height, preferably in corn during the whorl stage.

Insecticides

Insecticides are usually applied to sweet corn in the southeastern states to protect against damage by fall armyworm, sometimes as frequently as daily during the silking stage. Insecticides may be applied in the irrigation water if it is applied from overhead sprinklers. Granular insecticides are also applied over the young plants because the particles fall deep into the whorl.

Cultural techniques

The most important cultural practice, employed widely in southern states, is early planting or early maturing varieties. Early harvest allows many corn ears to escape the higher armyworm densities that develop later in the season.

Host plant resistance

Partial resistance is present in some sweet corn varieties, but is inadequate for complete protection.

Biological control

Fall armyworm has many natural enemies, few act effectively enough to prevent crop injury.

Parasitoids

Numerous species of parasitoids affect fall armyworm. The wasp parasitoids most frequently reared from larvae in the United States are *Cotesia marginiventris* (Cresson) and *Chelonus texanus* (Cresson) (both Hymenoptera: Braconidae), species that are also associated with other noctuid species.

Predators

The predators of fall armyworm are general predators that attack many other caterpillars. Among the predators noted as important are various ground beetles (Coleoptera: Carabidae); the striped earwig, *Labidura riparia* (Pallas) (Dermaptera: Labiduridae); and the insidious flower bug, *Orius insidiosus* (Say) (Hemiptera: Anthocoridae). Vertebrates such as birds, skunks, and rodents also consume larvae and pupae readily.

Pathogens

Numerous pathogens, including viruses, fungi, protozoa, nematodes, and a bacterium have been associated with fall armyworm but only a few cause epizootics. Among the most important are the *Spodoptera frugiperda* nuclear polyhedrosis virus (NPV), and the fungi *Entomophaga aulicae*, *Nomuraea rileyi*, and *Erynia radicans*.

Impact of COVID-19 on fall armyworm control activities

In March 2020, a global pandemic was declared in relation to COVID-19. Governments have taken urgent actions to control the spread of the virus which are affecting agricultural production activities and impacting the implementation of the Global Action for Fall Armyworm Control. To address this new threat, FAO has prepared a new guidance note on "Addressing the impact of COVID-19 on the Global Action for Fall Armyworm Control".

The fall armyworm *(Spodoptera frugiperda)* is a lepidopteran pest that feeds in large numbers on leaves and stems of more than 80 plant species, causing major damage to maize, rice, sorghum, sugarcane but also other vegetable crops and cotton.

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FERTILIZER REACTION AND THEIR EFFECT ON SOIL FERTILITY

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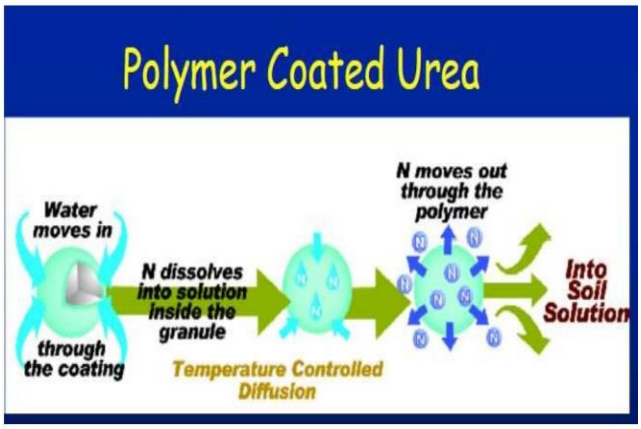
"The Effects Fertilizer reaction on Soil Fertility focuses primarily on the behaviour of nitrogen (N) and phosphorus (P) in soil because these two nutrients are the main nutrients that limit crop yields and they are also the nutrients of particular concern for environmental quality"

Nitrogen (N)

Nitrogen (N) is a macronutrient that is required by crops in large amounts and is frequently deficient in agricultural soils. Therefore, applications of N frequently increase yield and quality of crops. When fertilizer N and manure are applied to the soil, the N enters the soil N cycle.

REACTION OF SLOW RELEASE NITROGENOUS FERTILIZER



Similar to the nutrient cycle, the N cycle can be thought of in terms of gains, removals, internal transformations and losses of N in soil.

Gains of N to Soil

- **Atmospheric fixation and deposition** – Reactions between atmospheric N and lightning or sunlight generate small quantities of plant available ammonium (NH_4) and nitrate (NO_3) that is deposited onto soil.
- **Combustion fixation and deposition** – During the combustion process, diesel and gasoline engines convert small quantities of atmospheric N into plant available N that is eventually deposited onto the soil.
- **Biological N fixation** – Most of the biological fixation of N in agricultural soils is by Rhizobium bacteria in the nodules of legume crops such as alfalfa, beans, peas and lentils. In the case of green manures, legume crops are grown to fix N for the subsequent crop.

Application of synthetic N fertilizers – Synthetic N fertilizers are applied to agricultural soils to increase crop yields and quality. A variety of N fertilizers are available with the N in specific proportions. Nitrogen fertilizer can be in a granular, liquid or gaseous state. Specialty products are also available that slow the release of N.

Internal Transformations of N in Soil

The main transformations of N in soil are mineralization, nitrification, immobilization, mineralization immobilization turnover, NH4 adsorption and NH4 desorption.

Mineralization of N – Mineralization is the microbial process of converting organic N to NH4, increasing the amount of plant available NH4 in soil. This process occurs when the microbes are feeding on organic material that contains more N than they require for their own growth. For example, during the decomposition of organic material with a low C:N ratio, such as legume crop residues, microorganisms release N that is not required for their own growth, increasing the amount of N available to crops.

Nitrification – Soil bacteria convert NH_4/NH_3 to NO_3 to generate energy for their own benefit. Nitrite (NO_2) is formed as an intermediate step in the process but is usually rapidly oxidized to NO_3 by the bacteria. Although most readily available N in manure is applied as NH4/NH3, nitrification of available manure N can create significant quantities of NO_3 in soil. Nitrification is slow below 5°C and above 40°C with optimum temperatures occurring between 15 and 30°C.

Nitrifying bacteria can release nitrous oxide (N_2O) and small amounts of nitric oxide (NO) as by-products of the nitrification process.

Immobilization of N – Immobilization occurs when microbes take up plant available N (NH_4 and NO_3) from the soil solution and retain it in their own biomass, thereby decreasing the amount of plant available N in soil. This process occurs when the microbes are feeding on organic material that contains less N than they require. For example, during the decomposition of organic material with a high C:N ratio, such as straw, microorganisms immobilize soil N that is required for their growth (see C:N ratio below).

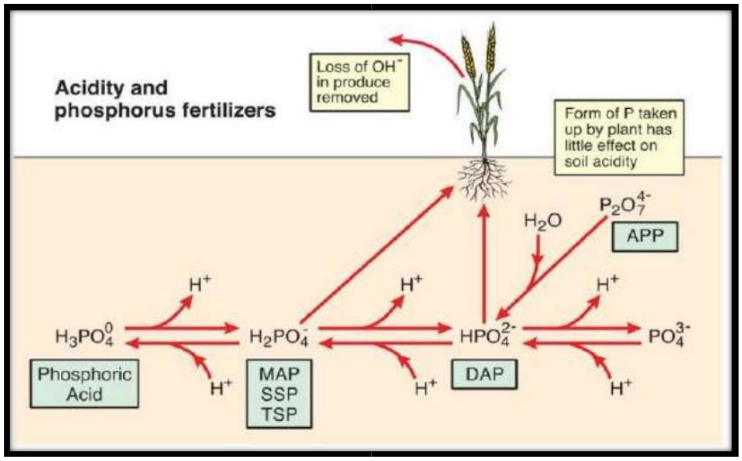
Mineralization immobilization turnover – Both mineralization and immobilization occur simultaneously in soil. However, the net balance between the two varies with environmental conditions and the characteristics of the organic material available for decomposition.

Phosphorus (P)

Similar to N, P is a macronutrient that is required by crops in large amounts and it is frequently deficient in soils. Therefore, applications of P fertilizer and manure frequently increase yields and quality of crops in. When P fertilizer and manure are applied to the soil, the P enters the soil P cycle. From an agricultural perspective, the P cycle can be thought of in terms of gains, removals, internal transformations and losses.

Atmospheric deposition – From an agricultural perspective, the small amounts of P deposited by rainfall, snowfall and phosphine gas (0.2 to 0.4 lb/acre) to soil are not significant. However, over the long term, these rates of P addition can be an important source of P loading to lakes and natural areas.

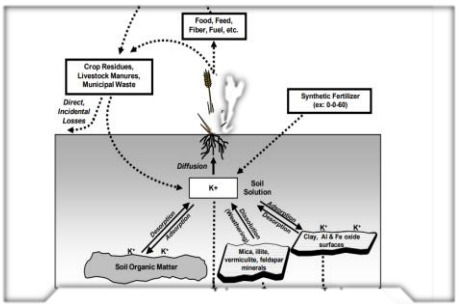
- **Application of synthetic P fertilizers** – Most of the P applied onto agricultural land in as synthetic fertilizer such as monoammonium phosphate (11-52-0) or ammonium polyphosphate (10-34-0). These fertilizers contain P in readily soluble, inorganic forms that are immediately or quickly available for uptake by plant roots. By convention, the amount of P in fertilizers is expressed as diphosphorus pentoxide or P_2O_5, even though this form of P is not found in fertilizers.



Gains of P to Soil

Livestock manures– In contrast to synthetic fertilizers, the P concentration in livestock manures is much lower. Therefore, the amounts of manure that must be applied to match crop requirements are much greater than for synthetic fertilizer. Annual manure application rates, however, are most often applied to meet the N requirements of the crop.

Plants use P for energy transfer (ex: P bonds are used in ADP and ATP to store and release energy for plant growth and survival), structural components (ex: phosphate bonds join the subunits of DNA and RNA together), intermediate compounds in metabolic pathways and overall regulation of plant growth.



Potassium (K)

Similar to N and P, K is a macronutrient that is required by crops in large amounts. Crops require nearly as much K as N. When K is added to soil, it enters the soil K cycle. The K cycle can be thought of in terms of gains, removals, internal transformations and losses of K in soil.

Gains of K to Soil

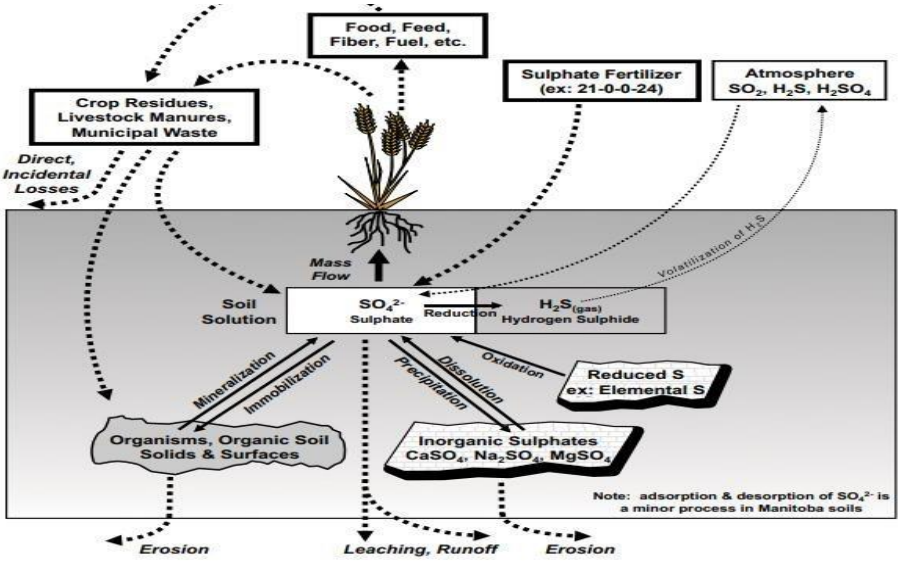
Synthetic K fertilizer – Potassium is applied by some researchers to some soils as potash fertilizer (0-0-60). However, the amounts of K fertilizer applied is very small, compared to N and P fertilizer because of substantial reserves of K in most clay and loam soils.

Livestock manures – Most manures contain substantial amounts of K. The K in manure is in an inorganic, highly soluble form and is considered to be 90-100 per cent as available to crops as synthetic fertilizer K.

Repeated applications of fertilizers and livestock manure increase plant available K in soil. High concentrations of plant available K can suppress plant uptake of divalent cations such as Ca2+ or Mg2+. Feeding high K forages to cattle or sheep increases the risk of dietary imbalances, such as grass tetany, milk fever and udder oedema. Testing to determine the risk of dietary imbalances should be considered for all feeds grown on heavily manured soils.

Sulphur (S)

Sulphur is a macro nutrient, however, it is required by crops in much smaller quantities than N and K. Ensuring adequate S nutrition is important, especially for crops with high S demand. Sulphur is abundant in most of agricultural soils, mainly due to large reserves of calcium sulphate (gypsum, $CaSO_4$) in subsoils. However, well drained sandy soils, highly leached soils and some well drained areas of loam soils may be deficient in S. These soils require routine S fertilization, especially for crops that have large S requirements such as canola and alfalfa. When S is applied to land, it enters the soil S cycle (Figure). The soil S cycle can be described in terms of gains, removals, internal



transformations and losses.

Points discussed by some investigators

A lot of careful consideration by investigator goes into selecting which fertilizer should be added to a crop. After all the discussion by them have been made, little thought is then given to what actually happens next. A brief points of some important fertilizer reactions with soil and its effect on soil fertility.

There are five major processes that happen to applied fertilizer

1. It is taken up by the crop
2. It reacts with soil minerals and organic matter to become part of the soil reserve
3. It can leach from the root zone with water
4. It can be lost to the atmosphere as a gas
5. It can move from the field through soil erosion and water runoff

Nitrogen fertilizer can be subject to all five of these processes and may be the most difficult to manage of all nutrients. Nitrogen fertilizer is most commonly added in the form

of nitrate, ammonium or urea. Their behaviour is quite different and they need to be managed with their specific properties in mind.

- **Nitrate (NO3-):** Nitrate is very soluble in soil and moves freely with water in the soil. Excessive rainfall or irrigation can easily move nitrate below the root zone. In wet soils, bacteria may convert nitrate to nitrous oxide (N2O), causing a loss of a valuable resource and the production of a greenhouse gas. Nitrate can also be converted to inert N2 gas.
- **Ammonium (NH_4^+):** As a positively charged cation, ammonium is largely held on soil cation exchange sites. In warm aerated soils, ammonium is converted to nitrate within a few days or weeks. In flooded soils, ammonium can persist for long periods of time. When left on the soil surface, ammonium is in equilibrium with ammonia gas and can be lost to the atmosphere.
- **Urea ($CO(NH_2)_2$):** As an uncharged molecule, urea moves freely with water in the soil. In warm soils, urea is decomposed to ammonium within a week or two by an enzyme (urease) that is present in almost all soils and plants. When urea is left on the soil surface, a portion of the ammonium will be lost as ammonia gas. If urea is placed beneath the soil surface or washed into the soil by rainfall, ammonia losses are very low.

All added N fertilizer is accessed by soil microorganisms before the plant roots have a chance for uptake. Since there are between 100 million and 1 billion bacteria in a single teaspoon of soil, their numbers in an entire acre are almost unimaginable. When conditions are optimal (warm temperature and adequate carbon), microorganisms will immobilize some of the added N in their cells and it will become part of soil organic matter.

Phosphate fertilizer quickly reacts in soil to form many new compounds and remains very close to where it is applied. The most common phosphate fertilizers are diammonium phosphate (DAP; 46% P2O5, pH 7.5 to 8) and monoammonium phosphate (MAP; 48 to 61% P2O5, pH 4 to 4.5).

Phosphate fertilizers are initially soluble in water and thus readily used by plants, but they quickly react with clays and other elements in the soil to become less soluble. These newly formed compounds will slowly dissolve and release soluble P over many months or years. These chemical reactions can be influenced by modifying the fertilizer properties or by minimizing fertilizer contact with soil with banded fertilizer application.

Phosphorus movement in agricultural soils is quite limited, with diffusion occurring in the range of a few millimeters to less than an inch. In very sandy soils or where application rates greatly exceed agronomic needs, P movement through the soil can be greater.

Since P fertilizer is tightly bound to soil particles, erosion from the field in runoff water can be a pathway of loss. Conservation practices should be implemented to minimize erosion losses. Added phosphate fertilizer is incorporated into microbial biomass and soil organic matter, but in smaller amounts than N.

Potassium fertilizer is most commonly added as potassium chloride. However, all forms of K fertilizer contain the identical chemical form (K+). Other K containing fertilizers may contain nitrate, sulphate, thiosulfate, or phosphate, but the behaviour of the K will be the same.

Potassium is simpler to manage than N or P since it is not involved in biological transformations. Most K fertilizers dissolve quickly in the soil and the K will either immediately displace another cation on the clay surface or move with water until it displaces another cation.

To get the most value from fertilizers, it is important to know what happens after they are added to the soil. Many people have little appreciation for the complex task of delivering the right nutrition to growing plants. Integrating knowledge of soil chemistry, soil microbiology and soil physics will go a long way in helping improve fertilizer management.

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ROLE, DEFICIENCY SYMPTOMS OF PHOSPHORUS AND ITS MANAGEMENT

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"Phosphorus is a vital component for ATP, the "energy unit" of plant. ATP formed during photosynthesis; comprise phosphorus in its structure, and processes from the beginning of seedling till the formation of grain and maturity. Phospholipid, plays several critical roles in cellular membranes, is another class of universally important phosphorus-containing compounds. Bones and teeth are made of the calcium-phosphate compound\apatite."

Role of phosphorus in plants

Phosphorus is an essential nutrient for both as a part of several key plant structure and as a catalysis in the conversion of numerous key biochemical reactions in plant. Phosphorus is a vital component for ATP, the "energy unit" of plant. ATP formed during photosynthesis; comprise phosphorus in its structure, and processes from the beginning of seedling till the formation of grain and maturity. Phospholipid, plays several critical roles in cellular membranes, is another class of universally important phosphorus-containing compounds.

Bones and teeth are made of the calcium-phosphate compound\apatite. In fact, ground bone (called bone meal) has been widely used as a phosphorus fertilizer. In healthy plants, leaf tissue phosphorus content is usually about 0.2–0.4% of the dry matter, about 1/10th the comparable levels for nitrogen.

Phosphorus in soil

The total quantity of phosphorus in most native soils is low, with most of what is present in forms quite unavailable to plants. The total P- content in Indian soil ranges from 580 to 2900 ppm. The total P-content is generally highest in soil developed on granite gneiss followed by shales with basis intrusion, limestones with intrusions of micaceous schist and quartzite and a major fraction of total P is present in clay. The total P in soil consists of inorganic P and organic P forms.

Inorganic phosphorus

Inorganic forms of soil phosphorus consist of apatite (the original source of all phosphorus) complexes of iron and aluminium phosphates, and phosphorus absorbed onto clay particles. The solubility of these phosphorus compounds as well as organic phosphorus is extremely low and only very small amount of soil.

Organic phosphorus

Organic P represents about10 to 30% of the total P. The principal organic P compound present in the soils are (1) inositol phosphate 10 to 50 % of organic P (2) nucleic acid 1 to 10% of organic P (3) phospholipids 1 to 5% of organic P.

The Phosphorus Problem in Soil Fertility

Phosphorus presents a soil fertility problem in three ways. *First*, the total phosphorus content of soils (Figure 14.2) is relatively low, ranging from 500 to 10,000 kg P in the upper 50 cm of 1 ha of soil. *Second*, the phosphorus compounds commonly found in soils are mostly unavailable for plant uptake, often because they are highly insoluble. *Third*, when soluble sources of phosphorus, such as those in fertilizers and manures, are added to soils, they may become fixed (changed to unavailable forms) and in time form highly insoluble compounds.

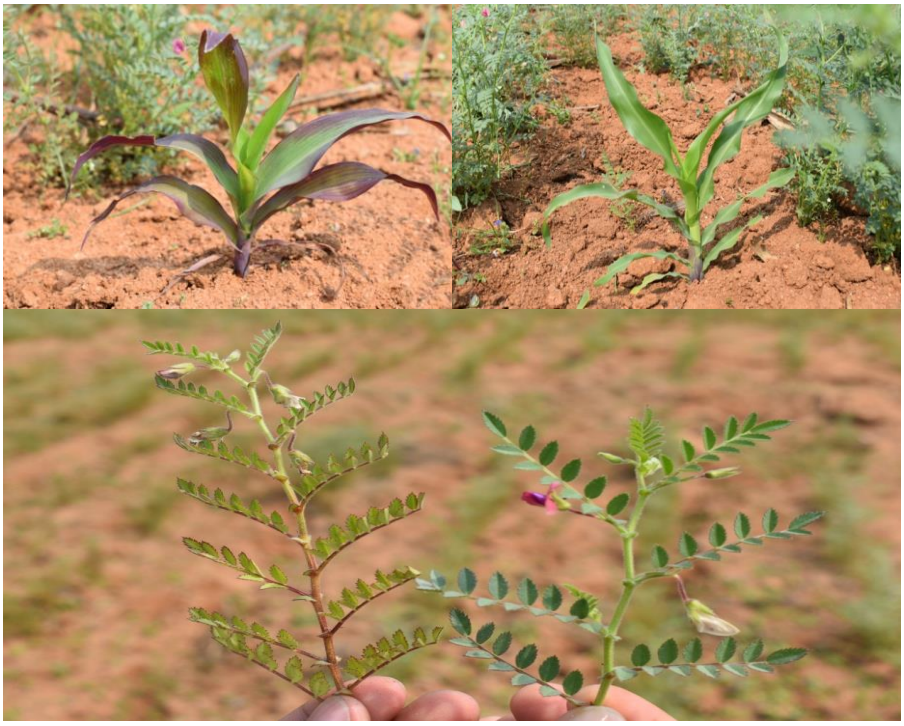
Phosphorus deficiency in plants

Phosphorus deficiency is more difficult to diagnose than a deficiency of nitrogen or potassium. Crops usually display no obvious symptoms of phosphorus is deficient. The plants are usually dark bluish-green in colour with leaves are stem becoming purplish. The purplish colour is due to accumulation of sugars that favour the synthesis of anthocyanin (a purplish-coloured pigment), which occurs in the leaves of the plant. Phosphorus is

highly mobile in plants, and when deficient, it may be translocate from old plant tissue to young, actively growing areas.

Symptoms in corn and gram

The photo at left displays a P deficient corn and gram plant. Older leaves are affected before younger ones because of the redistribution of P in the plant. Corn may display a purple or reddish colour on the lower leaves and stems.



Phosphorus deficiency symptoms in maize and chickpea

Sampling of low phosphorus content field

Determine the soil unit (or plot).Make a traverse over the soil unit (or plot).Clean the site (with spade) from where soil sample is to be collected. Insert the spade into soil. Standing on the opposite side, again insert the spade into soil. A lump of soil is removed. A pit of 'V' shape is formed. Its depth should be 0-6" or 0-9" or 0-12" (i.e., Depth of tillage).Remove the soil-slice (like a bread slice) of ½ inch thick from both the exposed surface of the pit from top to bottom. This slice is also termed furrow-slice. To collect the soil-slice spade may be used. Collect the soil samples in a polyethylene bucket. Collect furrow-slices from 8-10 sites. Select the sites at random in a zigzag (or criss-cross) manner. Distribute the sites throughout the entire soil unit (plot). In lieu of spade auger may be used. Do not take the prohibited samples and local problem soils. Furnish the following information on two sheets of thick paper with the sample. One sheet is folded and kept inside the bag. Another sheet is folded and attached to the bag.

Determination of phosphorus in soil and management

Soil available phosphorus in different plot D-11, D-21 and D-22 are 5.1 kg, 2kg and 16.5 kg respectively.

Phosphorus in integrated nutrient management

Repeated application of chemical P fertilizer is expensive and can lead to the loss of soil fertility by disturbing microbial diversity and reducing crops yield .In regions where

inorganic P fertilizers application is expensive, use of phosphate rocks in combination of phosphate –solubilizing microorganisms (PSM) is seen as a viable alternative. Integration of organic amendments of P with inorganic source is significantly better than the use of mineral P fertilizers alone. Addition of organic amendments to soils may increase the efficiency of applied and native nutrients required by plants on the production of organic acids during decomposition. The acids produced dissolve soil mineral P and increase P availability by coating P adsorption sites or via anion exchange in soils with high P-fixing capacity. Effectiveness of inorganic P fertilizers was increased and P recovery was improved with the addition of organic manure. Furthermore, most crop plants utilize organic P sources efficiently by increasing production of phosphatases, increasing fungal and bacterial growth (Tarafdar and Claassen, 1988). The only limiting factor is the availability of hydrolysable organic P. Phosphorus-solubilizing Microorganisms.

Phosphorus-solubilizing Microorganisms

A large number of heterotrophic microorganisms existing in the soil, which include bacteria, fungi, actinomycetes and cyanobacteria, can dissolve insoluble inorganic P sources present in the soil (Gaur, 1990) and are collectively known as phosphorus-solubilizing microorganisms (PSM). Among PSM, fungi are the most effective in solubilizing P (Gaur, 1990). The mechanism of P solubilization is organism specific and mainly through the processes of acidification, chelation and exchange reaction. Organic chelates form complexes with Ca, Fe, or Al thereby releasing phosphates to solution. The release of protons associated with respiration or NH3 assimilation is cited as a possible mechanism of P solubilization in organisms where organic acid production is not accompanied with release of soluble P. Several studies have shown the beneficial effects of PSM inoculums on agronomic crops (Table 6.9). In multilocation trials conducted with different crops, yields increased up to 50% owing to PSM inoculation over un-inoculated control with or without rockphosphate addition.

Arbuscular mycorrhizal symbioses

Symbiotic association between plant root and fungal hyphae is known as mycorrhiza (fungus – root). Arbuscular mycorrhizal (AM) symbioses are widespread in the plant kingdom and contribute significantly to plant P nutrition and growth. Being an obligate symbiont, these are uncultivable on nutrient media and need a live host. AM fungi colonize most agricultural species (exceptions include *Brassica spp*., and *Lupinus spp*.). Fungi infect and spread inside the cortex region of the root system where special structures, namely arbuscules and vesicles, help the plant root take up the nutrients from zones away from the reach of root hair. This has important implications especially on the low P soils. It has been

shown that the external hyphae of the AM fungi could deliver up to 80% of the plant P to the host plant over distance of more than 10 cm from the root surface. Arbuscular mycorrhizae has been associated with increased plant growth, enhanced uptake of nutrients and water primarily owing to greater soil exploration by the mycorrhizal hyphae. The factors affecting persistence and response to AM inoculation include crop plant, soil fertility, agronomy, biological and environmental factors. In general, the maximum response is observed in low-fertility soils. Practices such as fumigation, soil solarization, water-logging adversely affect abundance of AM fungi. Beneficial effects of the co-inoculation of AM fungi and phosphorus solubilizing bacteria (PSB) is well documented and results indicate that it is possible to substitute up to 25% of the P in the form of single super phosphate with rock phosphate following combined inoculation as compared to individual inoculation. The synergistic interaction of an inoculated PSB and mycorrhizal mycelium leading to improved P acquisition by the plant is attributed to solubilization followed by efficient uptake and mobilization of the solubilized phosphate, preventing it from being re-fixed in soil.

Phosphocompost

Among the organic sources of P, composts, FYM, phosphocompost, N-enriched phosphocompost can partially supply the crop P requirements when applied (5–10 t/ha). Phosphocompost/N-enriched phosphocompost is produced by the use of PSMs, namely Aspergillus awamori, Pseudomonas striata and Bacillus megaterium; phosphate rock, pyrite and bio-solids to increase the manurial value compared to ordinary FYM and compost. Field studies of the N-enriched phosphocompost indicated:

- 25% of fertilizer NPK could be substituted
- Yield advantage over NPK fertilizer ranged from 3 to 18%
- Significant residual effect on succeeding crop
- Cheaper source compared to single superphosphate or diammonium phosphorus.

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BAEL PROCESSING AND ITS IMPORTANCE

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"Ripe fruit of bael is rich in vitamins, minerals and fibres as well as act as tonic, restorative, laxative and good for heart and brain. Pulp of fruit are rich in psoralen and marmelosin. Hard shell, muciliganeous texture and numerous seeds of bael fruit make it difficult to eat out of hand, therefore can be processed into various excellent quality products."

Introduction

Bael (*Aegle marmelos*) is an ancient medicinal indigenous fruit tree of India belonging to family rutaceae with chromosomes number (2n=36). Aromatic trifoliate leaves is traditionally used as sacred offering to 'Lord Shiva' since ancient times. Bael is an essential crop in terms of environmental, nutritional and commercial importance. Ripe fruit of bael is rich in vitamins, minerals and fibres as well as act as tonic, restorative, laxative and good for heart and brain. Pulp of fruit are rich in **psoralen** and **marmelosin**. Hard shell, muciliganeous texture and numerous seeds of bael fruit make it difficult to eat out of hand, therefore can be processed into various excellent quality products.

Climate and soil

Owing to hardy nature, this crop has wide adaptability to adverse soil and climatic requirements. It requires subtropical climate where summer is hot and dry, and winter is mild. It can be grown upto elevation of 1,200m. They are not damaged by temperature as low as -7 degree celcius. A well-drained sandy loam soil is ideal. It can stand sodicity up to 30 ESP and salinity up to 9ds/m Ec.

Physical parameters of bael fruit

- External Colour: Brownish yellow
- Pulp Colour: Bright yellow
- Weight(g): 11.2
- Polar Diameter (cm): 12.9
- Transverse Diameter (cm): 13.3
- Specific Gravity (g/cc): 1.11
- Volume: 1.1
- Pulp(%) 68
- Seed(%): 1.29
- Shape: Roundish-oblong

Chemical constituents of bael fruit

Chemical parameters	:	Percentage
• Moisture (%)	:	61
• PH	:	4.9
• Acidity (% Citric acid)	:	0.3
• Crude Protein (%)	:	3.6
• Ash (%)	:	2.8
• TSS Brix	:	36

Medicinal value

(1) Diarrhoea and dysentery: Dried fruit pulp and powder are used for the treatment of diarrhoea. Dried powder is also used as an important remedy for chronic dysentery conditions like constipation.

Leucoderma: Psoralen compound present in the pulp of Aegle marmelos, increases tolerance of sunlight which aids in the maintenance of normal skin color and therefore used in the treatment of leucoderma.

Antiallergic: Since its pulp has a detergent property, it can be used as herbal substitute of soaps, for allergic patients.

Antiarthritic: Raw bael fruit is used for treatment of arithritis and gout. Its pulp mixed with hot mustard oil can be applied on swollen joints for relief from these disorders

Healthy brain: The ripe fruit of Aegle marmelos keeps the body and mind cool, helps to sharpen intellect and concentration of mind.

Cure of Anaemia: Powdered pulp of bael consumed with boiled cow's milk helps to cure anaemia

Processed products of bael

Bael can be processed into several products to make them available for longer period of time. Bael fruit have an excellent aroma which do not destroyed even during its processing. Bael fruit processing can make it economically important. Also processed products need surge to catch the national and international markets if it is properly focused under nutritional importance.

Various products are as follows:

Fig. 1 Bael jam

Fig. 2 Bael Powder

Fig. 3 Bael candy

Fig. 4 Bael sherbet

Fig. 5 Bael murabaa

Fig. 6 Bael cider

Conclusion

Being a minor sub-tropical fruit crop, potential of bael is yet to be explored and required promotion and publicity among local, national as well as international market. Bael presents edible and medicinal properties. However, uses of bael fruit crop as a potential edible and medicinal source is limited to Southeastern Asian countries only, therefore, it is essential necessity to familiarize the food and medicinal value of this crop in other countries also, as it contains various numerous health benefits. Processing of bael fruit into several products is an adequate practice to obtain shelf-stable product having wide scope of utilization. Processing of fruit can help farmers to get sure income for their produce as well as create employment opportunities for others in micro/macro fruit processing industries. More emphasis should be given on research work of qualitative post-harvest processing like introducing new flavor with certain change in the ingredients to alter taste, good storage and on marketing of processed products in domestic, national and international market.

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SCIENTIFIC CULTIVATION OF FODDER PEARLMILLET (BAJRA)

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"It is tolerant to drought, heat and soil salinity and also it has high water use efficiency that make it a "climate smart crop". It can tolerate soil moisture stress condition and perform better than sorghum. It is fed to cattle as green or dry and even it can be conserve in the form of hay and silage. Beside fodder, its grain is used as food to human and feed to poultry"

India is agriculture based country. While livestock is the backbone of Indian agriculture. Total livestock population of India is 535.78 million (2019) which is more than 512.06 million (2012). But the area under cultivated fodder is only 8.4Mha which is very less as compare to the livestock population. So, deficiency of feed and fodder is one of the major constraint. According to IGFRI vision 2050, at present India has net deficit of 35.6% green fodder, 10.9% dry fodder and 44% feed. There is huge gap between the demand and supply of the fodder. To narrow down this huge gap, there is need to develop high fodder yielding cultivars.

Pearlmillet (*Pennisetum glaucum*) is fast growing crop and also produces green fodder in around 50-60 days. It is native of Africa, grow well in warm season. It is tolerant to drought, heat and soil salinity and also it has high water use efficiency that make it a "climate smart crop". It can tolerate soil moisture stress condition and perform better than sorghum. It is fed to cattle as green or dry and even it can be conserve in the form of hay and silage. Beside fodder, its grain is used as food to human and feed to poultry. Its fodder is low in antiquality factors such as hydrocyanic acid and oxalic acid, while rich in protein, calcium, phosphorus and other minerals. On an average it contain 7-10% crude protein, 56-64% neutral detergent fibre, 38-41% acid detergent fibre, 33-34% cellulose and 18-23% hemicellulose on dry matter basis when harvested at 50% flowering stage. It also have oxalate content, which varies from 1.9 to 2.5%. It is grown in different part of country and is known by different names such as bajra (Hindi, Bengali, Oriya, Punjabi and urdu), kamboo (Tamil and Malayalam), sajjalu (Telugu) and bajri (Marathi, Gujarati).

Climate and soil requirements

Pearmillet is warm weather crop mainly grown in semi-arid and arid climate where average rainfall 25-75cm. Grow well in drained sandy loam to loam soil. pH 6.5-7.5 is ideal.

Sowing time

March to mid-April is best time for summer sowing. First fortnight of july i.e after the arrival of rain is suitable for monsoon season crop. In southern India, it is grown during rabi season i.e October – November is best for its sowing.

Seed rate and sowing method

General recommended seed rate of fodder bajra is 10-12 kg/ha. When sown in rows, row to row spacing should be 25cm. Seed of pearlmillet is small in size, therefore, should not be placed below 1.5-2cm.

Varieties

Sr. No.	Varieties	Suitable areas	Green fodder yield (q/ha)
Single cut			
1.	Raj Bajra chari	All bajra growing areas	350-400
2.	Co.-8	Entire country	350-500
3.	APFB	Andhra pradesh	300-400
4.	NDF-2B	North-eastern area	350-400
5.	GFB-1	Gujarat	300-400

Sr. No.	Varieties	Suitable areas	Green fodder yield (q/ha)
Dual purpose (both seed and forage)			
1.	Avika bajra-2	Central india	35-40
2.	BD-163	Haryana and entire country	70-80
3.	HHB-117	Entire country	70-80
4.	HHB-146	Entire country	75-84
5.	HHB-558	Entire country	70-80
6.	KBH-108	Entire country	100-110
7.	MB-78-72	Entire country	80-90
Multicut varieties			
1.	Joint bajra (for silage)	Entire country	55-110
2.	Pro. Agro. No.-1	Entire country	65-95
3.	APFB-2	Andhra pradesh	25-30
4.	FBC-16	N-W plain areas	70-80
5.	FMH-3	Entire country	65-95
6.	PHBF-1	Punjab	60-65
7.	PCB-164	Punjab	60-65
Hybrid bajra			
1.	FMH-3	Entire country	70-80
2.	GHB-15	Entire country	75-80
3.	GHB-235	Entire country	75-80

Intercropping

Forage bajra can be intercropped with cluster bean, cowpea and lablab in semi-arid to arid areas. Generally, pearl millet and cowpea should be in 1:1 ratio.

Nutrient management

Application of 10-12t/ha well decomposed farmyard manure 15-20 days before planting is recommended, which supplies both macronutrients as well as micronutrients. Application of 50kg nitrogen, 30kg phosphorus and 30kg potassium per ha as basal (at the time of sowing) followed by top dressing with 30kg N/ha one month after sowing is recommended. In rainfed condition, 20-30kg N/ha may be applied simultaneously with rain at 30-45 day stage. If dry spell prolong, spray 2% urea solution for quicker biomass production.

Water management

Generally grown as rainfed but when long dry spell occurs, require 4-5 irrigations in summer grown crop.

Weed management

If crop growth is slow during initial days then weed infestation is the major problem. Critical period of weed competition is upto 3-4 weeks after sowing. Intercultivation in initial stages, can suppress the weed growth. Mainly sathi (*Trianthema portulacastrum*), kewai *(Digitaria sanguinalis*), doob*(Cynodon dactylon)*, nut grass(*Cyperus rotundus*), witch weed (*Striga* sp.) infest the crop. Pre emergence application of atrazine @ 0.50 kg a.i./ha in 600 l of water control the weed effectively in sole crop of pearlmillet. In intercropping, pearlmillet with cowpea or guar, pre emergence spray of alachlor @1.0 kg a.i./ha should be done.

Disease and insect-pest management

Pearl millet harbor many insects and diseases. Important diseases of pearl millet are ergot, downy mildew and smut. In forage pearl millet, use of chemicals is not preferred for the control of insects and diseases. However, seed dressing with metalaxyl @ 2.0g/kg seed or spray of ridomil @ 1000ppm is effective. In insects, shoot fly is the common insect which can be controlled by spraying carbofuran @ 125ml/ha. In forage pearl millet, generally chemicals are not used so, clean cultivation and seed treatment is adopted.

Harvesting and yield

Timely harvesting is most important to obtain maximum yield. In single cut varieties, harvesting should be done at 55-60 days after sowing which give fodder yield around 30-40 t/ha. In multicut varieties, first cut at 40-45 days after sowing and subsequent cuts are taken at 30 days interval depending on the vegetative growth of the crop, giving fodder yield around 50-100 t/ha.

Conclusion

Pearl millet is mainly a rainfed crop. It is the most important fodder for animals in arid and semi-arid region. It uses less water and tolerate drought. It can be grown as sole crop as well as intercropping with other crops like cowpea. To obtain maximum fodder as well as good quality of fodder, high yielding improved varieties are must. Along with that proper time of sowing, optimum plant population, fertilizer, irrigation, pest & disease management is also important to get good quality as well as quantity of fodder.

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INSECT PEST OF TOMATO, NATURE OF THE DAMAGE AND THEIR MANAGEMENT

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"Tomato is attacked by many direct as well as indirect pests during all the growth stages causing severe yield losses and even sometimes complete crop failure. There are different eco-friendly management of several pests attacking in tomato crop for reducing the resulting crop failure and damage by these insects"

Introduction

Tomato (*Solanum lycopersicum*) is an important cash crop ranking second in importance after potato in most of the countries and grown throughout India during summer season (Choudhary, 2015). It is also an effective off-season crop that can be grown for fetching higher returns. Tomato is attacked by many direct as well as indirect pests during all the growth stages causing severe yield losses and even sometimes complete crop failure. Here we are discussing the host range, identification, nature of the damage, life cycle, and eco-friendly management of different pests attacking in tomato crop for reducing the resulting crop failure and damage by these insects.

1. Tomato fruit borer: - *Helicoverpa armigera* (Noctuidae: Lepidoptera)

Insect pests of this group are very destructive and can cause high damage to the crop that results in a major loss of crop yield of tomato, also decreases its economic value. These insects have many host plants so they are polyphagous. These insects cause severe damage to crop and field which not only decreases the yield of the crop but also decreases the quality of the tomato crop.

Host plants: It infests on many hosts that are over 100 host plants including tomato, castor, cowpea, millets, linseed, tobacco, safflower, pigeon pea, okra, carnation, etc.

Damage:

- The larva of this insect causes damage. The larva removes the tomato foliage in the instar stage makes bores in the fruit make it unsuitable for the market which not only damages it but decreases its economic value in the market.
- This insect feeds on the leaves of the plant's foliage, flowers, buds, and fruits also and decreases the economic value of the fruits.
- Small young green fruits are attacked quickly by this insect.
- Larva in its second instar stage is very dangerous and single lava only can destroy many fruits by making bores in it.
- Damage chances are more from March to June.

Identification:

- The egg's time phase is around 5 to 6 days.
- The well-matured caterpillar measures around 11 to 13mm in the length and are generally pinkish.
- The adult moth is cream-white having the wingspan of 25mm with the transparent wings.
- The life span of adult moth varies from 6 to 7 days.
- Eggs of the larva are yellow in the colour dome-shaped and around 0.5 mm in diameter but in the young stage, eggs are yellowish-white in color as it also depends upon the food they consume.
- Full mature adult caterpillars are around 40-50 mm long in height with having longitudinal stripes of whitish gray.
- Wings color varies from male to female as in male forewings are usually light yellowish whereas in females it is light brown.
- The apical portion of the wings of the insect is marked by the blackish-brown lines which are visible having a spot of black color which is visible in the upper sides of the forewings.
- Buch of hair is present on the pointed end of the abdomen of the female which is one of the specific features of the female.

Life cycle:

It has an incubation period of 2-5 days, the larval period of 5-22 days, Prepupal period: 1-2 days, Pupal period of 10-14 days, and Adult longevity around 6-10 days.

Salient features:

- The insect lays eggs singly on the leaves, flowers, and fruits.
- Juvenile larvae feed on tender foliage and older bore fruits.
- The larva is very destructive can one larva only can destroy 4 to 8 fruits easily makes bore on them makes them unfit for the market.
- Caterpillars thrust only a part of their body inside the fruit and feed on the inner contents.
- Fruits that are incompletely damaged are attacked by other microbes which also cause further diseases in them.
- The caterpillars of this species are flesh-eating in nature.

Fig.1 Eggs and damaging larval stage of tomato fruit borer

Fig. 2 Damaged fruits of tomato by fruit borer

Management:

- Resistant varieties like Punjab Kesari, Punjab Chuhara, Pant Bahar, Azad, Pusa Hybrid-4, etc should be used for the management of this insect.
- We can do tillage operations and deep ploughing so that the field and the pupae should be exposed to sunlight.

Fig.3 Adults of tomato fruit borer

- We can use African marigold (*Tagetes erecta* as a trap crop which attracts insect toward itself hence saving the main crop of tomato.
- Pheromone traps of (5 traps/ ha) of moths are used for surveillance.
- Monitoring of top three leaves for egg-laying.
- We can also spray a nuclear polyhedrosis virus of H that is HaNpv at the rate of 250 LE per hectare in one-week intervals.
- Formulation of Bt that is *Bacillus thuringienisis* is widely used at the rate of 0.5 kg per hectare.
- Neem Seed Kernel Extract at the rate 4 % is also used to control this insect.

- Periodic releases of egg parasitoid, *Trichogramma chilonis*, or *T. pretiosum* @ 100000 /ha.
- Emergency shower of cypermethrin (0.0075%) or deltamethrin (0.0028%)
- Natural enemies like *Campoletis chloridae, Bracon brevicornis* and *Trichogramma spp* are active.

2. Serpentine leaf miner: *Liriomyza trifolii* **(Agromyzidae: Diptera)**

The serpentine leaf miner is one of the damaging pests of the tomato and other crops like cucurbits, cruciferous crops, okra cotton brinjal, black gram, cowpea beans, and many other ornamental crops and weeds is one of the polyphagous insects which attack many hosts. It is a type of larva fly that damages the main crops badly. This leaf miner has a generally short life span and time to complete its life cycle in around 20 to 28 days or approximately 1 month. This leaf miner generally reproduces in warm climates at a suitable temperature of 25 C. These leaf miners deposit their eggs in the middle of the plant. Female generally gives their eggs on the lower surface of the leaves just below the epidermis.

Damage:

- Larva causes the damage in this insect which is legless and initially colorless but becomes yellow after becoming an adult. Spiracles are present in the larva at the posterior end.
- The major damage is caused by the larva as it punctures the fruit and leaves can result in stippled like appearance on the leave tips and mining of leaves is also done by its larva. It cuts the leaves at an irregular pattern which destroys the mesophyll cells. Damage is noticeable in the 3 to 4 days of the egg deposition.
- Infested leaves become transparent papery in the mined areas
- Photosynthesis is reduced.
- The attack appears during April and is more pronounced from June onwards.

Identification:

- Eggs: Newly laid eggs are white, translucent, and turn opaque as the development advances.
- Larvae: The larvae are orange-yellow, apodous. They move through peristaltic action between the two epidermis. Full-grown maggots are1.88 x 0.70 mm.
- Pupae: Orange-yellow initially which turns dark-brown on maturity. They measure1.84 X 0.68 mm
- Adults: The adults are very small greyish black flies with plum red eyes and a yellow spot on the scutellum. The females are bigger (2.01 x 0.61mm) in size than males (1.79 x 0.52 mm).

Fig.4 Mines made by leaf miner, larva feeding on pupal stage of leaf miner and adult of leaf miner (Left to right)

Life cycle:

Usually, eggs get hatched in 2 to 3 days. First, second and third stages of larva develop in 2-3, 1-3 and 5-7 days, Pupal period lasts for 8-10 days, Preoviposition period 1-3 days, Expulsion of the eggs period is 8-15 days, Post-expulsion of eggs period is for 1-3 days, Male longevity is 8-12 days, Females live up to13-17 days.

Salient features

- Eggs are deposited by females on the lower part of the leaf's margins below the epidermis area.
- Larvae feed through peristaltic action between the two epidermis
- Fecundity is 22-186 eggs
- Many generations in a year.

Management:

- The judicious use of nitrogenous fertilizer reduces the build-up of the pest in endemic areas.
- Severely infected leaves should be removed and destroyed. NSKE @ 4.0 percent along with sticker is effective.
- By sprinkling the crop with triazophos (0.15%) or deltamethrin (0.0028%) or imidacloprid (0.0075%) helps in saving this crop from insect attack.
- Natural enemies especially larval and pupal parasitoids are active during July-August.

3. Greenhouse whitefly, *Trialeurodes vaporariorum* (Aleyrodidae: Hemiptera)

Damage:

- Approx. all life stages leaving eggs and pupae cause damage to the plant and mainly damage is caused by nymphs and adults.
- Nymphs and adults suck the cell sap from the leaves of the plant hence make the leaves dead.
- After sucking sap leaves color changes to pale yellow, become dry, and shows the wilting symptoms.

- Plants are not able to do photosynthesis reaction hence are not able to make their food and become week.
- Nymphs of the insect secrete a gluey honey-like substance which causes sooty mould and attract other microbes and pest in the leaves hence it starts decaying and becoming loose.

Identification:

- Greenhouse whiteflies are small insects with white-colored wings.
- The eggs are 0.2 to 0.25 mm x 0.08 to 0.12 mm.
- Newly emerged nymphs are light yellow.
- Last nymphal instar is 0.70 to 0.90 x 0.40 to 0.60 mm.

Life cycle:

- The incubation period is 3 to 8 days.
- Development of first, second, third, and fourth instar nymph is completed in 2 to 6, 5 to 8, 3 to 5, and 3 to 6 days, respectively.
- The life cycle of the insect is not large and is completed in around 15 to 32 days.

Salient features:

- Remain hidden on the undersurface of leaves.
- Eggs are stalked and remain stuck below epidermis on the lower surface of the leaf
- Four nymphal stages are present.
- Full-grown nymph pupates in a yellow pupal case surrounded by a waxy palisade and waxy fringe.
- Many generations in a year

Management:

- Removal of weed hosts is important to reduce the incidence.
- Protect the nursery by using nylon nets (200 mesh) for 25-30 days.
- The insect can be managed by need-based spraying of the crop with imidacloprid (0.0075%) or triazophos (0.15%) or deltamethrin (0.0028%).

4. Fruit flies: *Bactrocera tau* (Tephritidae: Diptera)

Damage:

As the name suggests fruit flies damage occurred in fruits and the fruit pulp by the larval stage of the insects. It is one of the major pests of the tomato which damages the fruits of the tomato hence make it unfit for the market decreasing its economic value and makes it unfit for the consumption for the humans.

Identification:

- Adults are light brown with lemon yellow curved vertical markings across the thorax
- On the apical margin of the forewing, greyish brown patches are present.
- Larvae are pale or reddish-white which tapers anteriorly.

Fig. 5 Greenhouse whitefly infesting

Fig. 6 Fruit flies

- The pupa is barrel-shaped with dull to reddish-yellow.

Life cycle:

- One female can lay up to 60 to 100 eggs in one time
- Eggs get hatched in 1 to 4 days after laying of the eggs.
- Maggots become fullfed in 4 to 7 days.
- The pupal period lasts for 7 to 13 days.

Salient features:

- It is a type of insect which lays eggs inside the fruits.
- Larvae feed on pulp.
- After eggs get hatched inside the fruit, fully matured larva comes out from the fruits and makes the pupal stage in the soil.
- Adults require proteins for their ovaries to mature.

Management:

- Dead, decayed, and diseased parts should be collet and destroyed so that the infected debris should not be spread to the unaffected plant parts.
- Regular ploughing for some time can expose the pupae to the sunlight and kill it.
- Poison baits should be applied (40 ml malathion + 200g jaggery/molasses per 20L of water) in the form of sprinkle or bait stations.
- Mass trapping of adults using cue lure.
- Parasitoid larva named as *Biosteres dacusii* also attack the pest in nature and save the crops from the insect infestation.

5. Hadda beetles: *Henosepilachna vigintioctopunctata* **(Coccinellidae: Coleoptera)**

Distribution: India, south-east Asia

Damage:

- As the name suggests damage is caused by beetles and the grubs.
- Leaves are mainly attacked by beetles and grubs and damaged fully by feeding on the tissues of the leaves and destroying their chlorophyll between veins makes them unable to do photosynthesis process.

Identification:

- The grubs are around 6 mm long, yellow in color, with six rows, branched spines.
- Beetles are around 8 to 9 mm in length and 5 to 6mm in breadth.
- *H. vigintioctopunctata* beetles are copper in color having black spots visible on each elytron which has pointed tip.
- Beetles of *H. duodecastigma* are copper in color and black spots are visible on the elytron having rounded tip.
- *H. demurili* beetles are dull and light copper-colored with each elytron bearing 6 black spots surrounded by yellow margins.

Life cycle:

- 2-3 days of the incubation period of this insect.
- 1-2 days prepupal period.
- The time period of the pupa is 4-5 days.
- 5-6 days of pre oviposition period occurs.
- The maturity of the adult is in 60-65 days in males and 65-70 days in the female.
- These show several generations between March to April.
- 10 days of post oviposition time occurs.

Salient features:

- Beetles increase their activity during the month of March-April
- Adult shows the process of hibernation in the heaps of dry plants and cracks and crevices.
- Yellow cigar-shaped eggs are laid mostly on the below surface of leaves epidermis in clusters of 5 to 55 each.
- At one time a single female can lay up to 200-700 eggs.

Management:

- Collection and destruction of various stages of the pest.
- Larval parasitoids such as *Pediobius foveolatus* and *Uga Menoni* are active.
- The pest can be managed by spraying the crop with malathion (0.05%)

6. Phytophagous mites- *Tetranychus urticae* (Tetranychidae: Acarina)

Damage:

- Caused by the larvae, nymphs, and adults by sucking the cell sap from the underside of leaves, flower buds, and flowers.
- When the population is high bronzing occurs and leaves became curl and discoloration of leaves.

Fig. 8 Hadda beetle adult and grubs (Damaging stages)

Fig. 9 Phytophagous mites

Salient features:

- Eggs are laid mostly along the midrib and side margins on the lower surface of the leaves.
- Weather factors play an important role
- High humidity and temperature reduce the reproduction of the pest and hence the incidence is low.

Management:

- Remove the old and infested leaves and burn them.
- Try to avoid dry conditions and spray frequently with plain water at least twice a week with a sprinkler.

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ORGANIC FARMING IN HORTICULTURE

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"Organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc.) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". Organic farming is done to release nutrients to the crops for increased sustainable production in an eco-friendly and pollution-free environment. It aims to produce crop with a high nutritional value. Organic farming promotes agro-ecosystem health, soil biodiversity and provides opportunity for export of horticultural crops. People are becoming health conscious and ready to purchase organically grown food and plant products even at higher price."

Introduction

India is an agro based country. It ranks 2nd in agricultural products manufacturing in the world. So, organic farming plays an important role in agro field. Organic farming system in India

is not new and is being followed from ancient time. India has many natural resources of various organic compounds and so it is an excellent opportunity to produce sufficient quantity of organic foods to meet the global demand. There is a bright future for organic farming to export its quality product. It is a method of farming system which primarily aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (Bio fertilizers) to release nutrients to crops for increased sustainable production in an ecofriendly pollution free environment.

FAO suggested that "Organic agriculture is a unique production management system which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity, and this is accomplished by using on-farm agronomic, biological and mechanical methods in exclusion of all synthetic off-farm inputs".

Organic agricultural methods are internationally regulated and legally enforced by many nations, based in large part on the standards set by the International Federation of Organic Agriculture Movements (IFOAM), an international umbrella organization for organic farming organizations established in 1972. Organic farming is targeted to produce nutritive, healthy and pollution free food. It maximizes the use of on farm resources and minimizes the use of off-farm resources. It is social profit oriented, than profit oriented. In organic farming entire system i.e., plant, animal, soil, water and micro-organism are to be protected.

Organic horticulture is the science and art of growing fruits, vegetables, flowers, or ornamental plants by following the essential principles of organic agriculture in soil building and conservation, pest management, and heirloom variety preservation. The Latin words *hortus* **(garden)** and *cultura* **(culture)** together form *horticulture,* classically defined as the culture or growing of garden plants. *Horticulture* is also sometimes defined simply as "agriculture minus the plough." Instead of the plough, horticulture makes use of human labour and gardener's hand tools, although small machine tools like rotary tillers are common now.

Organic farming provides a real opportunity for horticultural crop production, expend the food market worldwide (organically produced food has great demand in foreign countries; there is major deficiency of home produced organic fruit and vegetable in certain countries like Island), has lower cost of production and provide good price premium which may cover reductions in yield during early phase of organic farming system. It increases the opportunity of direct sale of produce e.g. Farmers Markets, Farm Shops etc. (People are now keen interested to purchase organically grown food plant products even at higher price.).

Principles of Organic Farming

Organic agriculture is a unique production management system which largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, food additives etc.) & to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection.

Horticulture involves five areas of study. These areas are floriculture (includes production and marketing of floral crops), landscape horticulture (includes production, marketing and maintenance of landscape plants), Olericulture (includes production and marketing of vegetables), pomology (includes production and marketing of fruits), and postharvest physiology (involves maintaining quality and preventing spoilage of horticultural crops). All of these can be, and sometimes are, pursued according to the principles of organic cultivation. Organic horticulture (or organic gardening) is based on knowledge and techniques gathered over thousands of years. In general terms, organic horticulture involves natural processes, often taking place over extended periods of time, and a sustainable, holistic approach - while chemical-based horticulture focuses on immediate, isolated effects and reductionist strategies.

However, organic is not only about replacing inputs, which is the starting point of the process rather it is based on the four principles of organic farming as advocated by International Federation of Agriculture Movement (IFOAM).

- It should be based on living ecological system and cycles, work with them, emulate them and help sustain them.
- It should build on relationships that ensure fairness with regard to the common environment and life opportunities.
- It should be managed in a precautionary and responsible manner to protect the health and wellbeing of current and future generations and environment.
- Organic agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible.

Why Organic Farming?

Continuous use of synthetic fertilizers and pesticides chemical causes ill effect on soil crops as well as human and animal health. Some of ill effects are given below:

- Change in soil structure
- Chemical fertilizers and pesticides pollute our air and water
- Hormones and antibiotics leave residues in foods.
- Chemicals cause cancers and genetic damage.
- Create deficiencies of micronutrients in soil.

- Breeding more virulent and resistant species of insects and diseases.
- Killing of beneficial insects, microorganisms and predators that naturally check excessive crop damage by insect pests.
- Synthetic fertilizers and pesticides are costly.
- Fertilizer consumption has also been increased substantially.
- The pesticides and fertilizers persist in the soil which is harmful to the beneficial soil micro-organism and earthworms and thereby resulting in degradation of soil fertility.

Objectives of organic farming

1. To produce healthy, nutritious and quality food.
2. To maintain and enhance long-term fertility of soils.
3. To encourage and enhance biological cycles involving microorganisms, soil flora and fauna, plants and animals.
4. To help in soil and water conservation.
5. To minimize all forms of pollution that may result from agricultural practices.
6. To use on farm resources as far as possible.
7. To maintain genetic diversity.
8. To preserve and enhance traditional and indigenous knowledge in farming, varieties.
9. This Farming system avoids an instance use of chemical fertilizers and poisonous pesticides.
10. It maintains sustainability in agriculture.

Present status of organic farming in India

India is bestowed with lot of potential to produce all varieties of organic products due to its various agro climatic regions. In several parts of the country, the inherited tradition of organic farming is an added advantage. This holds promise for the organic producers to tap the market which is growing steadily in the domestic and export market. As per the available statistics, India's rank in terms of World's Organic Agricultural land was 9th and in terms of total number of producers was 1st as per 2018 data (Source: FIBL & IFOAM Year Book, 2018).

The Government of India has implemented the National Programme for Organic Production (NPOP). The national programme involves the accreditation programme for Certification Bodies, standards for organic production, promotion of organic farming etc. The NPOP standards for production and accreditation system have been recognized by European Commission and Switzerland for unprocessed plant products as equivalent to their country standards. Similarly, USDA has recognized NPOP conformity assessment procedures of accreditation as equivalent to that of US. With these recognitions, Indian organic products duly certified by the accredited certification bodies of India are accepted by the importing countries.

Area

As on 31st March 2018, total area under organic certification process (registered under National Programme for Organic Production) is 3.56 million Hectare (2017-18). This includes 1.78 million ha (50%) cultivable area and another 1.78 million Hectare (50%) for wild harvest collection. Among all the states, Madhya Pradesh has covered largest area under organic certification followed by Rajasthan, Maharashtra and Uttar Pradesh. During 2016, Sikkim has achieved a remarkable distinction of converting its entire cultivable land (more than 76000 ha) under organic certification.

Production

India produced around 1.70 million MT (2017-18) of certified organic products which includes all varieties of food products namely Oil Seeds, Sugar cane, Cereals & Millets, Cotton, Pulses, Medicinal Plants, Tea, Fruits, Spices, Dry Fruits, Vegetables, Coffee etc. The production is not limited to the edible sector but also produces organic cotton fibre, functional food products etc. Among different states Madhya Pradesh is the largest producer followed by Maharashtra, Karnataka, Uttar Pradesh and Rajasthan. In terms of commodities Oil seeds are the single largest category followed by Sugar crops, Cereals and Millets, Fiber crops, Pulses, Medicinal, Herbal and Aromatic plants and Spices and Condiments.

Exports

The total volume of export during 2017-18 was 4.58 lakh MT. The organic food export realization was around INR 3453.48 crore (515.44 million USD). Organic products are exported to USA, European Union, Canada, Switzerland, Australia, Israel, South Korea, Vietnam, New Zealand, Japan etc. In terms of export value realization Oilseeds (47.6%) lead among the products followed by Cereals and millets (10.4%), Plantation crop products such as Tea and Coffee (8.96%), Dry fruits (8.88%), Spices and condiments (7.76%) and others.

Organic vegetables fetch a premium price of 10%- 50% over conventional products. Market of organic products is growing at faster rate (20%) as compared to conventional ones (5%). This growth rate is highest in Japan, USA, Australia and EU. Export preference of organic vegetables offers a great scope to a country like India, which has inculcated the skill of growing organically since time immemorial.

Components of organic farming

- **Organic manures**

i. Compost
ii. NADEP Compost
iii. Green manures
iv. FYM
v. Crop residues
vi. Vermi compost

vii. Bio fertilizers
viii. Bio-Dynamic manure
ix. Homa farming
x. Liquid organic manures

- **Non chemical weed control measures**

Uses of bio herbicides- Biological agents like insects, fungi, bacteria etc, are effective against number of weeds. Important examples ***Zygogramma biocolorata*** is effective against **Parthenium.**

- **Biological pest management**

Bio pesticides- Several pathogens including viruses such as nuclear polyhedrosis viruses (NPV) and Granulosis viruses (GV), bacteria like *Bacillus thuringiensis*, Fungi *Verticillium*, several insect parasitoids *Trichoderma* is an egg parasitoid of several pests.

Approaches for organic farming

1. Nature farming; 'do nothing' approach
2. Ecological agriculture; tools used are biofertilizers , botanical pesticides, bio-control agents, stress resistant varieties, vermi-compost etc.
3. Rishi krishi;

- Angara - bhoomi sanskar, to make soil fertile.
- Amrit pani - for seed treatment.
- Aancha gavya - for vegetative and reproductive growth.
- Biodynamic farming; for micronutrient supply.

Organic Farming Methods

The reason why organic agriculture is enforced in many nations is because it minimizes the use of various harmful chemicals that have hazardous effects on crops in the field. Here, there is more focus on using natural ways to enhance the quality of soil and the cultivated crops. Organic agriculture is nothing more than a modernization in agriculture. It is a combination of science, technology and nature. Following are the different methods that combine together to form organic agriculture:

Earlier, Monoculture was the only practice used in the agricultural fields wherein only one type of crop was harvested and cultivated in a particular location. However, in the recent world, Polyculture has come into the picture wherein different kinds of crops are harvested and cultivated in order to meet the increasing crop demand and produce the required soil microorganisms.

Soil Management

After the season of cultivation has been conducted, the soil loses its nutrients and becomes less in quality. Rather than using harmful chemicals to enhance this soil, organic agriculture focuses on implementing natural ways to not only increase the health of soil but also keep the nature and human health unharmed. One of the best examples of natural ways to enhance soil is the use of bacteria that is present in animal waste. This bacteria help in making the soil nutrients more productive; much higher as compared to the chemical containing liquids.

Weed Management

"Weed", in simple words, is nothing but the unwanted plant that grows in agricultural fields. However, in organic agriculture, there is more focus on suppressing the weed rather than eliminating it completely.

The two most widely used weed management techniques are:

- Mulching – a process wherein plastic films are used in order to block the growth of weed
- Mowing and cutting – wherein there is a removal of weeds' top growth

Nutrient Management

- Inclusion of legumes in cropping systems
- Use of FYM, compost, vermicompost
- Use of bacterial fertilizers–*Azotobacter*, PSB etc.
- Green manures
- Crop residues management
- Organic fertilizers/native phosphate
- Weed control

Diseases Management

- Proper selection of the field
- Resistant varieties
- Manipulating sowing time
- Planting density
- Crop rotation
- Roughing of infected plants
- Fallowing

Insect pest management

- Summer ploughing
- Use of clean seeds
- Regulating irrigation

- Use of resistance varieties
- Clean culture
- Cropping scheme
- Trap crops
- Pruning and Thinning
- Adjust sowing time

Advantages of Organic Farming

- Organic manure produces optimal condition in the soil for high yield and good quality of crops.
- Supply the entire nutrient required by the plants.
- Improved the plant growth and physiological activities of the plant.
- Improve the physical properties of the soil.
- Reduce the need for purchased inputs.
- Organically grown crops are beloved to provide healthier and nutritionally superior food for man and animals.
- Organically grown crops are resistant to insect pest and diseases.
- Limitations of organic farming
- Low amount of plant nutrients
- Time consuming
- Low yield of crop
- Requires Skill
- High C:N ratio of different organic residue

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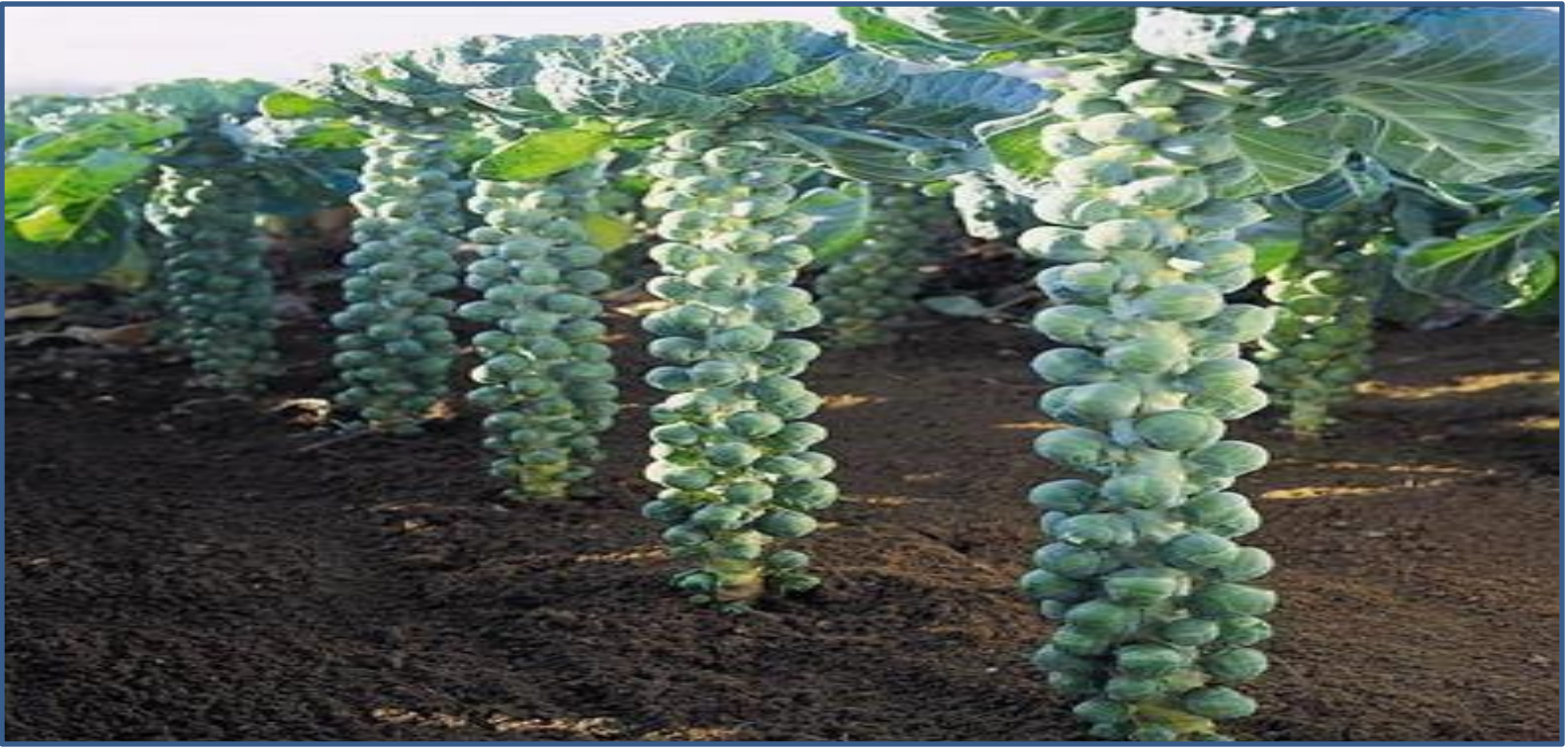

BRUSSELS SPROUTS: ORIGIN AND PRODUCTION TECHNOLOGY

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> "The sprouts resemble miniature cabbages and are borne in the axils of leaves along and around the main stock progressively from the bottom upwards. This crop is slowly gaining popularity with Indian growers around big cosmopolitan cities and hill stations to meet the demand of hotels and tourists"

Summary

Brussels sprout is a delicious cold-climate winter vegetable that has been grown in Brussel's (capital of Belgium) since the 13th century. It took 500 years to reach English gardeners but now it is a very popular crop in North-West Europe and the California state of USA. In other parts of the world, it is grown on a very limited scale. In Europe, it is mainly grown for fresh market whereas in California it is grown for freezing. The sprouts resemble miniature cabbages and are borne in the axils of leaves along and around the main stock progressively from the bottom upwards. This crop is slowly gaining popularity with Indian growers around big cosmopolitan cities and hill stations to meet the demand of hotels and

tourists. Brussels Sprouts is botanically known as *Brassica Oleracea var. gemmifera*, having a chromosome number 2n=2x=18 belonging to the family Cruciferae/Brassicaceae. Its center of origin is Mediterranean Origin. Its edible part is Sprouts/buds in the axils of leaves which develop into miniature/cabbage-like heads/enlargement of axillary buds/buttons. The inflorescence is racemose and cross-pollination is its mode of pollination which is done by bees. Generally, the seed rate required is 300-400 g/hectare with a spacing of 60 X 45-65 (Dwarf); 90 X 90 (Tall) depending upon the variety. The predictable yield established in Brussels Sprout is 200-300 quintals/hectare and seed yield are 6 quintals/hectare.

Taxonomy and origin of Cole crops

Cole crops belong to the family Cruciferae, genus Brassica under order Papaverales. The genus Brassica has about 100 species. Linnaeus included all the forms of cole group in one species oleracea. Efforts made by Barley, Yarnell, Helm, Nieuwhof, and others resulted in putting them in different forms, *i.e.* Brussels sprouts (*Brassica oleracea* L. var. *gemmifera*), Sprouting broccoli (*Brassica oleracea* L. var. *italica*), Knol khol (*Brassica oleracea* L. var. *gongylodes*), Cabbage (Brassica oleracea L. var. capitata), Cauliflower (*Brassica oleracea* L. var. *botrytis*), Kale, Collard or Tree Kale (*Brassica oleracea* L. var. *acephala*), Kitchen Kale (*Brassica oleracea* L. var. *fimbriata*), Marrow Stem Kale (*Brassica oleracea* L. var. *acephala* sub var. *medullosa*) and Thousand Head Kale (*Brassica oleracea* L. var. *acephala* sub var. *mellicapitata*) Syn. (*Brassica oleracea* L. var. *frmticosa*).

The basic chromosome number is 9 (2n=18). The species *B. oleracea* is a triple tetrasomic with 6 basic genomes and the genomic formula is AABBCCDEE. The ideal temperature for fertilization is between 12°-18°C and the pollination to fertilization period is 24-48 hours. All these crops are highly cross-pollinated in nature and cross-pollination up to 95% in broccoli, 91% in knol khol, and 72% in Brussels sprouts is reported. The main pollinating agents are honey bees and flies.

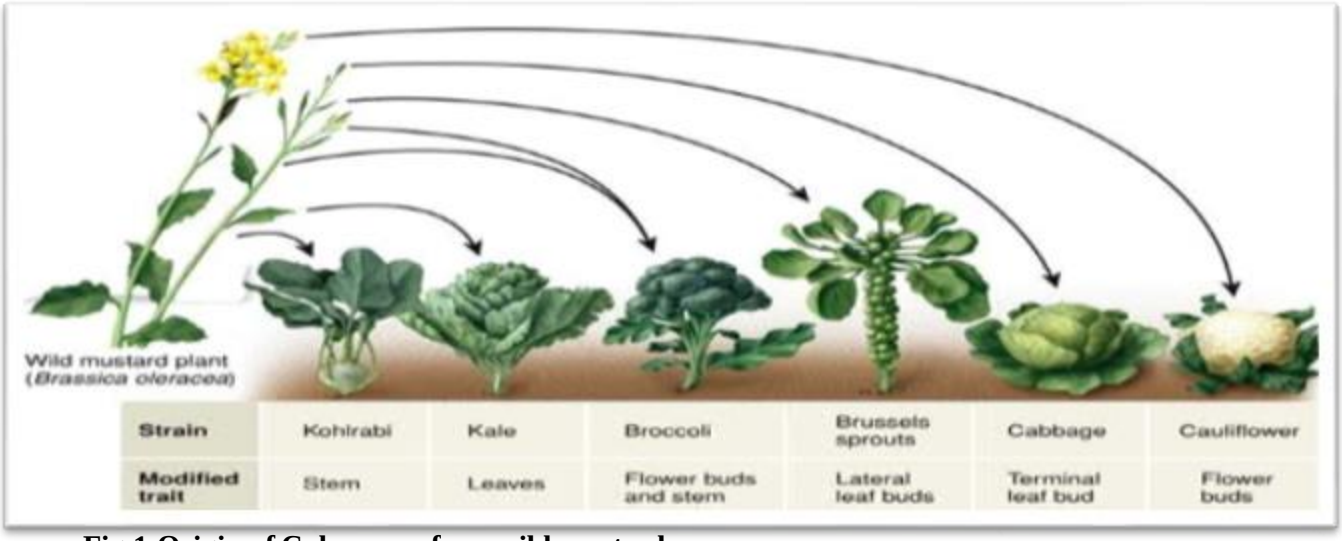

Fig.1 Origin of Cole crops from wild mustard.

Source: http://microfarmgardens.com/blog/2014/8/27/brassica-oleracea-the-cabbage-family.html

Distribution of Brussels sprout

It is an important vegetable in European countries. This vegetable, although a popular vegetable in England and its continents, is sparingly cultivated in the United States of America. From Belgium, it has been introduced to England (1810). Some parts of Long Islands in New York are also well known for Brussels Sprouts production. In India, it is widely grown in Kodaikanal and Nilgiri hills of Tamil Nadu and Maharashtra.

Nutritive Value of Brussels sprout

Every 100 gram of Brussels sprout contains 45 Kilocalories energy, 85.2% Moisture, 0.4 g fat, 4.9 g protein, 8.3 g carbohydrate, 550 IU vitamin-A, 0.10 mg thiamine, 0.16 mg riboflavin, 0.9 mg niacin, 102 mg ascorbic acid, 36 mg calcium, 80 mg phosphorus, and 1.5 mg iron.

Uses and Importance of Brussels Sprouts

- The edible part of Brussels sprouts is swollen axillary buds, known as 'Sprouts' or buttons' or 'mini-cabbages'.
- The stem of the crop makes normal longitudinal growth. Buds in the axil of petiolate leaves develop into the swollen small head like structure about 5-8cm in diameter.
- The sprouts are cooked and served in the same way as cabbage heads. These can be used as a salad or cooked as a single or mixed vegetable with potato or other vegetables.
- The sprouts are usually cooked and also pickled. This is a very nutritious winter season crop of temperate regions
- Sprouts after cutting vertically into two halves or fried with besan (gram flour) and paste can be used for the preparation of pakoras (fritters)
- Like cabbage head, boiled sprouts can also be consumed after adding salt, butter, and black pepper powder depending upon your taste.

Export Potential

Sprouts in general, if harvested at the proper stage have longer shelf-life and now a large number of hybrid varieties suitable for freezing are also available. So, there is a good potentiality for its export from cultivated areas to hotter places within and also outside the country as a fresh vegetable. There is also a good scope to export this vegetable in frozen form since a large number of hybrid cultivars suitable for freezing are available.

Soil and Climatic Requirements

Sandy and silt loam soils are most suited for Brussels sprouts. It grows well in drained upland soil. Soils must-have the capability for retention of good moisture. Soil pH should be 5.8 to 7.2 for better growth. Brussels sprout requires a cool climate. It is somewhat sensitive to temperature. In warm weather, bud clusters become loose quickly. It can tolerate frosty

conditions. However, the best quality sprouts are produced in the sunny weather and light frost during nights. The suitable temperature for seed germination optimum growth is 16-20^{o}C.

Varieties

Extensive selections made by the growers themselves keeping in view their requirements have resulted in the development of a large number of cultivars. These cultivars adapted so much to the prevailing agro climatic conditions that they failed to perform better in new conditions. This has also helped in generating variability in the crop during its early years of cultivation. But nowadays mostly hybrid cultivars are grown, which have wider adaptability and uniformity in maturity. There are two distinct types of cultivars 1) Dwarf and 2) Tall

Dwarf Cultivars: They have short stem less than 50cm in length and sprouts are small and crowded on the stem. These are mostly early cropper and most suitable for the areas where the growing season is short. Example: Improved Long Island, Early Morn, Dwarf Improved, Frontier Zuerg, and Kvik.

Tall Cultivars: They are grown in areas where the growing season is longer especially in England, other parts of Europe, and North Indian hills. Strains of cultivar Eveshan Rapid (Sweden) and Wilhelmsburg (Germany) are early in maturity but do not withstand hard winters. Late and hardier cultivars are Hilds Ideal, Red Vein, Amager, and De Rosny Polarstjernen. However, open-pollinated cultivars in both early and late groups have been replaced by hybrids.

Hilds Ideal

It is an introduction and recommended by IARI, Regional Station, Katrain (Kullu Valley). Plant height varies from 60-65cm with 45-55sprouts/plant and the number of leaves varies from 45-55. The average diameter of sprouts is 7.0-8.0cm and each sprout weighs about 7-8g. Sprouts are light green, globular, and solid with good flavor. It takes about 115days for first picking after transplanting. The average yield per plant varies from 250-400. Picking at 10 days interval is recommended to get the higher quality sprouts, as they start bursting if not harvested at the time.

Jade Cress

It is an early hybrid that matures in 90 days after transplanting. Sprouts are firm, dark green, closely packed on long stems. It can be grown under a wide range of growing conditions.

Sowing Time and seed rate

Brussels sprout is sown in June-July and seedlings are transplanted from July to September (for the early crop) and October to middle November (for the late crop) in northern parts of India. In eastern India, sowing is generally started from mid to late September. Sowing is delayed further in the southern hills except in the western and southern peninsular, where this crop can be grown almost round the year by selecting a proper cultivar. In hills, especially in high hills, seeds are sown in April-June for summer/autumn crop. In the hilly areas which receive heavy rains, the summer and autumn crops are rather limited and sowing is done in autumn to harvest them in later spring on in early summer by overwatering them. About 300-400g seed/ha is required for raising the seedlings.

Transplanting

Seedlings are ready for transplanting after 4-5 weeks. Older seedlings generally give poor yield. The planting is done on the flat land, ridges, or in furrows depending upon climate and soil conditions. For early planting, the ridge method will be more suitable, especially, in areas where the rains occur at the time of planting. In saline soils, planting should be done in furrows. In north Indian hills, planting is done from August to mid-September and also in May depending upon the altitude. Under North Indian plains, planting is done in September-October to get better yield. The planting time should be adjusted in such a way that at the time of sprout formation temperature is mild.

Spacing

The spacing depends upon the type of cultivars and method of harvesting. For single mechanical harvesting, the close spacing between the plants is followed. In European countries, the spacing of 70 cm x 45 cm in hybrid variety Valliant gave optimum yield. Spacing of 60 cm x 45 cm and 60 cm x 60 cm are recommended. The spacing of 90 cm x 90 cm is recommended in the case of tall-growing cultivars and for places having longer growing periods.

Nutrient Management

The land is well prepared to get uniform distribution of fertilizer and a healthy crop. During ploughing, add 15—20 tonnes of well rotten cow dung or farmyard manure per hectare. At the time of final ploughing, add 100-150 kg N, 50-150 kg P, and 100-200 kg K per hectare. The remaining half dose of nitrogen, i.e. 100-200 kg is divided into 2-3 equal doses and applied after 30-45 and 60 days of planting. Application of 200 kg N/ha in the form of spilt-applications results in the production of the highest number of marketable sprouts. Further increase in nitrogen results in the reduction of total sugar, dry-matter content, and ascorbic acid. Excessive application of nitrogen also results in quick growth of the plant

and the development of loose sprouts, so it should be avoided. Similarly, excessive application of potash imparts a bitter taste to the sprouts.

Water Management

The crop is irrigated immediately after the transplanting of seedlings and subsequent irrigation depends upon the climate and soil conditions. Sufficient moisture is maintained during the growing period to get better yield. In general, the crop requires irrigation at 8-10 days interval.

Intercultural Operations

To provide good aeration to the root zone, one or two hoeings may be done. Hoeing will also help in keeping down weeds if any. However, if growing weeds are very close to the plants, they should be pulled out by the hands. Sometimes, removal of terminal buds and lower leaves may result in early and good sprouts.

Topping

Removal of the apical point is done to harvest the whole crop at one time. In normal crops also, it is done in some regions after 1st or 2nd picking when the temperature is low.

Weedicides

At the time of transplanting, the climate is also favorable for the growth of a large number of weeds. Application of weedicide like Trifluralin (l kg/ha), Fluchloralin (0.5 kg/ha), Nitrofen (2 kg/ha), Oxyfluonen (l kg/ha), Alachlor (0.2 kg/ha), Butachlor (2 kg/ha) 2-3 days before transplanting helps in checking the growth of weeds having broader leaf.

Harvesting, Storage, and yield

In a normal crop, as soon as lower sprouts on the stem attain proper size and firmness, they may be harvested. Delayed harvesting results in poor quality sprouts. Loose sprouts at the base of the stem should be rejected otherwise the whole lot will be spoiled. Sprouts should be solid, upper leaves folded closely, attractive dark-green in color, and uniform in size. The freezing industries require a sprout less than 3 cm in diameter. At least 3-5 harvestings are required to be done. In the north Indian plains, the harvesting period in January-February and hills from November-March or July-September depending upon the cultivars and altitude. It is difficult to handpick crowded sprouts on the stem, which is more common in short-stemmed varieties and cultivars having sprout with a broader base. Generally, leaves are removed from the plants before harvesting. After one or two harvestings, plants are cut from the base and after removing leaves, harvesting is done in the shed. By close plant spacing and removal of growing tips after the formation of sprouts in late summer or autumn, it is possible to harvest the whole crop after 4-6 weeks of topping. Hybrid cultivars are more suitable for this purpose. The topping method is more suitable for mechanical harvesting.

Sprouts packed in polythene ceramic film (0.013 mm thickness) can be stored well for 16 weeks at 0°C and only for 11 days at 20°C. Storage of sprouts in sealed polythene packs at 0°- l° C in a modified atmosphere, 2-5% $C0_2$, and 14.5-16.8% 0_2 reduces the yield losses and improves their quality in comparison to open storage at the same temperature. Yield varies between 200-300 q / ha depending upon cultivars and agroclimatic conditions.

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Rauwolfia serpentina (L). Benth. ex Kurz. A Traditional Hypertensive Drug

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"*Rauwolfia Serpentina* (L). Benth. Ex Kurz is a classical Ayurvedic formulation widely prescribed for anxiety and insomnia, generally known as Sarpagandha. Due to the presence of alkaloids, flavonoids, glycosides, carbohydrates, phenols, phlobatannins, resins, tannins, saponins, sterols, and terpenes, the plant is known for treating numerous disorders. In Ayurvedic medicines, the root and rhizome of the plant have been used for centuries to treat a large number of diseases such as high blood pressure, epilepsy, mental agitation, anxiety, trauma, schizophrenia, sedative insomnia, excitement and insanity. This study presents botanical knowledge, medicinal applications, Sarpagandha crop production and practice. We need to pursue alternate, naturally available methods for the healing of millions of people around the world."

Introduction

Sarpagandha belongs to the Kingdom: Plantae, Division: Magnoliophyta, Class: Magnoliopsida, Order: Gentianales, Family: Apocynaceae, Genus: Rauwolfia Species: *R. serpentina* .Sarpagandha is an erect, green, perennial, tiny shrub that grows to around 15 -45 cm in height. Sarpagandha has a long, irregular, yellowish, nodular root stock, and is an upright perennial shrub. The leaves are lengthy in hue, lancelike and light green. They bear a whorl of three on a stem. The flowers are pink or white and arranged in bunches. The fruits are small, globose; at first greenish purple in colour, but when ripe, they gradually turn black.In the Indian climate, the flowering period is from March to May.In humid, hot weather, Sarpagandha grows well in a temperature range of about 10-38 ^{0}C.

It is usually seen in tropical and subtropical areas with monsoon rains of good quality. In India, China, Pakistan, Bangladesh, Indonesia, Sri Lanka, Thailand and Myanmar, Sarpagandha can be found. Himachal Pradesh, Jammu and Kashmir, Uttar Pradesh, Bihar, West Bengal, Andhra Pradesh, Tamil Nadu, Kerala, Lakshadweep and the Andaman and Nicobar Islands are situated in India.

This plant is often referred to as the Snakeroot of India; in Sanskrit as, Chandrika, Sarpakshi , Patalguruda; in Hindi as Chandrabhaga, Chota-chand, Sarpagandha; in Assamese as Arachoritita; in Bangla as Chandra; in Kannada as Sarpangandha, Sarpagandhi, Shivanabhiballi, Sutranavi, Patalagandhi; in Malayalam as Churannavilpori, Suvapavalporiyam; in Marathi as Harkaya: Harki; in Tamil as Chevanamalpodi; and in Telugu as Patalaguni, Patalagaruda, Sarpagandha.

Medicinal values

In Ayurveda, Unani and folk medicines, as well as in traditional western medicine , Sarpagandha (Rauwolfia serpentina) is used. A variety of bioactive chemicals are found in the plant, including ajmaline, deserpidine, rescinnamine, serpentinine, and yohimbine. In the plant, the alkaloids lower blood pressure, depress the central nervous system activity and function as hypnotics.

Roots and leaves are the beneficial parts. The roots are bitter, acrid, sharp, pungent and anthelminic, according to Ayurveda. The root decoction is being used as an antidote to snake venom in some tribal rich district of Odisha, India (Behera *et al.*, 2007), tribes of Chhatarpur district, Madhya Pradesh, India use this plant against snake bite (Arjariya and Chaurasia, 2009). Roots of this plant are used as an ethnomedicine to cure high blood pressure at the Manas National Park, Assam, Northeast India (Das *et al.* 2009). Roots of this plant are used in stomach-ache by the Chakma community of Bangladesh

(Roy *et al.* 2008). About 10 g root paste is mixed with a cup of water and drunk early in the morning for fever and stomach-ache by the people of Nawalparasi district, Central Nepal (Bhattarai *et al.* 2009). It is also used in the treatment of hysteria, schizophrenia, insanity, insomnia, and epilepsy dueto multiple central nervous system disorders.

Market Potential

As a result of overharvesting, the natural reserves of this plant are decreasing, particularly after reports of its medicinal properties have appeared in the literature. This plant has been held at risk by the International Union for the Conservation of Nature and Natural Resources(IUCN). Every year, importers, domestic consumers, producers, conventional practitioners, Ayurvedic and Siddha drug manufacturers throng the procurement markets for this factory. Its domestic demand is very high. As there is much less output in India, the internal market itself has great potential.

Soil and Climate

The plant prefers soil with a lot of humus and with good drainage rich in nitrogenous and organic matter. For commercial agriculture, alkaline soils are not suitable. It is ideal for sandy loam to medium black cotton soils rich in organic matter with pH 6-8 and good drainage facilities. It grows in a wide variety of climatic conditions, but flourishes best in open or partial shade in hot humid tropical climates. For this species, elevations of 1300 m with a temperature range of 10-38 ° C and annual precipitation of 2500 mm are acceptable. In areas less vulnerable to frost and having less harsh winters, the strong yield is achieved.

Land Preparation

In May, the soil is ploughed deep and left for weathering. FYM is applied after pre monsoon rains, followed by second ploughing and two cross harrowing to split the clods. Finally, the land is dressed with planking and beds are laid out. In a partly shaded area with sufficient irrigation facilities, nurseries should be erected. Each bed should be approximately 1.5 m wide, 150-200 mm high and comfortable in length. Beds are prepared in April and irrigated with shallow furrows 80-100 mm apart.

Propagation

For sowing an area of one hectare, about 57 kg of seed is required. For sowing, fresh seeds are chosen as their viability lasts for only 6 months. Seeds stored for more than a year are difficult to germinate. It is therefore important that seeds collected from September to December should be used in the following season for planting purposes. After soaking in water for 24 hours, seeds are handled with Thiram (2 to 3 g / kg seed) and so

wn from the end of April to thefirst week of May at a distance of 8-10 cm and 1-2 cm de ep. These are covered everyday with a blend of FYM and soil and irrigated. Within 30-35 days, germination is complete.The rate of germination ranges from 10-50 per cent.

By means of the stem and root cuttings and root stumps, it can also be propagated b y vegetative means. In June-July, root cuttings 30 to 50 mm long and not exceeding 12 5 mm in diameter are planted and fully covered with soil, leaving just 10 mm above the surface. When good moisture is present, the cuttings sprout within 3 weeks.

The success rate is 50- 80% and about 100 kg of root cuttings are required to plant an area of one hectare. In June, 150 to 200 mm long stem cuttings with 3 to 4 nodes are planted in the nursery and kept moist until they sprout. IAA treated (30 ppm) cuttings i nitiate rooting within 15 days. In stem cuttings, the performance rate achieved is around 65 percent. In the case of root stumps, approximately 50 mm of roots with a stem porti on above the collar are plant in irrigated fields in May-June. While this method achieve s about 90 95 per cent of success, only one plant can be raised from a single stump.

In the first week of July, the seedlings, 40-50 days old with 4 6 leaves, are ready fo r transplantation. These seedlings are uprooted and treated with 0.1% Bavistin for 30 mi nutes and then transplanted into the main field at a distance of 450 x 300 mm. This is ac companied by a light irrigation method. Around 10-15 percent of the seedlings are store d 10 15 days after planting for gap filling.

Nutrient Management

Natural cultivation is typically practiced. 10-15 tonnes of farm yard manure / ha is used before sowing. FYM (1/3rd of the prescribed dose) is needed in the nursery, along with 2/3rd of soil mixed with 10 percent B.H.C @ 20 kg per hectare. 30 kg of nitrogen and 30 kg per hectare of phosphorus and potash are needed. 1/3rd of the nitrogen and the whole dose of phosphorus and potash were added 450 mm away from the rows and 70-100 mm deep at the time of planting. Nitrogen is added 50 days after planting 2/3 rd and the residual nitrogen in the next rainy season is top-dressed.

Water Management

Almost 15-16 irrigation procedures are required. During the warm dry season and o nce a month in the winters, irrigation is required twice a month. Sarpagandha can be int ercropped as a long term Crop and slow growth in the initial stages. In Kharif, vegetable s such as brinjal, cabbage, okra and soya may be planted.

Weed Management

It needs two weeding in the primary year and one weeding in the second year, usually at the beginning of the growing season, followed by one hoeing. To encourage root growth, flowers that appear on very young plants should be nipped.

Disease and Pest Management

It is understood that illnesses such as Leaf spot, Anthracnose and Dieback cause harm to this crop. Leaf spot and dieback can be managed before the monsoon by spraying 0.2 percent Dithane Z-78 or DM-45 in early June and repeating the spray until November at monthly intervals. By spraying Blitox 50WP @ 40 g in 10 L of water, Anthracnose can be handled. Moth, grub, black moth, and weevils are the main pests that occur on this crop. At the time of land preparation, grubs can be handled by mixing BHC 10 percent with the soil, while caterpillar, black bug and weevils can be managed by spraying 10 g / 10 L of water with Asataf.

Harvesting

After 18 months of planting, the crop is ready for de-rooting when the alkaloid content is maximum, i.e. 1.4 percent. 8-10 days before de-rooting, it is irrigated and the above ground vegetation is cut and roots are taken out.

Post-harvest operations

Drying

The roots in the shade are cleaned, washed and dried until the moisture content decr eases to around 8%. Because about 80 percent of the total alkaloid is found in the outer skin, the skin should not be harmed when cleaning the roots. Brown to black seed is col lected and soaked in water for 15-20 hours and rubbed with hands to extract the seed co at from August to December. The seeds will be washed and dried three times. For futur e sowing, dried seeds are stored in a moisture-
proof spot. The weight is approximately 3.5-4 g for 100 seeds.

Yield

3,000 kg of dried roots and 30 kg of seeds is the approximate yield per hectare. Economics of cultivation per hectare of land for 18 months and root sales of 3,000 Kg @ Rs.140 / kg = 4, 20,000 with net returns of Rs. 2, 52,000 Net returns of Rs. 2, 52,000.

Conclusion

Due to the presence of alkaloids, flavonoids, glycosides, carbohydrates, phenols, phlobatannins, resins, tannins, saponins, sterols, and terpenes, the plant is known for treating numerous disorders. In Ayurvedic medicines, the root and rhizome of the plant

have been used for centuries to treat a large number of diseases such as high blood pressure, epilepsy, mental agitation, anxiety, trauma, schizophrenia, sedative insomnia, excitement and insanity. We need to pursue alternate, naturally available methods for the healing of millions of people around the world.

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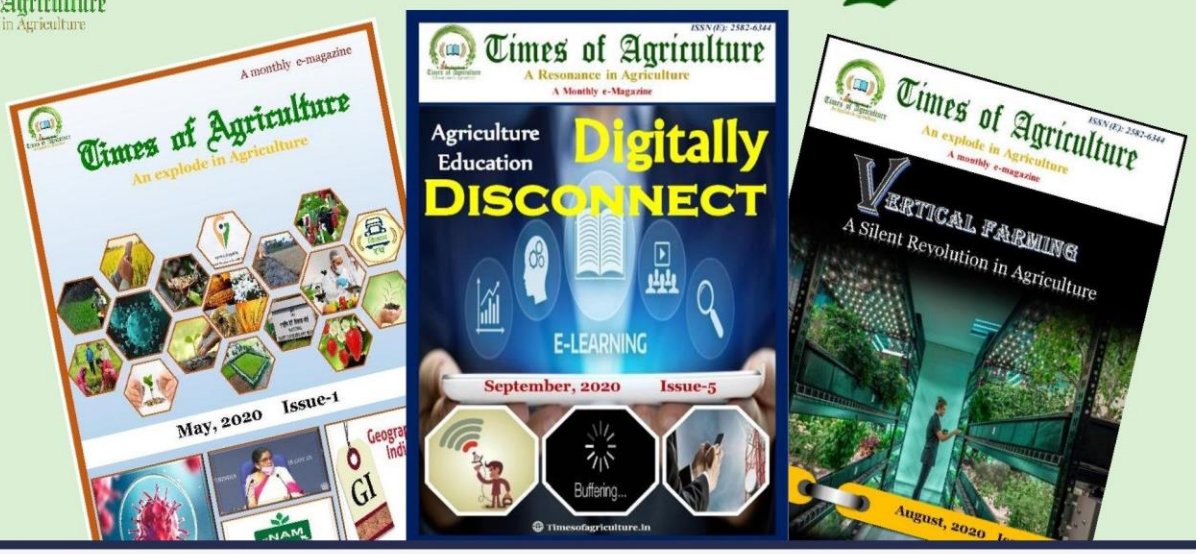

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