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Times of Agriculture

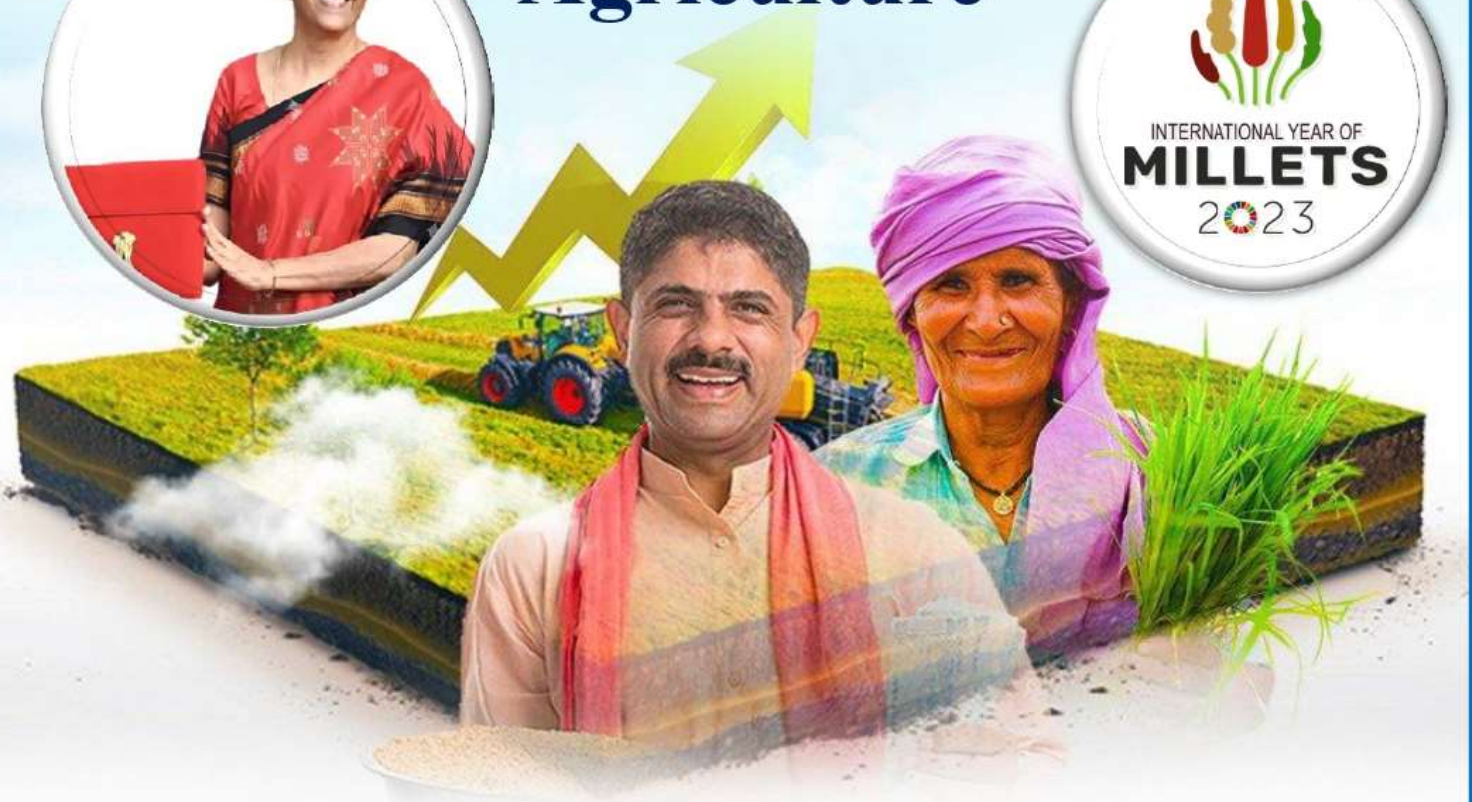
A Resonance in Agriculture

Monthly Agriculture E-Magazine

February-2023

UNION BUDGET 2023

A New Direction to Agriculture



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FROM THE EDITOR'S DESK

Hello readers, **Times of Agriculture e-Magazine** is presenting the second issue of the year 2023. This issue is based on the **Union budget** presented by **Smt. Nirmala Sitharaman**, Honorable Finance Minister, Government of India. In this issue, the complete details of the announcements made by the Finance Minister in the field of agriculture in the union budget 2023-24 have been published.

It is often seen that various government welfare schemes do not reach the farmers on time, due to which their development is hindered. Let us make our country's agriculture excellent by making our farmers aware. The purpose of our magazine is that whatever new information is coming, it should be conveyed to you. The aim of this issue is that the information about the schemes announced through the budget must reach the farmers so that we all can contribute to the upliftment of agriculture and farmers.

You can send your suggestions or complaints to us via mail.

Happy Reading...

Dr. Devraj Singh
Editor-In-Chief

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Monthly Agriculture e-Magazine

About us

"Times of Agriculture" is a monthly agriculture e-Magazine initiated for the purpose of providing information about recent innovations and technologies in agriculture and allied sectors. This e-Magazine gives a platform to dignitaries like scientists, researchers, scholars, students and innovative farmers to share their views and vivid ideas about agriculture. The main objective of this e-Magazine is to provide an open access platform for authors to get on the soapbox and spread awareness regarding the technologies and awareness in agriculture sector by e-publishing articles addressing the upcoming needs in the field agriculture.

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Union Budget 2023: A New Direction to Agriculture

AGRICULTURE UPDATES

2nd Advance Estimates of production of major crops released

2nd Advance Estimates of production of major crops for agricultural year 2022-23 have been released by the **Ministry of Agriculture and Farmers Welfare.** As per this Estimates, Total Foodgrain production in the country is estimated at *record* **323.55 Million tonnes** which is higher by 79.38 LMT as compared to previous year 2021-22.

Total production of **Rice** during 2022-23 is estimated at *(record)* **130.8 million tonnes**. The production of **Wheat** in the country is estimated at *(record)* **112.1 Million Tonnes.**

Food grains	**323.5 Million Tonnes**	**Total Pulses**	**27.8 Million Tonnes**
Rice	130.8 Million Tonnes	**Oilseeds**	40.0 Million Tonnes
Wheat	112.1 Million Tonnes	**Cotton**	337.23 Lakh bales
Coarse Cereals	52.7 Million Tonnes	**Sugarcane**	468.7 Million Tonnes

World's first vaccine for Honey Bees has been approved

The world's first vaccine for honeybees has been approved for use by the **US government**.

The US Department of Agriculture (USDA) has granted a conditional license for a vaccine created by **Dalan Animal Health**, a US biotech company, to help protect honeybees from **American foulbrood disease** caused by the bacterium **Paenibacillus larvae** that can weaken and kill hives. **The vaccine, which will initially be available to commercial beekeepers.**

The 1st meeting of the G20 Agriculture Working group, held at Indore

The 1st meeting of the G20 Agriculture Working group, held at Indore, Madhya Pradesh **from 13th - 15th February 2023**. Around 100 delegates from G20 member countries, guest countries and International Organizations participated in the meeting.

During the 3rd day event brainstorming sessions was held on various themes including ***'Food Security and Nutrition', 'Climate Based Approaches for Sustainable Agriculture', 'Value Chains and Food Systems for Inclusive Agriculture','Digitization for Agricultural Transformation'*** *and many more.*

भारत 2023 INDIA

वसुधैव कुटुम्बकम्

ONE EARTH • ONE FAMILY • ONE FUTURE

Shamalbhai B Patel appointed as chairman of Amul

Gujarat Cooperative Milk Marketing Federation (GCMMF) that markets milk and dairy products under the Amul brand has announced the appointment of **Shamalbhai B Patel as its chairman** and **Valamjibhai Humbal** as **vice chairman**.

The announcement was made after an election was carried out by the deputy collector, Anand, in presence of 17 out of 18 members. GCMMF is made up of 18 member unions overlaying 33 districts.

India ranks 1st, contributes 24% of global milk production

According to production data of Food and Agriculture Organization Corporate Statistical Database (FAOSTAT), India is the highest milk producer in the world contributing **24% of global milk** production in the year 2021-22.

Milk production of India has registered a **51 % increase** during the last 8 years- during the year 2014-15 and 2021-22 and increased to **22 crore tonne** in the year 2021-22.

New Integrated Food Security Scheme

The **New Integrated Food Security Scheme** for providing free foodgrains to **Antodaya Ann Yojna (AAY)** and **Primary Household (PHH)** beneficiaries has been named **PM Garib Kalyan Anna Yojana ((PMGKAY)**, the Ministry of Consumer Affairs, Food & Public Distribution.

The integrated scheme will strengthen the provisions of NFSA, 2013 in terms of accessibility, affordability and availability of foodgrains for the poor.

The **PMGKAY started on 1st January 2023**, benefiting more than 80 crores of poor and poorest of poor people.

Nagaland Orange Festival

Nagaland has celebrated the **Orange Festival** for two days **(January 25 to 26)**. Nagaland Fruit Festival is being organized in the state **to praise the hard work of orange growers.** Revenue from oranges in the state almost doubled recently.

The most popular fruit festivals in the world are the **Pineapple Festival of Thailand**, the **Pumpkin Festival in Germany**, the **Mango Festival of India**, the **Cranberry festival in Canada**. etc

FSSAI notifies first-ever regulatory standards for basmati rice

For the first time in the country, the Food Safety and Standards Authority of India (FSSAI) has specified identity standards for basmati rice (including brown basmati, milled basmati, parboiled brown basmati, and milled parboiled basmati).

As per these standards, basmati rice shall possess natural fragrance characteristic of basmati rice and be free from **artificial colouring, polishing agents** and **artificial**

Meghalaya launched agriculture responsive vehicle scheme

Meghalaya Chief Minister **Conrad Sangma** launched the shared school bus system, prime tourism vehicles and **agriculture response vehicle scheme**.

Meghalaya Agriculture Response Vehicle Scheme will mitigate the amount spent on transportation of agriculture produce by our farmers by giving them financial assistance for procurement of the 'Agriculture Response Vehicles' under the scheme.

FAO: India elected the Vice Chairperson

The Inter-Governmental Technical Working Group reviews the technical issues at the FAO. **India will hold the position of Vice Chairperson at the 12th session of the group.** The ITWG is to meet at Rome in and discuss animal genetic resources. **USA is the Chair of the session. Along with India,** other countries will also hold the Vice Chair position. India will also hold the position of Rapporteur along with the Vice Chair post**. Mr. Bhupendra Nath Tripathi is to represent India and hold these positions.**

UNION BUDGET 2023

A New Direction to Agriculture

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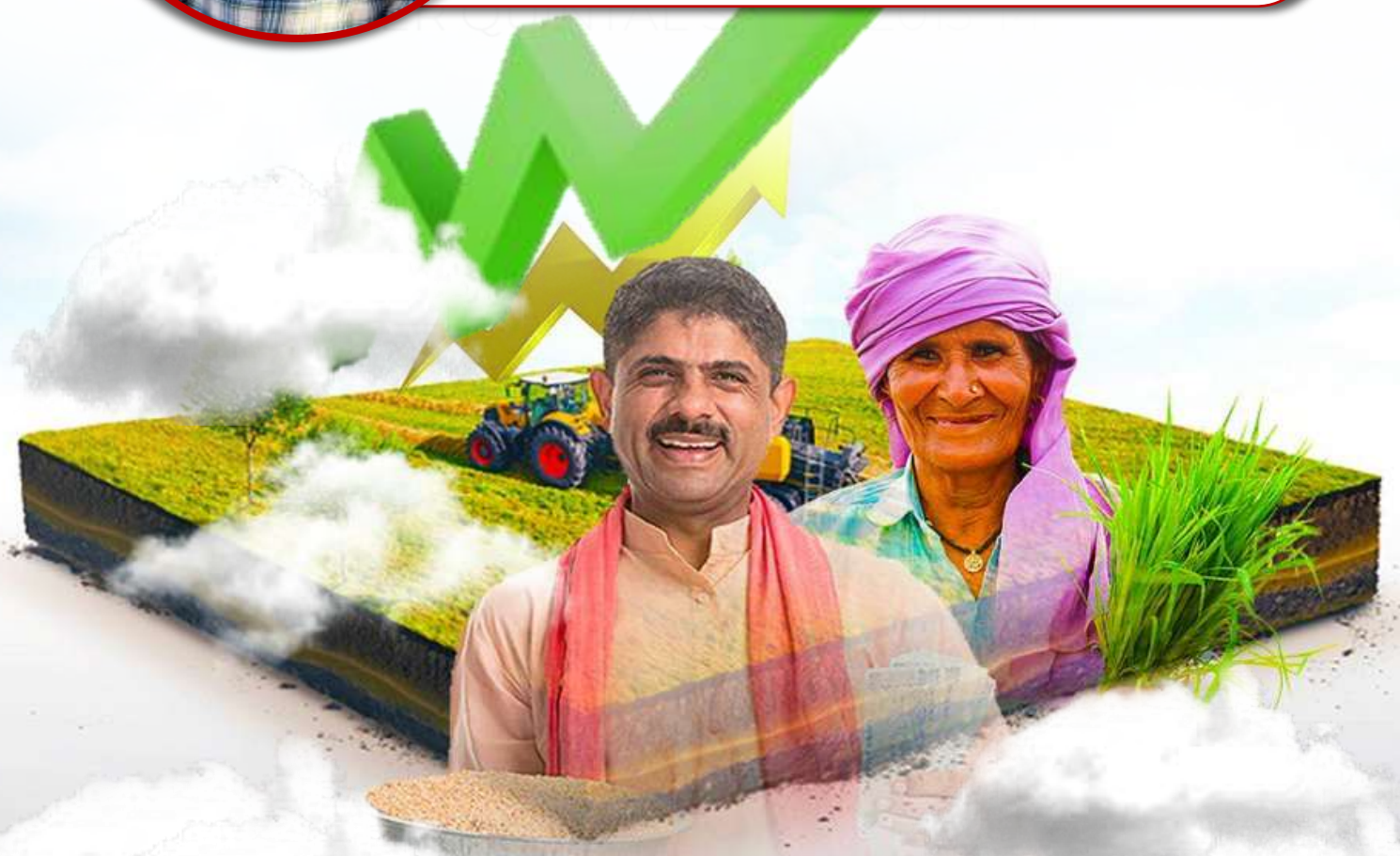


The Union Budget, presented by Finance Minister Nirmala Sitharaman, announced a number of measures for the agriculture sector, including an increase in the credit target to ₹20 lakh crore, with focus on animal husbandry, dairy and fisheries. The allocations for the sector, such as the food subsidy, however, saw a drastic fall inviting criticism from farmers' organisations.

The Finance Minister introduced a "Digital public infrastructure for agriculture" in the Budget. Ms. Sitharaman said it would be built as an open source, open standard and inter-operable public good. "This will enable inclusive, farmer-centric solutions through relevant information services for crop planning and health, improved access to farm inputs, credit, and insurance, help for crop estimation, market intelligence, and support for growth of agri-tech industry and start-ups," she added.

Allocation for the Department for Agriculture and Farmers' Welfare was ₹1,24,000 in the last Budget estimate, but ₹1,15,531.79 crore this time, a decrease of about ₹8,469 crore.

Though the Economic Survey suggested shifting crop patterns due to unexpected climatic conditions, **the allocation for the Pradhan Mantri Fasal Bima Yojana decreased from ₹15,500 crore in the last Budget's estimates to ₹13,625 crore in this Budget**.

The Pradhan Mantri Kisan Samman Nidhi **(PM-Kisan) saw an allocation of ₹60,000 crore, a decrease of ₹8,000 crore compared with the last Budget**. Allocation for the Department of Agricultural Research and Education has been increased by about ₹1,000 crore.

Union Budget 2023 Allocation for Agriculture Sector

The total budget of the Ministry of Agriculture and Farmers Welfare, including Agricultural Education and Research, is about **Rs. 1.25 lakh crore this time**. Allocations in Union budget 2023-24 for various government initiatives and schemes are given below-

PM KISAN: Out of this, provision of **Rs. 60,000 crore** has been made for the Modi Government's ambitious scheme, the Pradhan Mantri Kisan Samman Nidhi (PM-Kisan).

Kisan Credit Card (KCC): This time, Rs. 23,000 crores has been allocated for this, to enable our farmer brothers and sisters to continue to avail its benefit.

Agricultural Loan: Focusing on Animal Husbandry, Dairy and Fisheries, the agricultural loan target has been **increased to Rs. 20 lakh crore.**

Digital Agriculture Mission: Provision of **Rs. 450 crore** has been made for the ***Digital Agriculture Mission*** started by the Modi Government. **About Rs. 600 crore allocated for the promotion of Agriculture sector through technology**

Natural Farming: A provision of **Rs 459 crore** has been made to make Natural Farming a mass movement. In 3 years, 1 crore farmers will be supported for Natural Farming, for **which 10,000 Bio Input Research Centers** will be opened.

Farmers Producer Organizations (FPOs): a target has been set to provide them all facilities related to agriculture, for **which 10,000 new FPOs are being constituted.**

This FPO is a revolutionary step in the direction of raising the standard of living of small and medium farmers, whose benefits have started percolating to these farmers. In order to maintain the same momentum in the future, a budget provision **of Rs 955 crore** has been earmarked for the formation of new FPOs this year.

Food and nutritional security: It is one of the priorities of the Union Government, for which the budget has been hiked to **Rs 1,623 crore.**

Startup Ecosystem: Priority will be given to Startups related to agriculture. The Agriculture Accelerator Fund will be set up to encourage agri-startups by young entrepreneurs, for which **Rs 500 crore has been allocated over a period of 5 years**.

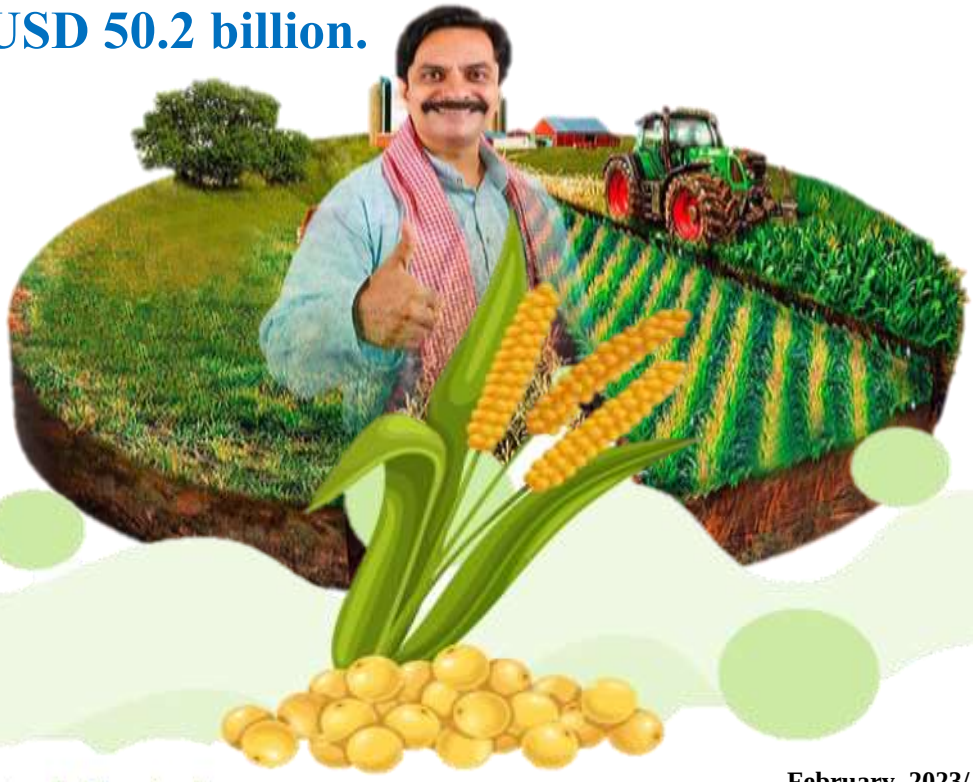
The **Indian Millets Research Centre, Hyderabad will be promoted as a Center of Excellence,** so that it can excel at the global level as well.

Horticulture Development: For the development of Horticulture sector, the budget has been increased to **Rs 2,200 crore.**

Economic Survey Highlights 2022-23

India's agriculture sector has witnessed a robust average **annual growth rate of 4.6% over the last six years.** This enabled agriculture to contribute significantly towards the country's overall growth, development and food security.

In recent years, India has emerged as the net exporter of agricultural products, with **exports in 2021-22 touching a record USD 50.2 billion.**



Agri sector saw buoyant growth due to the following measures taken by the govt:

- Private investment in agriculture increased to **9.3% in 2020-21.**
- **Institutional credit** to the Agri sector continued to grow to **Rs. 18.6 lakh crore** in 2021-22.
- Foodgrains production in India saw sustained increase and stood at **315.7 million tonnes** in 2021-22.
- As per the First Advance Estimates for 2022-23 (Kharif only), total foodgrains production in the country is estimated at **149.9 million tonnes** which is higher than the average Kharif foodgrain production of the previous five years (2016-17 to 2020-2).
- Also, the GoI has recently decided to provide **free foodgrains to beneficiaries under the NFSA 2013** for one year from 1 January 2023.
- The National Agriculture Market **(e-NAM)** Scheme has established an online, competitive, transparent bidding system to ensure farmers get remunerative prices for their produce **(covering 1.74 crore farmers and 2.39 lakh traders).**
- Under Paramparagat Krishi Vikas Yojana **(PKVY),** organic farming is being promoted through Farmer Producer Organisations (FPO).
- India stands at the forefront to promote millets after the UNGA, in its 75th session in 2021, declared **2023 the International Year of Millets (IYM).**

Scheme Wise Budget Allocations

- **60000 Cr.** Pradhan Mantri Kisan Samman Nidhi (PM-Kisan)
- **44000 Cr.** Nutrient Based Subsidy
- **23000 Cr.** Modified Interest Subvention Scheme (MISS)
- **13625 Cr.** Crop Insurance Scheme
- **955 Cr.** Formation and Promotion of 10,000 FPO
- **500 Cr.** Agriculture Infrastructure Fund (AIF)
- **100 Cr.** Pradhan Mantri Kisan Man Dhan Yojana

Department of Agricultural Research and Education			2423 Cr.
Agricultural Extension	**327 Cr.**	Animal Science	**300 Cr.**
Agricultural Engineering	**65 Cr.**	Fisheries Science	**150 Cr.**
Crop Science	**714 Cr.**	Agricultural Universities and Institutions	**322 Cr.**
Horticultural Science	**212 Cr.**	National Agricultural Higher Education Project (NAHEAP)	**92 Cr.**

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USE OF MAGNETIC WATER IN AGRICULTURE

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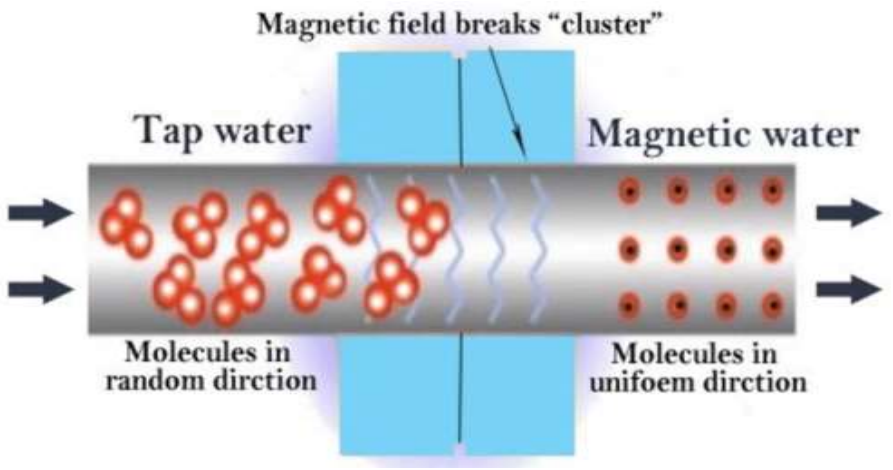

Water plays a key role in the existence of life on earth. However, the water resources are being constantly under pressure and scarcity of good quality water is the biggest challenge faced by most of the countries. In light of the current water scarcity, increasing competition from other sectors of water use and other environmental concerns, it becomes imperative to reduce agricultural water input per unit area. Hence, modern agricultural efforts are now in search of an efficient eco-friendly production technology to sustain the productivity of agricultural crops. Magnetic technology can become a useful tool, as proved by many researchers, to tackle the problems related to reduced crop productivity due to continuous use of saline water in agriculture.

Magnetically treated water (MTW) is water which has been passed through a magnetic field prior to use. When water is exposed to a magnetic field, the magnetization of water changes its properties including optics, electromagnetism, thermodynamics and mechanics. Magnetized water has extensive applications in industry, agriculture and medicine.

The magnetic field applications have been known for centuries, but still the exact mechanism of this phenomenon is not well understood. However, some contradictory hypotheses and theoretical models have been proposed by several scientists. The device for magnetization of irrigation water is installed on the main pipeline and the two common installation variations are invasive and non-invasive configuration. Invasive devices are those systems with some or all of the operating equipment within the flow field and require out of service times for installation. While, non-invasive devices are completely external to the pipe and require no out of service times for installation.

Application of magnetized water can influence the structure of cell membrane, increase its permeability and ion transport, and alter enzymatic activities resulting in increased water uptake. The beneficial effects of magnetically treated irrigation water have been reported on germination percentages of seeds, emergence rate, seedling growth, essential element uptake, crop growth, fruit and seed yield and quality. Apart from these, magnetized water can indirectly improve the soil environment through increasing the water holding capacity and soil desalinization Magnetized water treatment was found to improve the leaf area index, photosynthetic rate, yield and water use efficiency of cotton. Reduction of scales on pipe walls with the assistance of magnetic water technology could contribute to the sustainability of water resources by limiting the use of chemical scale inhibiting reagents and reduce the cost of the hard scale removal.

However, the available studies and application of this technology in agriculture is very limited. The effectiveness of magnetic field for water treatment applications is still a controversial question and the mechanism of magnetic applications has not been completely confirmed scientifically by researchers.

CROP RESIDUE TO COMPRESSED BIOGAS

AN OPPORTUNITY TO MOVE AWAY FROM FOSSIL FUELS AND IMPROVING FARM INCOME

About Author

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Agriculture contributes nearly 16% of India's GDP and employs approximately 58% of the population. Crop residue management and the reduction of stubble burning are global concerns. Approximately 1.4 tonnes of straw are left on the crops for every tonne of rice harvested, and a similar proportion applies to the other major crops. The United Nations Environment Program (UNEP) strongly advises recovering the energy contained in these carbon-rich crop residues. It is also estimated that waste generated by the Indian agriculture sector can contribute 18,000 MW of power annually.

Global warming is a hot topic that is already wreaking havoc on human communities and the natural world. The greenhouse effect is a natural process in which heat is trapped close to the Earth's surface by "greenhouse gases," preventing life (including us) from flourishing. The rise in these gases can be attributed to a variety of factors. Among these greenhouse gases, methane is thought to be the most potent, trapping heat in the atmosphere more effectively than carbon dioxide. Despite the fact that methane has a much shorter lifetime in the atmosphere than carbon dioxide (CO_2), CH_4 traps 84 times more radiation than CO_2. Globally, human activities account for 50-65% of total CH_4 emissions, which are emitted from energy, industry, agriculture, and land use.

Every year, India produces up to 620 million tonnes (MT) of crop residues. The reality is far from this, as nearly half of crop residues are treated as waste and are openly burned in the fields. According to the Centre for Science and Environment, Stubble burning is the large-scale burning of crop residues from the rice-wheat systems of Punjab, Haryana, and western Uttar Pradesh.

Challenges of crop residue

The problem of stubble burning, though seasonal, has had a significant impact on the level of pollutants in the air, thereby affecting the health of humans and livestock.

Biogas plant

Vermicompost

Aside from pollution, crop residue has an impact on soil fertility, moisture loss, and useful microbes. Biogas production from crop waste could be a cost-effective and environmentally friendly alternative. Methane is produced in large quantities during the decomposition of organic waste. Organic waste can be removed and used to produce biogas to reduce greenhouse gas emissions and

pollution risk. It can be used as an alternative to fossil fuels, which helps to reduce emissions.

Government of India initiatives

a. **GOBARDHAN-** Under the Swachh Bharat Mission, the Government of India launched the "GOBAR-DHAN" initiative in 2018 to convert waste into wealth. The initiative aimed to improve village cleanliness while also generating wealth and energy from cattle and organic waste. The primary goal is to keep villages clean, increase rural household income, and generate energy and organic manure from cattle waste.

b. **STAT-** Sustainable Alternative Towards Affordable Transportation (SATAT), which envisions establishing 5,000 compressed Bio-Gas (CBG) units across the country to produce 15 tonnes of CBG by 2023, will assist India in moving toward clean energy in a more efficient manner in the years ahead.

Biogas is a fuel that is generated through the anaerobic decomposition of organic waste such as agricultural waste, plant waste, and organic municipal waste. Compressed biogas (CBG) is developed by further processing biogas in which other gases such as carbon dioxide are reduced while methane is kept at 90 - 95 percent. CBG is primarily composed of methane, with trace amounts of carbon dioxide, nitrous oxide, and other gases. CBG, also known as bio-CNG, could be used directly in vehicles that currently use CNG or compressed natural gas, a fossil fuel. CBG is also used as a substitute for natural gas in cooking and in other industries such as cement and steel. Compressed Biogas is produced from bio-mass feedstock like agricultural residue, cattle dung, sugarcane press mud, municipal solid waste, and so on. Because CBG has properties similar to compressed natural gas (CNG), it can be used to replace CNG in automotive, industrial, and commercial applications. Reduced reliance on fossil fuels would result in significant forex savings, crop residue utilization, climate change mitigation, pollution control through vehicular emissions, efficient cooking methods, and so on.

Ayurvet Research Foundation (ARF), a Public Charitable Trust has been promoting "Sustainable Agriculture and Animal Husbandry Practices" and supporting technologies which are environment friendly and affordable. It has installed different capacity Gobar Gas Plants in gaushalas and villages of Haryana to produce clean energy. One of the FPOs (Farmer Producer Organization) managed by it is producing vermicompost for better farm productivity.

Widespread production and usage of CBG will not only reduce India's dependency on crude oil imports but also enhance farmers' income and rural employment. But the benefits of CBG don't stop there. Solid by-products of CBG can be used as bio-manure which can enhance agricultural output. Thus, the entire CBG value chain has economic and environmental advantages waiting to be tapped by entrepreneurs.

■■■

INTEGRATED APPROACH IN SCIENCE AND TECHNOLOGY FOR SUSTAINABLE FUTURE

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With the aid of technology, we can comprehend nature and utilize it to our advantage. The use of science has altered our lives in such a way that the foodstuffs we need for life depend on technology and that lives are saved as a consequence. We rely on science and technology every day. Currently, humanity has discovered a way to transform brown, foul-smelling into magic: cheap, sterile plastic. This invention has revolutionized our way of life. But things got a little out of hand with this wonder of technology. The packaging industry uses 40% of all polymers. Approximately 8.3 billion metric tons of plastic have been produced, including 335 million tons last year. By 2050, the ocean will contain more plastic than fish. Another issue comes in the latter half of the 1960s, when population growth accelerated to previously unheard-of levels and the age of revolution began, bringing about the biggest improvement in living circumstances since the agricultural revolution. From being peasants, they became workers. The Sciences developed rapidly, advancing communication, transportation, and medicine. Where science and technology have improved things, something else has come along. However, the question is how long we can maintain it, if it is sustained in the future, will it be sufficient to meet our needs on a daily basis?

Innovative strategies towards a sustainable future include

Diverse integrated technologies are developing to address the demand for a sustainable future. Among them are:

1. **Solar Energy Power:** It converts the sun's photons, or light, into

power. The planet receives 10,000 times more energy from the sun each day than it will ever require, therefore it goes without saying that solar power is readily available and abundant. In certain warmer nations, it has even surpassed main grid as the preferred source of energy. According to estimates, if the world had 50,000 miles of solar electricity, the entire planet could be powered. However, the issue occurs in nations where there is abundant sunlight, even if it typically shines for 12 hours, and here is where batteries, which store energy, come into play.

2. **Hydroponics:** Hydroponics uses running water and supplies nutrients directly to the plants, as opposed to a regular farm, which uses dirt to absorb the water to feed the plants. Some farmers installed rain capture on the roof and irrigated land nearby with subterranean pipes. This means they literally have zero water waste. It was initially utilized in 1879 in Niagara Falls and provides power 24 hours a day, seven days a week, negating the need for batteries or storage.
3. **Reducing waste in store:** Microsensors that continuously monitor the condition of fruits and vegetables as well as the amounts of ethylene have thus been developed to aid in this post-harvest process. One can reduce waste in cold rooms from 45% to just 5% by using this method. This could reduce carbon emissions for the environment as well as industry emissions.
4. **Using drones:** Drones make it possible to use fertilizers effectively, which would otherwise have negative effects on both soil health and human health. It includes a variety of sensors, such as chlorophyll sensors, which sense the plants and apply the precise amount of fertilizer needed in the plant.

Conclusion

Science has both benefits and drawbacks. Science has performed some of the most incredible life-saving miracles, but we have also paid a high price for the disruptive impact of inventions. While life must be comfortable, the desire for science and technology should not be founded on creation. The goal of science is to determine how to maximize a systems or an individual's functionality while minimizing any potential harm to other systems or individuals. Because sustainability maintains both life forms and non-living elements together, science combined with sustainability creates a better third world that is also more productive. However, users are the ones who create needs since, as the saying goes, "necessity is the parent of invention."

CLIMATE SMART PRODUCTION PRACTICES AND TECHNOLOGIES
NEED FOR ADAPTATION TO CLIMATE CHANGE

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Crop production is very climate-sensitive. It is impacted by interannual climate variability, shocks during particular phenological stages, long-term trends in average rainfall and temperature, and extreme weather events (IPCC, 2012). Distinct forms of pressures have different effects on each crop species at each phenological stage, and some crops are more resilient to particular types of stresses than others. Crop production systems must adapt to the changing climate. Modeling the intricate connections between agricultural production and potential climate changes will always include some degree of uncertainty.

Climate change impact on crop production:

Different crops will be impacted differently by an increase in carbon

dioxide levels in the environment. C_3 plants respond to elevated CO_2 levels by speeding up photosynthesis. Rising atmospheric carbon dioxide levels brought on by the climate change is advantageous to C_3 plants. A temperature shift can take many different forms, including variations in the average temperature, variations in daytime high and night time low temperatures, and variations in the frequency, severity, and length of very hot or cold weather. The reproductive stage and the grain-filling/fruit maturation stage are most vulnerable to high temperatures. Plants consume less energy to sustain their growth and more to support their respiration when the average temperature rises during the growing season. The primary food and cash crop's yields can drop by 5 to 10% with a 1°C increase in average temperatures. Changes in the seasonal mean, the timing and intensity of specific rainfall events, and the frequency and duration of droughts are all examples of changes in precipitation regimes. When temperature fluctuations that affect the crop's evaporative needs are paired with changes in precipitation, the effects of these changes will be very noticeable. Depending on the phenological stage the crop has reached, this may result in various types of moisture stress.

Climate smart crop production practices and technologies:

These include practices with an explicit focus on adaptation to specific climatic stressors, and practices that simultaneously reduce production risks and lower greenhouse gas emissions. The majority of these methods enhance soil and water conservation, boost productivity, and stop soil deterioration from releasing carbon and water into the sky.

1. Use of quality seeds and planting materials of well-adapted crops and varieties:

Quality seeds and planting materials of well-adapted crop varieties are an essential component of the development of climate-smart crops. It is very necessary to devote more resources and efforts to protecting the greatest variety of plant genetic resources for food and agriculture in their natural habitats in situ, on farms, and in gene banks ex situ in order to overcome the difficulties posed by climate change. As their natural habitats are lost as a result of climate change, the diversity of crop wild relatives, a significant source of heritable traits for crop improvement may be diminished. Generating novel varieties will most often depend on obtaining heritable variations, especially from the non-adapted materials, including crop wild relatives, which are not usually used by breeders.

2. Biodiversity management

Crop systems diversity can take many different forms, including different crop species and/or varieties (intra- and/or inter-specific diversification), different spatial scales (landscape, farm, individual fields and/or crop), and different time periods. Increasing the resilience of production systems can be achieved by cultivating "a genetically varied portfolio of enhanced crop varieties, suitable for a variety of agro-ecosystems and farming practises, and adaptable to climate change" (FAO, 2011). The level of current biodiversity (both functional and response variety) can make the difference between a stressed agricultural ecosystem and a resilient one when dealing with abiotic (e.g., shifting rainfall and temperature patterns) and biotic disturbances (e.g., insect infestations).

3. Integrated Pest Management

Climate change will affect the spread and establishment of a wide range of insect pests, diseases and weeds. Integrated pest management is an ecosystem approach to crop production and protection. It is based on the careful consideration of all available pest management techniques. In order to prevent the growth of pest populations, keep the use of pesticides and other interventions at economically viable levels, minimise risks to human health and the environment, and cause the least amount of disruption to the agricultural ecosystem possible, integrated pest management entails the use of appropriate measures.

4. Improved water use and management

Where water is a scarce resource, better water management can be achieved through measures that save soil and water, deficit irrigation that increases crop yields per volume of applied water, more effective irrigation technology that lower wasteful evaporation losses, and/or other means. Increased energy expenses are frequently needed to achieve higher irrigation efficiency. For this reason, the expansion of irrigation needs to be accompanied by appropriate energy technologies (e.g. solar powered pumps).

5. Sustainable soil and land management for increased crop productivity

Sustainable soil and land management practices like crop residue management are designed to protect and restore soils and soil biodiversity, control soil erosion control, sequester soil carbon and optimize water management in the soil. Conservation agriculture is an approach that combines limiting soil disturbance to a minimum, maintaining soil cover and diversifying crop production. Although developed to reduce soil erosion and restore degraded soils, conservation agriculture provides a strategic entry point for climate change adaptation.

6. Sustainable mechanization

The availability of appropriate machinery to carry out sustainable crop management practices increases productivity per unit of land. It also increases efficiency in the various production and processing operations and in the production, extraction and transport of agricultural inputs, including coal and oil. Investments in mechanization enable farmers to expand the range of their activities and diversify their livelihoods in ways that can reduce

their vulnerability to climate change. Sustainable mechanization can create opportunities to provide hired services for field operations, improve transportation and agro-processing and increase the possibilities for adding value to farm production. In a long-term approach, the initial investment in mechanization is compensated in the following years by higher returns on farming and labour, surplus production or increases in the amount of land under production; and greater efficiency in the use of resources and the associated savings.

7. Technologies for decision-making

Developing simple and robust scientific tools that can guide the decision-making of farmers on a seasonal and long-term basis is essential for planning strategies to address climate change. In terms of risk management, some of the most relevant technologies relate to weather forecasting and early warning systems. The improved timing and reliability of seasonal forecasts and hydrological monitoring enables farmers to make better use of climate information, take pre-emptive actions and minimize the impact of extreme events. In modern commercial horticulture production systems, weather stations often monitor irrigation in accordance with the water requirements of crops. In this way, the irrigation is automatically adjusted to changes in climate. Information and communications technologies can also support the exchange of information that is needed to respond adequately to climate change.

Conclusion

Climate-smart crop production and food systems can only be successful if they increase the synergies and reduce trade-offs among the different stakeholders and their different objectives regarding sustainable food production, ecosystem conservation and livelihoods. An integrated assessment of resource use efficiency, ecological services and economic feasibility needs to guide the choices concerning the most appropriate crops and production practices for each purpose. This must be done not only to safeguard food security, but to help reduce the concentration of greenhouse gas in the atmosphere, improve the cycling of nutrients in the soil, maintain an adequate supply of clean water and preserve the protective functions that are healthy and to provide self-maintenance of agricultural ecosystems. All of this will be crucial for coping with the increasing changes and variability of climate.

ONE-HEALTH APPROACH IN AGRICULTURE AND THE ROLE OF AGRONOMISTS IN MAINTAINING IT

About Author

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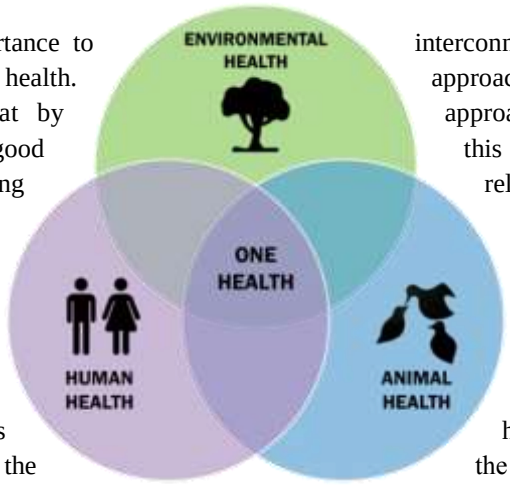
The global health is at risk. Serious life- threatening and life-limiting illnesses are becoming an enormous burden on health system of the mankind.As the global population increases there is a need for a fundamental reshaping of human relationship with nature. People have become very selfish these days. They give more importance to only human health. People think that by maintaining good health among humans, all health related issues could be minimized. But these cannot happen until and unless we prioritize the health of other living components of the globe which includes the agricultural crops, the reared livestock of the farm, etc. And out of all the health of agricultural produce and soil are of much importance. According to the food and agriculture organization (FAO), "the health of animals, people, plants and the environment is interconnected. One health approach is an integrated approach that recognizes this fundamental relationship and ensures that specialists in multiple sectors work together to tackle threats to the animals, humans, plants and the environment".



Role of agronomists in achieving "One Health" approach:

Healthy Crop Harvest:

Harvesting a healthy crop is very important from nutritional point of view. Harvesting a crop at right

recommended time and method will ensure a better quality of the produce. It will be of high nutritional quality with no infections of pests and pathogens. As the produce is the main thing which goes on higher trophic level, its quality is very important. An agronomist should judge the right time of harvest of a crop and with right method.

Adoption of Diversified Farming:

An agronomist should encourage diversified farming among the farmers rather than monoculture. More diverse an ecosystem, more difficult for the insect, pest and pathogens to spread. It helps to prevent the developing resistance power of disease causing harmful pathogens and pests and thus reducing their incidence on crops and ensure a good yield.

Maintaining quality of irrigation water:

Quality of irrigation water is also an important point to keep in mind by the agronomists. Irrigation water should be of good quality to for better yield and quantity of crops, maintenance of soil productivity and protection of the environment. Water to be used in irrigation should not be very saline and should not contain weeds seeds. If water is saline then it may cause salinity hazards.

Good quality crop residue as feed for livestock:

The residues of the crop to be used as feed for the livestock should not be toxic. It should be free of weed seeds and other contaminants. It should not be too moist or too dry. Too moist will invite fungal pathogens to colonize it thus making it hazardous for animals to feed on it. An agronomist should ensure a good nutritional quality fodder is given to animals as feed.

Adoption of organic farming:

Organic farming should be practiced to get organic produce which are safe to consume and free of chemicals. Even organic farming is good for soil health as chemicals are excluded, so it cannot degrade soil health. However does organic farming alone can feed the ever rising population is a big question. So it is better to follow integrated farming practices which do not solely depend on chemicals.

No to stubble burning:

An agronomist should educate the farmers not to burn the stubbles of the previous crops. It is followed in few states of the country. It hampers the air quality and causes respiratory ailments in humans and animals.

Reduction of use of agricultural chemicals:

Agricultural chemicals like commercial fertilizers, pesticides, weedicides, fungicides and other plant protecting chemicals should be used in a minimal rate. In alternate to those uses organic products which do not persist long in the soil and reduce soil health. These harmful chemicals when washed off by water accumulate in the ponds and water surface and causes eutrophication and biochemical oxygen demand and thus causing death of aquatic animals. So an agronomist should encourage sustainable methods like IPM, INM, IWM etc.

Adoption of line sowing in place of broadcasting:

An agronomist should not advocate broadcasting as it is less scientific method of sowing. Due to very crowded condition insect , pest and disease attack is more and to combat them more amount of chemicals are being sprayed which shows a negative impact on soil and environment. So line sowing should be adopted as it is a more scientific method of sowing and can reduced the above problems.

Use of more surface water than ground water:

An agronomist should use more surface water as compared to ground water for various uses like irrigating crops etc. Ground water increases the problems of arsenic and other heavy metals in plants and soil. Surface water is much safer.

Rainwater harvesting should be followed:

Rain water should be collected, stored and later used for irrigating crops. Rain water is an excellent source of sulphur. It helps the plant in making resistant against sucking insects and fungal diseases.

Use of organic protectants in preservation:

It is better to use organic and herbal commodities in preservation of commodities. These organic protectants repel insect and pathogens and do not cause ill effects when consumed along with the produce. On the other hand, chemicals protectants are toxic to the consumers and may cause health hazards.

Use of weeds in improving soil health:

Some weeds like water hyacinth and hydrilla can remove heavy metals from soil or aquatic system and serve for bioremediation of lead mercury and cadmium. Agronomist can use these weeds to reduce contamination from spoil.

Prevent surface runoff of inputs from fields:

An agronomist should try to reduce the surface runoff of chemicals from the field along with water. These chemicals when drop to water bodies, makes it polluted. These contaminants may even enter the body of fish which can cause harm to animals and humans feeding in it. Even when animals drink water from such water bodies, contaminants reach their system and causes hazard.

Conclusions

Thus Agronomist has a vital role to play in managing the health of soil, crops and finally whole mankind because the mankind sustain on crop production. They must educate the farmers about the negative practices that harm not only the soil but the quality of their produce too. If the agricultural produce would be healthy and contaminants free, then most of the problem of one health could be easily managed.

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MILLETS

CROPS HELPING TO HEAL THE PLANET

Millets are considered to be the historically oldest cultivated crops in the world and they were mostly confined to the traditional consumers in the rural and tribal areas. They were the first crops to be domesticated by the humankind in Asia and Africa which later on spread across the globe as critical food sources to the evolving civilizations. The history of millets dates back to more than 5,000 years where they were produced and consumed by farmers living in nomadic communities. Millet consumption in India is also mentioned in the oldest Yajurveda texts. Millet grains have been discovered in pots used for storing grains and seeds discovered at archaeological sites in present day China, India, Europe and different parts of Africa. Millets have been a good part of the staple diet among many communities across the world. Millets are seen popping up in literature, sculptures, paintings, folk songs and religious compositions from different times and geographies. One finds many millet preparations in traditional cuisines surviving to this day in different parts of India, China, Japan, Korea, Russia, Turkey, Russia, Ethiopia, etc. Millets are thus environmentally, ecologically, economically friendly sources of food and nutrition.

However, in the last few decades, millets have lost ground in production and consumption, especially with the Green Revolution in the 1960s that gave preference to high yielding rice and wheat farming. Before the Green Revolution, millets made up around 40 per cent of all cultivated grains and it came down to around 20 per cent over the years. Not only has the consumption of millets declined, but the area under production has been replaced with commercial crops, oilseeds, pulses and maize. These commercial crops are profitable, and their production is supported by several policies through subsidised inputs, incentivised procurement and inclusion in the Public Distribution System. Additionally, urbanisation and changing food habits brought an aspirational diet based on cereals and refined sugar. This has resulted in changes in dietary patterns with preferential consumption towards fine-calorie-rich cereals. With growing health consciousness, environmental concern, and the pressing need for updating our food systems to survive climate change, millets, probably the earliest of cereal grains that humans started domesticating, are making a comeback. This article focuses on environmental benefits of growing millets.

Millets have evolved to survive in extremely harsh environmental conditions without any need for human intervention. Some of the millets have been domesticated more (foxtail, pearl, finger, proso, sorghum) than the others (kodo, brown top). But so far, most varieties developed have preserved the characteristic feature of surviving in the harsh environmental conditions and adapting to thrive in fairly diverse environments. In the current situation of worsening conditions due to climate change, it is these features that have brought millets back into the focus of researchers and policy makers seeking to develop a more sustainable food system.

Millets as Environmentally Friendly Crops

Short Duration:

Millets reach maturity in a short duration compared to other commercial crops. Crop like Proso millet, needing just 70 days to be ready for harvest takes very little from the soil. This quality of short duration for cultivation is probably what made this the staple grain of nomadic communities across the Central Asia, spreading far as these tribes moved from place to place. There are several other millet cultivars that mature in a short duration.

Low Uptake:

When compared to other cereal grains, millets do not take up much from the soil. Their nutrient requirements are far less that those of the other food crops and commercial crops.

Resistance to Pests and Diseases:

Millets are not susceptible to various diseases and pests either in the field or during storage after the harvest. Hence these crops do not

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demand large number of sprays of chemical pesticides.

Capacity to Mitigate Global Warming:

A healthy environment is vital to all living beings in the world, as it provides air, water, food, and other needs that are essential to the existence of life. Unfortunately, due to human activities, the environment is deteriorating immensely, resulting in many negative consequences. Millets are highly capable of playing an pivotal role in mitigating the negative effects of global warming because they do not contribute much to water depletion and can help to prevent overall soil depletion.

Low Water Requirement:

As global warming is accelerating, the world is experiencing more frequent surface water droughts, which is problematic as surface water is a main source for most irrigation. According to the United Nations World Water Development Report (2018) agriculture sector is the major consumer of water resources. A whopping 70 per cent of total water consumed globally is used for agricultural production. As a result, the global production of rice and wheat is reducing as they are very water-intensive crops. This scenario will only get worse as scientists predict the temperature will keep rising at a rate of 0.2°C per decade for the next two decades, resulting in the current surface-water depletion rate becoming higher. This will make rice and wheat non-sustainable choices to produce in the future. Millets are drought resistant, requiring a very low amount of water; approximately 200-300 litres of water is required to produce 1 kg of millet, whereas a whopping 3000-5000 litres of water is required to produce 1 kg of rice, 1500-3000 litres for 1 kg of sugarcane, 900-1000 litres of water to produce 1 kg of wheat. As a matter of fact, millet production is benefitted as the temperature increases, making millets a more sustainable choice to produce both now and in the future.

Conserve Soil Fertility:

Millets are very hardy and tough crops that help in conserving and increasing soil fertility. They play an important role in nurturing soils and improving their texture and fertility, thus benefiting the farmer as their composting process is slow which, in turn, helps in maintaining soil structure and retaining water. Therefore, millets can help with soil depletion caused by the damage to the environment.

Stronger Root System:

Millets have also played an important role in nurturing soils and improving their fertility and texture, there by increasing the yield and hence the returns to the farmer. Once the root system is established, millets can survive many dry weeks. Once it starts raining, the plants jump back to life and yield something by the end of the season. Millets are thus fairly effective at aggregating nutrients and if we conscious in closing the nutrient loop locally, one can realize a manifold increase in soil health.

Adjust to different Soils:

Millets can grow virtually anywhere and in any type of soils. They can grow in harsh conditions and this makes them a perfect crop for dry, arid climates as well. The quality of soil is not a barrier to growth, as they can grow even in sandy soils with differing pH balances.

Reduce Water Pollution:

Water pollution is one of the major concerns of the millennium. Among the reasons for the contamination of water, soil, and air is the intensive use of chemical pesticides and synthetic fertilizers to grow crops. Again the crops listed above such as rice, wheat, sugarcane, soyabean etc require them in large quanitities.

Human Health Friendly:

Millets are not only environmentally friendly crops but can bring best results for human health preservation. Water contamination due to chemicals and fertilizers also affects the health of humans, animals, and plants. Health issues such as leukemia, brain cancer, and asthma are a few examples of illnesses linked to pesticides and fertilizers. All of this can be reduced by growing millets, since these crops can be grown without much use of pesticides and fertilizers. Thus millets have a much smaller environmental footprint than that of rice or wheat and prevent pollution through their limited need for agro-chemicals, making millets the most environmentally friendly choice of grain.

No cost on irrigation infrastructure:

Millets being rain fed crops, do not require standing water in their fields, so no need for big dams, forests going under reservoirs and elaborate canal systems to get water to the farms. Thus there is need for huge costs on irrifation infrastructure development.

Nutritious for Human Beings, Birds and Animals:

Millets are extremely nutritious grains. Their high nutrient content makes them desirable not just to humans, but also to birds and other animals too. The birds have co-evolved with these grains and therefore have beaks adapted to hulling these grains while ruminatory animals such as cattle have a digestive system that can digest the hard cellulosic fibers in their husk. So all the typical by products of processing millets for human consumption gets utilized as an additive to bird and cattle feed.

Irradiate Hunger:

The hardiness of millets makes them an ideal candidate to solve world hunger. The world's population is growing at such a rate that in a few decades conventional crops like rice, wheat and others won't be able to keep up. Enter the humble millet, its hardiness and ability to grow

anywhere means it could play a huge part in solving world hunger.

Can thrive in harsh environments ?

Lower dependence on Irrigation:

Millets are rain fed crops which don't need complicated irrigation systems to grow. They have an ingenious root system that finds and stores water, so even in harsh environments like Sub-Saharan Africa, they can thrive.

Lower monetary and environmental cost of growing:

Millets do not depend on a high nutritive index of the soil they're grown in. So they do not need any supplemental help from fertilisers. They are also extremely resistant to pests, so pesticides are rarely needed for their growth, making it extremely lucrative for farmers to grow the crop and profit from it.

Conclusion

Hence one can say that millets are not just an all-conquering superfoods, that is damn good for human beings, birds, animals but are also a force that can eventually play a huge role in environmental management, solve the world's food problem and decrease cost and increase profitability for often marginalised communities.

■■■

MANAGING CROP RESIDUE

A REVIEW OF RECENT TECHNOLOGIES

About Author

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India is a leader in agriculture on the planet. India's population is primarily dependent on agriculture, and a variety of farming techniques are used to raise diverse crops there. The majority of India's land is used for agriculture, and different crops are grown in different locations depending on the local meteorological circumstances. The 2011–12 crop year had the following production of wheat, rice, millets, pulses, and oil seed crops: 93.8, 104.7, 30, 20.8, and 17.1 mt. Additionally, these crops produce a substantial amount of agricultural residue, with our country producing close to 550 m t annually. Burning trash is a significant issue in our country. Additionally, it results in the combustion of nutrients like N, P, and Why did farmers burn crop residue on their own land?

- It takes time to create manures from leftovers.
- nothing else commercial
- Currently, combine harvesters are used more frequently.
- Farmers prepare the field to plant the crop for the upcoming season.
- Waste pickup requires labour and takes time.
- Farmers currently keep fewer animals in captivity.

Crop residue treatment refers to the quantity and distribution of plant waste on the soil's surface as well as their use as a source for other value-added goods in industry. A large volume of agro-waste is produced annually. The two primary types of crop leftovers are:

Process residue:

They are the parts that are still there after a crop is transformed into a useful resource. The following materials can be used as animal feed, nutrients, soil conditioners, and industrial materials: seed, root, baggases, molasses, and husk. Crop waste is not a waste product because it may be utilised for a variety of things and also helps the soil:

a) The leftover material is used to create biogas.
b) The addition of residue enhanced the organic matter content of the soil and improved the environment for the establishment and development of microorganisms.
c) States like Punjab, Haryana, Tamil Nadu, Assam, etc. employ rice straw and husk from various crops as animal feed.
d) When added to soil, nutrients including carbon, nitrogen, phosphorous, and potassium are present in some amount as residual material.

Field residue:

These are the materials that are left over after a crop has been harvested in an agricultural field. The husks, petals, stalks, and stems are among the remains.

Recent practices

- Balling of straw
- Mulching
- Composting process
- Bio methanation
- Gasification
- Straw baler
- Stubble shaver
- Straw reaper
- Happy combo seeder.

Other machineries

- Forage chopper
- Rotatory mulcher
- Residue crushing machine
- IISR plant residue shredder.

Nutrient losses from burning crop remains

S. No.	Particulars	Loss during one ton of straw	Loss in soil/ha
1	Nitrogen	6-7.2 kg	-
2	Phosphorus	1.2-1.7 kg	-
3	Potassium	15-23 kg	-
4	Sulphur	1.2-1.4 kg	-
5	Organic carbon	-	94 lakh ton
6	Urea	-	79 kg
7	Diammonium phosphate	-	13.74 kg
8	Potash	-	127 kg

Conclusion:

Crop residue is not a waste material, according to a review study. It enhances soil's chemical, physical, and biological qualities. It serves a variety of functions and is also employed in agriculture. The technology is more advanced today, and different machines are employed to cut the waste material. Therefore, use the leftover materials instead of burning them.

NATURAL FARMING

A SUSTAINABLE AGRICULTURE PRACTICE

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Natural farming means farming with Nature and it is a chemical-free alias traditional farming method. It is considered as agroecology based diversified farming system which integrates crops, trees and livestock with functional biodiversity. The indigenous (Desi) cow dung and urine is preferred and plays a major role for preparation of concoctions. Natural farming is low-input, climate-resilient type of farming that encourages farmers to use low cost locally resources. It encourages natural symbiosis of soil microflora and have less chance of effecting soil and environmental health.

In ancient time of India, only natural farming is to followed by all the farmers, later on mid of 19th century, use of chemicals in agriculture was introduced due to increasing in the population growth and food security. Farmers cultivate crops using chemicals and reported high yields there by agriculture projected profitable. Enormous opportunities by offering good yields under those challenging circumstances of the country. It made the sustainable availability of food to ever increasing population. Present scenario majority of Indian farmers are practising chemical farming, producing chemical food should lead to effect on human health and also causes soil, air and water pollution mainly by applying of chemical fertilities and pesticides.

Objective of natural farming

Natural Farming methods or principles was promoted by Mr. Subhash Palekar, an alternative to the Green Revolution's methods. A set of toolkit was developed for all cropping systems and practising in various states across the country in the name of 'Zero Budget or Subhash Palekar Natural Farming'. The area covered under natural farming is 6.5 lakh ha in India by following states *viz*., Kerala, Andhra Pradesh, Jharkhand, Gujarat, Uttar Pradesh, Himachal Pradesh, Chhattisgarh, Madhya Pradesh, Tamil Nadu, Odisha and Rajasthan. In natural farming no chemical or organic fertilizers are added to soil, the organic matter is decomposed of by available microbes and earthworms in soil surface itself, thereby it adds nutrition to soil. Usually, no practices such as tillage and weeding are followed, it kept in such a way that just like natural ecosystem. To retain and enhancing a soil organic matter a healthy soil microbiome is important factor.

Majorly the soil fertility is enhanced by the concoctions, there are various ways to prepare concoctions. In India, the most popular concoctions are based on fermentation of animal dung and urine, such as Jeevamrit, Beejamrit, Ghanjeevamrit, Saptdhanyankur, Brahmaster, Agnister, Dashparniark etc., Natural Farming majorly based on four pillars such as Jeevamrit (consisting of microbes), Beejamri (seed treatment), Acchadana (mulching) and Waaphasa (soil aeration or moisture). Plant protection measures such as butter milk, cow milk, pepper powder, neem seed and green chilli etc.

Principles of natural farming

The following principles area considered for practicing natural farming *viz.*, Increase organic residues on the soil, mixed cropping, no external inputs, use indigenous seed, moisture conservation, minimal disturbance of soil, and soil to be covered with crops

365 days (Living root), pest-management through botanical extracts, no pesticides, no synthetic fertilizers, no herbicides and integrating animals and trees into farms.

Benefits of natural farming

- The naturally produced food has higher nutrition content and people have better health benefits.
- Reduction of production cost of farmer by preparing of biological inputs from their own farm resources.
- Eliminates the ploughing, fertilizing and weeding operations, which saves farmer expenditure.
- It is a cost-effective farming by eliminates application of synthetic chemicals.
- Reduction of greenhouse emissions by reducing the environmental pollution levels.
- Improves soil fertility and save water use.
- Improves soil health ecosystem and conservation of resources.

RICE BIOFORTIFICATION

SUSTAINABLE WAY TO MITIGATE MALNUTRITION

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The green revolution considerably increased productivity and solved the food security issue for developing countries like India, yet it still lags behind developed countries in terms of dietary diversity. About half of the global population reported to have deficiencies of Zinc, Iron and vitamin-A leading to impaired immune function, iron deficiency anemia and xerophthalmia, respectively. People are encouraged to be cautious about diversifying their daily diets to avoid micronutrient deficiencies, however due to their poor economic situation, the majority of people cannot afford to supplement their diets. There is a lot of potential for biofortification of staple crops like rice and wheat to solve the issues of nutrient deficiencies. Biofortification in rice can be done by different method like agronomic, breeding and biotechnology based biofortification.

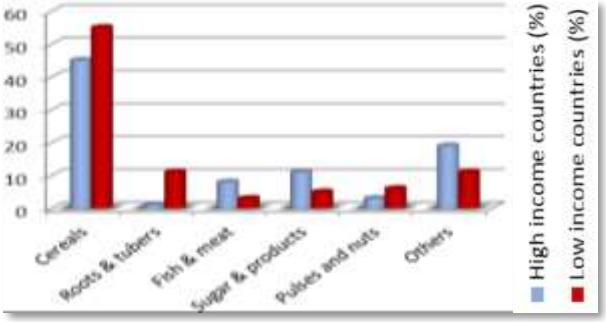

Fig 1: Dietary diversity by sources of dietary energy (FAO, 2008)

From the figure it is clearly observed that in low income countries they consume more cereals but less animal originated products like fish and meats and in other hand high income countries their proportion of energy source from other parts is higher than low income countries showing their diversity in foods. This imbalance in diet plan leads to micronutrient deficiency.

Nutrition gap

Recommended daily intakes of vitamin A, Iron and Zinc are 600µg, 15mg and 15mg, respectively (RDA, 1989). Swarna is the most widely grown and consumed rice variety in India which constitutes 0.78mg Iron/100g white rice and 2.28mg Zinc/100g brown rice. By consuming twice or thrice a day taking 100-150g rice/meal a person can get hardly 2-3mg Iron and 7-8mg Zinc which is 1/5th and half of the recommended daily intake of Iron and Zinc respectively.

What is biofortification ?

Biofortification is the development of nutrient dense staple food crops using the best conventional breeding practices and modern biotechnology, without sacrificing agronomic performance and important consumer preferred traits.

Reason for rice biofortification

For almost a billion people, rice is a main food crop. The starchy and most edible portion of the rice seed, the endosperm, is lacking in many of nutrients including vitamins, proteins, micronutrients and others. Dehusked rice grains have an aleurone layer that is nutrient-rich but is removed during milling and polishing. Unprocessed rice becomes rancid, losing its flavour and becoming odorous. 30–50% of the daily caloric intake is provided by rice. Rice plays an important role in food security for its wider adaptability.

Agronomic approaches to biofortification

Major agronomic methods for biofortification include ferti-fortification, tillage, and the application of cyanobacteria and plant growth promoting rhizobacteria. Numerous approaches are used in ferti-fortification, including the source of nutrients, the quantity of nutrients used and the timing of the applications. According to Pooniya and Shivay (2011), basmati rice that received a foliar treatment of zinc sulphate (0.2%) had higher grain and

straw zinc concentrations than rice that received a 2% application of ZEU (zinc enhanced urea). According to Yilmaz *et al.* (1997) experiment, combined soil and foliar application of zinc gave higher zinc concentration in grain and shoot followed by seed and foliar application rather than single application as soil, seed and as foliar. Tillage has also significant influence on nutrient content and uptake of plants.

Golden rice - A GM food crop

It is a genetically modified provitamin A (β-carotene) enriched rice genome. Professor Ingo Potrycus and Dr. Peter Beyer considered as the founder of β-carotene enriched golden rice. They used crtl gene from a soil bacterium (*Agrobacterium tumifascience*) and the daffodil gene for modification of the genetic makeup. There are two grades of golden rice:

- **Rice-1 (SGR1):** contain 5-7µg β-carotene/g rice
- **Golden rice2:** contain 31 µg β-carotene/g rice.

Biofortified varieties

- **CR Dhan 310 :** Protein 10.3%, Grain yield - 45 q/ha, Developed by – NRRI, Cuttack
- **DRR Dhan 45** : Zinc- 22.6 ppm, Grain yield – 50 q/ha, Developed by – IIRR, Hyderabad
- **CR Dhan 315 :** Zinc – 24.9 ppm, Grain yield – 50 q/ha, Developed by – NRRI, Cuttack.

Advantages and disadvantage of rice biofortification

Rice biofortification have certain advantages *i.e.* 1. Improvement in nutritional value 2. Reduced adult and child micronutrients caused mortality 3. Reduced dietary deficiency diseases and healthier population with strong and quick immune responses to infections. With these advantages, biofortification of rice has also certain disadvantage *i.e.* 1. High production cost 2. Potential negative interaction of biofortified rice with other plants/ non- GM rice crops causing loss of wild type rice varieties. 3. Low substantial equivalence *i.e.* inability to provide high micronutrient and protein content compared to supplements. 4. Poor rural populations have limited access and resources to purchase biofortified rice. 5. Genetic engineering methods used may compromise immunity in humans *i.e.* increased risk of allergenicity.

Conclusion

Awareness of dietary diversity must be followed up to alleviate micronutrient malnutrition. As people of underdeveloped nations cannot afford supplemented and diversified foods, research and development of nutrient enriched biofortified crops should carried out to face this problem. There are several aspects of biofortification but agronomic aspect (Ferti-fortification) is simpler one and is mostly followed. The concept of food security therefore may be now a day well defined as access of nutritious foods at an adequate amount.

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SOYBEAN AND BUNDELKHAND REGION

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The crop which is the main source of protein (35-45%) and oil (18-22%) in our global food supply is soybean which contributed 121.76 lakh hectares (2021-22) in area but still lacks the production ability in India especially in the Bundelkhand region. Even after the increased MSP by the government from Rs. 3950 in 2021-22 to Rs. 4300 in 2022-23, the farmer is still unwilling to grow soybean in the Bundelkhand area.

Reasons

The dilemma of varietal sustainability, traditional thoughts and unawareness of advantages are the chief reasons.

Solutions

After brainstorming at Institute of Agricultural Sciences of Bundelkhand University, conclusion formed was that varieties, namely NRC-128, JS 95-60 and JS 20-98 which were free from contamination under organic rainfed condition were fit for sandy-loamy soil of certain areas of Jhansi. The above-mentioned varieties may be used by farmers for better yield, both in terms of quality and quantity. Therefore, this side-lines the varietal issue faced by farmers in this particular region.

Traditional thoughts occupying the main reason for decreased soybean production can be overlooked since now various tolerant varieties and management factors are effectively used without causing any serious damage to the crop. Mostly, green gram, black gram, groundnut, sesame and pigeon-pea are monotonously being grown from ages and hence growing a different crop like soybean will be an added benefit to the farmer as this will fetch more money due to less competition. Even growing it in rotation will be beneficial.

Advantages

- Adds agronomic value
- Restores good quality soil
- Used as livestock feed
- Requires less fertilizers
- Boosts farm diversity
- Immense industrial uses.

Conclusion

Soybean is a high fibre, high protein, cholesterol free, lactose free, low in saturated fat and a good source of antioxidants which thus makes it most important bean/oilseed crop in the world. The food products like- soymilk, soy chunks, soy nuts, tofu, protein powders, soy oil, soy sauce, tempeh, soy beans, etc. are highly in demand now as compared to past and even in the biofuel industry. Hence, seeing the increasing ongoing need, its advantages and the future aspects, farmers should try growing soybean which will not only benefit themselves personally but also the Indian economy.■

PURPLE REVOLUTION OR LAVENDER FARMING

A NEW REVOLUTION

About Author

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What is lavender?

Lavender (*Lavandula angustifolia*) is a member of the Lamiaceae family (also called mint family). It is a perennial plant that can live up to 20 years. Lavender is a purple blossomed aromatic shrub. It produce purple flower, which contain high levels of essential oil. It is of very low toxicity, while showing remarkable antiseptic and antimicrobial action.

Purple Revolution

The Ministry of Science and Technology initiated the Purple Revolution or Lavender Revolution in 2016 through the Aroma Mission of the Council of Scientific and Industrial Research (CSIR). By switching from imported aromatics to domestic ones, it seeks to support the local agro-economy based on aromatic crops. As part of the objective, free lavender seedlings were provided to first-time growers, and those who had previously grown lavender were compensated with Rs. 5–6 per plant. The nation's first "Lavender Festival" was launched in September 2022 in `Bhaderwah.

In India, Lavender growing has started in the Ramban district of Jammu and Kashmir as part of the CSIR-Aroma Indian Institute of Integrative Medicine (IIIM) Initiative. Almost all 20 districts of Jammu and Kashmir have lavender farms. A lot of progress has been made in this direction, especially in the districts *viz*., Kathua, Udhampur, Doda, Kishtwar, Rajouri, Srinagar, Bandipora, Budgam, Ganderbal, Anantnag, Kulgam, and others. CSIR also plans to introduce aroma crops in other hilly states like Uttarakhand, Himachal Pradesh, and the North-Eastern States.

What is Aroma Misson

The CSIR Aromatic Mission intends to conduct focused interventions in agriculture, processing, and product development to promote the growth of the aroma industry and rural employment. Its goal is to bring about transformative change in the aroma sector.

It will encourage the development of aromatic crops for the production of essential oils, which are in high demand in the aroma sector. It is anticipated that Indian farmers and the aroma business will be able to become worldwide leaders in the production and export of various essential oils in the menthol mint pattern. Aroma Mission is drawing entrepreneurs and farmers from all across the country. CSIR assisted in the cultivation of 6000 hectares of land in 46 aspirational districts across the country during Phase I. In addition, almost 44,000 employees were trained. The CSIR has started Phase II of the Aroma Mission, which will include over 45,000 skilled human resources and help over 75,000 farming families.

Under the Aroma mission, the farmers in Kashmir have advanced toward the "purple revolution." They have switched from growing conventional crops to the more profitable lavender crop, a fragrant plant with purple blossoms. To learn more about them, read on. The Aroma Mission aims to further encourage the development of aromatic crops on around 60,000 hectares by bringing an additional 30,000 hectares under cultivation through CSIR interventions. As a result, an additional 700 tons of essential oil will be produced for the perfumery, cosmetics, and pharmaceutical industries. The usage of these oils in value-added and herbal products will result in at least 200 crores in revenue. The goal of the CSIR's Aroma Mission is to raise farmers' incomes by between Rs. 30,000 to 60,000/ha/year by growing high-value, high-demand aromatic crops.

About 45,000 skilled human resources capable of multiplying quality planting material, distillation,

fractionation, and value addition will also be developed under "Skill India" initiatives. More than 25,000 farming families would be directly benefitted and employment of more than 10-15 lakhs man days will be generated in rural areas.

Uses of lavender

Lavender oil, which sells for at least Rs. 10,000 a litre, is the main item. Oil from lavender is extracted and used to make goods like soap, cosmetics, fragrances, air fresheners, and medicines. The lavender plant doesn't require a lot of water, and bugs and other creatures that prey on crops are unlikely to harm it. A single lavender plant blooms for fifteen years, can be used in two years after planting, and requires little maintenance. A single lavender plant can be used after just two years after planting.

Significance of purple revolution and aroma mission

Because it helps the government's objective of tripling agricultural earnings by 2022, it is significant. It would foster the region's entrepreneurial culture, further the Start-Up India project, and provide future farmers and agri-entrepreneurs with a means of subsistence. More than 500 young people received assistance from the purple revolution, and as a result, their income increased by double. Lavender oil is currently a net importer into India, but the CSIR's Indian Institute of Integrative Medicine, Jammu aims to change that through its extension initiatives.

■■■

MEDICINAL PROPERTIES OF PAPAYA (*Carica papaya*)

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Papaya and its phytochemicals and antioxidants

Carica papaya, a tree-like herb, is cultivated in more than 50 tropical and subtropical countries worldwide. The parts :-leaves, fruit (ripe and unripe), seeds and The stem, leaf and fruit of papaya contain plenty of latex. The latex from unripe fruit contains enzyme papain, Papaya and its parts can be used as food as well as medicine in several ways for a number of diseases. Papaya, with a variety of phytochemicals like carotenoids, polyphenols, benzyl isothiocynates, benzyl glucosinates, prunasin (cyanogenic substrate), papain and chymopapain, alkaloids, phenolic compounds, flavonoids, vitamins A, C, E and E, carotenoids, cyanogenic-glucosides, cystatin, and glucosinolates exhibits significant health benefits ranging from digestive to immune modulation. These compounds have antioxidant, chemoprotective, anti-diabetic,anti-bacterial, anti-plasmodial, anti-fungal, anti-inflammatory, anti-tuberculosis, anti-microbial, anti-arthritic, anti-sickling,anti-ulcer, anti-HIV, anti-tumor, anti-cancer, anti-helmintics, anti-hypertensive, anti-hyperlipidemic activities.

Parts of papaya and its medicinal uses

Leaves: To treat a tumour, weakening of heart, high blood pressure, malaria, dengue, jaundice, obesity, overweight, chronic indigestion, arteriosclerosis, urinary infection, gonorrhea, abortion, fever, asthma,bacterial & viral diseases. Anti-anemic agent and body cleanser and used as tonic & blood purifier.

Fig-1 Layout of papaya with longitudinal sections showing the fruit seeds.

Flowers: Jaundice, emmenagogue, febrifuge and pectoral properties.

Fruits: To treat ulcer, impotency Laxative, avoid heart attack or strock.

Seeds: Cures piles, typhoid, intestinal worms, poisoning related disorders,sickle cell diseases, clear nasal congestion,detoxify the liver, protected kidneys from the toxin To shown anthelmintic bactericidal anti-amoebic activities and bleeding piles and enlarged liver and pectoral properties.

Latex: Anthelmintic relieves a whooping cough, dyspepsia, burns pain,bleeding haemorrhoids, stomachic, and diarrhea.

Roots: Syphilis (infusion), bronchitis, cough, respiratory diseases, renal,urinary bladder problem, effective purgative & analgesia.

Stem bark: Sexually transmitted diseases (STD), jaundice, sore teeth, anti-fungal anti-haemolytic activities.

Papaya in folkloric medicine

All around the world, papaya has traditionally been used as folklore medication from a very long time. Ripe papaya fruits help the digestive system in reducing dyspepsia and give relief in constipation and are used as a laxative in countries like China, Dominican Republic, Panama, Turkey and Mexico and unripe fruits of papaya are called as abortifacient in some countries like Mexico, jawa , Turkey and Sri Lanka. . Ripe papaya fruit is regarded as amebicide ,bactericide , vermifuge in Japan, India, Haiti, Malaya, Panama, Samoa, Turkey respectively and is used to treat diarrhea and dysentery in Honduras, Papaya is also useful for corns, boils and for surgical injury dressings in India, Malagasy, It is also used for urological problems in several countries.

Papaya against dengue

Papaya leaves were collected and thoroughly washed with water and then grinded and as the taste of papaya leaves extract was very bitter so some amount of sucrose was added About 25 mL of leaves extract was administrated orally, twice daily for five consecutive days. Before extract administration, the patient blood was evaluated for total platelets counts, after 24 hours each time. After extract administration the patient blood was rechecked for platelets counts again for five consecutive days. After which the patient starts improvement. Before administration of leaves extracts, the patient blood test have been taken. From the tests results it was observed that PLT, WBC and NEUT decreased from normal level. After the infection the patient immediately felt fatigue and fever, these symptoms aggravated over the night. Different antibiotics and anti-malarial drugs were administrated orally and intravenously, but no successful results.

Papaya in decubitus ulcers, burn dressing and wound healing

An ointment named Accuzyme is available (8.3 × 10 5 USP units papain and 100 mg of urea/g of ointment) which helps the breakdown of dead skin, liquefying pus and improves the recovery time of open wounds necrotic wounds and pressure ulcers. Papaya has enzyme named papain which dissolves dead tissues without adversely affecting live cells.

To manage burn injuries are very difficult clinical task and needs special facilities because of excessive loss of body fluids, diaphorosis build up that result in significant morbidity. fabricated from Polyurethane (PU)-based bionanofiber loaded with honey and papaya fruit extract a dressing is made. This dressing material diameter is of 190±19.93nm and pore sizes of 4–50µm supports nutrient infiltration and gas exchange is important and very useful.in burn injuries because it reduces clinical complications and fastens patient's recovery.

Table-1 Nutritional value of papaya (raw, 100g)

Nutrients		Minerals & Vitamins	
Total fat	0.3g	Sodium	8mg
Saturated fat	0.1g	Calcium	20mg
Carbohydrate	11g	Iron	0.25mg
Dietary fibre	1.7g	Potassium	182mg
Sugar	7.8g	Vitamin C	60.9mg
Protein	0.5g	Vitamin A	950IU

Food-Data Central USDA (2019) Unites States Department of Agriculture

Antimalarial properties of papaya

Folkloric medicine helps to cure malaria made up of plant extract in African countries.

Anticancer properties of papaya

Papain is cysteine protease enzyme from andolytic plant which is isolated from papaya latex**.** Papain optimal temperature ranges from 60°C to 70°C because it is relatively heat resistant enzyme**.** Cancer cells have protective coating of fibrin so they were undetectable. Papain breaks down that fibrin coat of cancer cell wall. So ultimately it helps against the cancer. Papaya is a storehouse of cancer fighting lycopene.

Conclusion

Papaya originated in Mesoamerica, likely in southern Mexico. Papaya was introduced in India in 16th Century from Malaysia. Fruit is sweet, juicy with satiny consistency. Papaya is referred to as the fruit of the Angel's this implies that fruit must be power packed. Papaya plant has been used as traditional healers from centuries as a source of powerful medicine. Regular intake of papaya will improve our health and enhance our immune system to fight against the foreign pathogens.Thus, intake of papaya as fruit salads, fruit juice, leaf extract, decoction prepared through papaya leaves, etc. should be a part of our diet.

■■■

Agaricus Bisporus

AN EDIBLE MUSHROOMS TO MEET THE FOOD SECURITY

About Author

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Mushroom is a plump, fruiting body of fungus that belongs to basidiomycetes. The most commonly cultivated mushroom is *Agaricus bisporus* followed by *Lentinus edodes*, *Pleurotus spp*., and *Flammulina velutipes*. It has become the alternate source of income for farmers in agriculture. Mushroom farming is the most profitable agribusiness in India and can be started with minimum investment and space. Farmers with lower or minimal income can also invest and run their own farm. Mushrooms are a rich source of nutrition, high amount of fiber, and contain less fat predominantly of unsaturated fatty acids such as linoleic acid. Mushrooms are low in calories, carbohydrates and fats ,it has become part of the daily diet all over the world. Many of the edible mushrooms have therapeutic properties and several used for medical purpose are also edible. Mushrooms have a high nutritional and functional value that's why they are considered for their medicinal properties. Mushrooms are an excellent source of minerals and vitamins such as phosphorus, magnesium, selenium, copper, and potassium, and are rich in dietary fiber and chitin. An enormous assortment of mushrooms has been used generally in various societies for the upkeep of wellbeing, just as in the avoidance and treatment of infections through their immunomodulatory and antineoplastic properties. In excess of 100 therapeutic capacities are created by mushrooms and organisms. The key restorative uses are cell-reconstructive, anti-inflammatory, cardiovascular defender, antiviral, antibacterial, antiparasitic, antifungal, detoxification and hepatoprotective impacts.

Nutritional value of mushroom

Mushrooms have become valuable diet for vegetarians who abstain from food since they give everyone the fundamental or essential amino acids to meet the amino acids requirement for adults. Mushrooms have higher protein content than most vegetables and are rich in omega-3 fatty acids. Mushrooms are rich in nutrients and contain a wide range of bioactive mixtures with various human health benefits. The nutritional status and chemical compositions of mushrooms vary from species to species and depend on the environment they are grown in:

1. Mineral composition

The composition of minerals in edible Mushrooms typically varies from 60 to 120 g/kg on a dry basis. Phosphates, chlorides, and nitrites were all significantly reduced in concentration, while bromides and fluorides were found to be in negligible. The average values of nitrate, chlorates, and sulfates, in wild-growing species, are 22.6, 20.4, and 3.6 g/kg respectively.

2. Lipids

Mushrooms typically contain fatty acids like oleic, linoleic, and linolenic as the main constituents. Mushrooms have the benefit of having high quantities of polyunsaturated fatty acids (PUFA) compared to other foods of a vegetable and animal origin. These fatty acids might add to the decrease in the blood cholesterol level.

3. Phenolic compounds

Phenolic compounds are auxiliary metabolites having a fragrant ring with at least one hydroxyl group. They show a wide scope of physiological properties, for example, antiallergenic, antiatherogenic, mitigating, antimicrobial, antithrombotic, cardioprotective, and vasodilator impacts. Phenolic particles can be decreasing specialists, free extreme foragers, singlet oxygen quenchers, or metal particles.

4. Proteins

Mushrooms produce countless proteins and peptides with intriguing natural exercises like lectins, fungal immunomodulatory proteins and ribosome inactivating proteins. Bioactive proteins are a significant piece of practical parts in mushrooms and

Fig 1: Different ages of *Agaricus bioporus*

have an extraordinary incentive for their drug potential.

Agaricus bisporus is commonly cultivated, edible mushroom having medicinal properties. Button mushroom , cremini mushrooms and portobellos are all *Agaricus bisporus*, in fact, just different ages.

1. White button mushroom

Agaricus bisporus, from the Agaricus genera, is the most evolved mushroom all throughout the planet. *Agaricus polytricha* have been viewed as powerful invulnerable energizers. *Agaricus blazeiis* is an exceptionally famous basidiomycete known as "sun mushroom,".

2. Cremini mushrooms

Cremini mushrooms are at the center phase of development, more brown than the natural white mushroom. Consequently, you may likewise hear creminis alluded to as "child bellas," or "Child portobellos". Cremini mushrooms have a hazier shading and a meatier surface and flavor, and can likewise be tracked down entire or cut. The enzyme and microscopic organisms contained in crimini mushrooms give a few medical advantages.

a. Crimini mushrooms boost immune system

Crimini mushrooms contain a lot of accommodating microorganisms that are gainful to the microbiome found in the human intestinal system. These supportive microscopic organisms can further develop absorption and lift the body's invulnerable reaction.

b. Crimini mushrooms help in preventing cancer

Crimini mushrooms might help protect against malignant growth and cellular breakdown in the lungs. This impact is an after effect of the aromatase inhibitors in crimini mushrooms, which block a protein that advances the production of estrogen. This hormone leads to the development of certain sorts of carcinogenic growths.

3. Portobello mushroom

Portobello mushroom is one of the largest-sized mushrooms. It has a level cap, with close to dark gills in the cap. It is the regular wellspring of Vitamin D, which relies upon the measure of openness to UV light. The taste makes it desirable to be eaten fresh and also as flour in soups and gravies.

In a 100-gram 100-gig serving, rough white mushrooms give 93 kilojoules (22 kilocalories) of food energy. Mushrooms are an incredible source of the vitamin B, riboflavin, niacin, and pantothenic destructive. Fresh mushrooms are also a decent source (10–19% DV) of the mineral phosphorus. The *Agaricus bisporus* just holds back 0.2 micrograms (8 IU) of vit-D as ergocalciferol (vitamins D_2).

■■■

NONI A FRUIT FOR HEALTH BENEFITS

About Author

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Noni is botanically known as *Morinda citrifolia* and belong to the family of Rubiaceae. It is tropical fruit that is native to Southeast Asia and Australasia. It is also known as cheese fruit, great morinda, Indian mulberry, beach mulberry, bois douleur, canary wood, hog apple, rotten cheese fruit, ruibarbo, caribe, wild pine and wuning. The fruit has a strong, pungent odor and is typically used for medicinal purposes. Noni is rich in antioxidants and is believed to have anti-inflammatory, anti-cancer, and immune-boosting properties. It is commonly consumed as a juice or supplement, and can also be used as an ingredient in skincare products. The

leaves and root of the noni plant are also used in traditional medicine to treat a variety of ailments, including skin conditions and infections.

Botany of noni

Noni (*Morinda citrifolia*) is a tropical fruit-bearing evergreen shrub or small tree that can grow up to 9 meters in height. The plant is native to Southeast Asia and Australasia, and is commonly found in coastal areas and along roadsides. The leaves of the noni plant are glossy and dark green, and are simple, opposite and elliptical shaped. They are about 15–25 cm long and 7.5–12.5 cm wide. The flowers are small and white, and are arranged in clusters at the base of the leaves. They have five petals and are about 1 cm wide. The fruit is a large, bumpy, green or yellow-white berry that becomes brown and slightly translucent when ripe. The flesh of the fruit is soft and has a strong, pungent odor. The fruit contains many seeds, which are embedded in a sticky white pulp. Noni fruit is usually eaten ripe, but also can be consumed as a juice or supplement. The leaves and root of the noni plant are also used in traditional medicine to treat a variety of ailments, including skin conditions and infections.

Nutritional value of Noni

Noni fruit is high in antioxidants, including Vitamin-C (39mg/100g), Vitamin-E (0.2mg/100g), Vitamin-B_6 (0.1mg/100g) Potassium (291mg/100g), Magnesium (24mg/100g) and β-carotene, as well as other compounds such as xeronine, proxeronine and scopoletin. These compounds are believed to have anti-inflammatory, anti-cancer, and immune-boosting properties. The plant also has anti-bacterial, anti-fungal and anti-inflammatory properties. Noni also contains compounds called anthraquinones and damnacanthal, which have been shown to have anti-inflammatory and pain-relieving properties.

Health and meditation importance of Noni

Noni fruit and its extracts have been traditionally used for medicinal purposes in many cultures, and is believed to have various health benefits. Some of the most commonly reported benefits include:

- **Anti-inflammatory properties:** Noni contains compounds that have been shown to have anti-inflammatory properties, which may help to reduce pain and inflammation in the body.
- **Immune system support:** Noni is rich in antioxidants and other compounds that are believed to boost the immune system, which can help to fight off infection and disease.
- **Cancer prevention:** Some preliminary research suggests that noni may have anti-cancer properties, although more research is needed to confirm these findings.
- **Cardiovascular health:** Noni contains a compound called scopoletin that may help to lower blood pressure and improve circulation.
- **Digestive health:** Noni has been shown to improve digestive health by reducing inflammation in the gut and promoting the growth of healthy gut bacteria.
- **Pain relief:** Some studies suggest that noni may have pain-relieving properties, making it helpful for individuals with conditions such as arthritis or other chronic pain condition.
- **Antioxidant properties:** Noni contains high levels of antioxidants that can help protect the body against oxidative stress and cellular damage.
- **Anticancer properties:** Some preliminary studies suggest that compounds in noni may have anticancer effects, including the ability to induce cell death in certain types of cancer cells.

Value-added product of Noni fruit

Noni fruit can be processed into various value-added products, including Juice, supplements, skincare products, health foods, cosmetics, candies and syrups.

- Noni juice and supplements are believed to boost immunity, improve digestion, and promote overall wellness.
- Noni skincare products are used for anti-aging, moisturizing, and skin rejuvenation.
- Candies, syrups, and teas offer a convenient way to consume Noni's health benefits.
- Cosmetics containing noni are used for hair care and skin care.
- Noni is used in traditional medicine practices and is believed to have medicinal properties.

BIO-FORTIFICATION IN FRUIT CROPS

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Biofortification is derived from the Greek words 'bios' which means "life" and 'fortificare' which means "to strengthen." The process of improving the nutritional quality of food crops through conventional plant breeding, agronomic practices, and modern biotechnology is known as biofortification. There are two methods for biofortifying food. The first is to increase desirable nutrients in staple food crops, such as provitamin-A, vitamin-C, protein, iron, zinc, calcium, lysine, tryptophan, anthocyanin, oleic acid, and linoleic acid, and the second is to reduce antinutritional factors such as erucic acid, glucosinolates, and trypsin inhibitor.

INTRODUCTION

The largest issues facing the majority of the countries in the globe are the growing population, inadequate food and nutrition, hunger, undernourishment of vitamins and minerals, etc. Children under the age of five die from vitamin A deficiency (VAD), which is common in underdeveloped nations among children and women and causes more than 600,000 deaths annually worldwide. About 60% of the population is undernourished in iron, 30% is undernourished in zinc, 30% is undernourished in iodine, and 15% is undernourished in selenium. However, biofortification is the practice of adding nutrients to food crops using traditional, agronomic, and transgenic breeding techniques to give a sustainable and long-term solution to treat the harmful effects of vitamin and nutrient deficits. According to the Food and Agriculture Organization, 780 million of the world's estimated 792.5 million malnourished individuals reside in developing nations. In addition, two billion people worldwide experience "hidden hunger," which is brought on by a daily diet that is insufficient in vital micronutrients despite increased agricultural production of food. Biofortification is a potential tactic for addressing hidden hunger, as shown by the findings of efficacy and effectiveness studies as well as recent breakthroughs in delivery. The process of enhancing a crop's nutritional worth is known as biofortification. It speaks about nutrient enrichment of crops to address the detrimental effects of vitamin and mineral deficiencies in humans on the economy and health.

Biofortification of fruit Crops with vitamins and micronutrients are the recent necessity of the hour for developing countries to combat numerous health issues. Biofortification of crop plants can provide plenty calories to meet the energy needs along with providing all the essential nutrients needed for complete health.

OBJECTIVES OF BIOFORTIFICATION OF FRUITCROPS

1. To develop fruit crops containing highly available micronutrients *i.e.* iron, zinc and vitamin A for preventing worldwide deficiency of these nutrients.

Fig.1 Nutri banana (yellow colour, Provitamin-A rich)

Fig. 2 Solapur Lal

2. To screen for biofortification of fruit crops from existing germplasm.
3. To study the efficacy of mineral nutrients.

BIOFORTIFICATION TECHNIQUE

Three techniques can be used to achieve biofortification.

1. Agronomic Biofortification.
2. Conventional plant breeding.
3. Genetic engineering.

1. Agronomic Biofortification

In agronomic biofortification fertilizer is used either as a spray on the leaves or as a soil. The use of foliar application to improve the nutrients in plant tissue and edible parts was stated to be effective in biofortification of Fe and Zn. Selenium (as selenate), iodine (soil application of iodide or iodate), and zinc are the most important micronutrients for agronomic biofortification (foliar applications of $ZnSO_4$). The foliar application of micronutrients is a modest and fast way to deliver micronutrients to plants (Fe, Zn, Cu etc.).

2. Conventional plant breeding

Conventional breeding practices aid in enlightening the concentration of β-carotene, caroteniods, amino acids, amylase, carbohydrates and other minerals through making proper

selection of breeding material to enhance the nutritional efficiency.

Steps in biofortification by conventional plant breeding are:

Discovery:
1. Identify target populations.
2. Set nutrient target levels.
3. Screen germplasm and gene.

Development:
4. Breed biofortified crops.
5. Test performance of new crop varieties.
6. Measure nutrient retention in crops /food.
7. Evaluate nutrient absorption and impact).

Dissemination:
8. Develop strategies to disseminate seeds.
9. Promote marketing & consumption of biofortified food.

Outcomes:
10. Improve nutritional status of target populations.

3. Genetic engineering

Biotechnology is an efficient biofortification technique that is being used all over the globe to tackle the severity of mineral and vitamin deficiency. The current development in genetic engineering tools and practices allows for the integration of traits that are not possible to achieve by traditional breeding. Genetic engineering techniques employ a boundless pool of genes to create novel cultivars through allocation of desirable attributes from one organism to another to evolve elite cultivars, thereby improving its value. Transgenic crops are genetically modified crops in which not only the nutritional quality is improved but also delivers protection against various biotic stresses *i.e.* insect, viruses and pathogens.

Table 1: Biofortified varieties of fruits in India

Sr. No.	Fruit Crop	Mineral content	Variety
1	Pomegranate	Iron-5.6-6.1 mg/100 g Zinc-0.64-0.69 mg /100 g Vitamin-19.4-19.8 mg /100g	Solapur lal
2	Grape	Antioxidants	Pusa navrang
3	Mango	β carotene, Vitamin C	Pusa surya, Pusa pitamber
4	Banana /Plantain	Provitamin A, carotenoid	_

CONCLUSION

It is well-known that biofortification is a promising, cost-effective, agricultural approach for enhancing the dietary status of malnourished peoples throughout the world. So, varieties developed through biofortification are a way to enhance immunity and nutritional safety in developing and under developed nations. India is now surplus in food production but at the same time, we are facing the problems of under nutrition and poverty. With appropriate arrangement and implementation, biofortified food crops will benefit India address the malnutrition problem with least speculation in research and have a noteworthy effect on the lives and health of millions of needy people of the country. Yet there are many challenges ahead for governments, especially in the areas of safety testing, regulation, industrial policy and food labeling.

CASHEW NUTS

THEIR USES AND VALUE-ADDED PRODUCTS

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Cashew nut is an important and valuable crop that provides a wide range of benefits. It is a good source of protein, healthy fats, and minerals, making it an important source of nutrition for millions of people around the world. Cashew nut also plays a significant role in the global economy as it is a major source of income for many countries, particularly those in Africa, Asia, and Latin America. are commonly consumed as a snack, roasted or salted, and also used in a wide range of recipes, both sweet and savory. Cashews are a popular ingredient in curries and other spicy dishes, particularly in Indian and Southeast Asian cuisine. They are also used in many vegetarian and vegan dishes as a meat substitute, and also in the production of vegan cheese and cream sauces, and can be used to make delicious cashew butter. Cashew nut shell liquid (CNSL) is also used as a raw material for the manufacturing of resins, paints, and other industrial products. Cashew oil is used in many cosmetic and personal care products. They are a great source of protein, healthy fats, and

Figure 1.1 fresh edible cashew, cashew butter and cashew oil

essential minerals and have many uses in cooking, snacks, and even in industrial products. In terms of value-added products, cashew nuts can be processed into various products such as cashew butter, cashew milk, cashew flour, cashew cheese, cashew oil, and roasted and salted cashew nuts. These value-added products can be used in a variety of food and non-food products, making them versatile ingredients. Cashew nuts, also known as cashews, are a popular and versatile ingredient that is used in a variety of ways.

Uses of cashew nut

Cashew nuts, also known as cashews, are a popular and versatile ingredient that is used in a variety of ways. The nut is actually a seed that is harvested from the cashew tree, which is native to Brazil but is now grown in many tropical regions around the world. Cashews are a rich source of protein, healthy fats, and essential minerals, making them a nutritious addition to any diet. One of the most popular uses of cashews is as a snack. Cashews are often roasted or salted and sold in small packs or jars as a healthy and delicious on-the-go snack. They are also a popular ingredient in trail mix and other snack blends. Cashews are also used in a wide range of recipes, both sweet and savory. They are a popular ingredient in curries and other spicy dishes, particularly in Indian and Southeast Asian cuisine. They are also used in many vegetarian and vegan dishes as a meat substitute. Cashews are a staple ingredient in many vegan cheese and cream sauces, and can be used to make a delicious cashew butter. They are also a great addition to salads, stir-fries, and other dishes for a little extra crunch.

In addition to their culinary uses, cashews have many other benefits. Cashew oil is used in many cosmetic and personal care products, and the shells of the cashew nuts are used to make a variety of industrial products. The shells contain a toxic oil called cardol, which is used in the production of varnishes and brake linings. Cashew nut shell liquid (CNSL) is also used as a raw material for the manufacturing of resins, paints, and other industrial products. Overall, cashews are a versatile and nutritious ingredient that can be used in a wide range of ways. They are a great source of protein, healthy fats, and essential minerals and have many uses in cooking, snacks, and even in industrial products.

Value added product of cashew nut

Cashew nut is a valuable and versatile ingredient that can be used in a variety of value-added products. One popular use for cashew nuts is as an ingredient in cashew butter, which is similar to peanut butter but has a slightly sweeter and nuttier flavor. Cashew butter can be used as a spread, as a baking ingredient, or as a base for sauces and dips. Another popular value-added product made from cashew nuts is cashew milk, which is a non-dairy milk alternative that can be used in place of cow's milk in cooking and baking. Cashew nuts can also be processed into cashew flour, which is a gluten-free alternative to wheat flour that can be used in baking or as a thickening agent. Cashew flour is high in protein, healthy fats, and minerals, making it a nutritious alternative to traditional wheat flour. Cashew nuts can also be processed into cashew cheese, which is a vegan alternative to dairy cheese that can be used in a variety of recipes. Another value-added product of cashew nut is cashew oil, which is extracted from the nuts and used in cooking, as a salad dressing and as a hair and skin care product. It is rich in unsaturated fatty acids and is known to improve skin health. Cashew nuts can also be roasted and salted, making them a popular snack food. They can also be used in a variety of sweet and savory dishes, such as curries, stir-fries, and desserts.

Overall, cashew nuts offer a wide range of potential uses as a value-added ingredient in a variety of food and non-food products. Cashew nut is an important and valuable crop that provides a wide range of benefits. It is a good source of protein, healthy fats, and minerals, making it an important source of nutrition for millions of people around the world. Cashew nut also plays a significant role in the global economy as it is a major source of income for many countries, particularly those in Africa, Asia, and Latin America. Furthermore, the cashew industry provides employment opportunities throughout the entire value chain and can provide a sustainable source of income for farmers over the long-term. In terms of value-added products, cashew nut can be processed into various products such as cashew butter, cashew milk, cashew flour, cashew cheese, cashew oil, and roasted and salted cashew nuts. These value-added products can be used in a variety of food

and non-food products, making it a versatile ingredient.

Cashew apple, also known as the cashew fruit, is the fleshy, juicy fruit that surrounds the cashew nut. The cashew apple is often discarded or used as animal feed, but it can also be used to create a variety of value-added products. One popular use for cashew apples is to make juice or wine. The juice has a sweet and tangy taste and is high in Vitamin C, making it a nutritious and refreshing drink. Cashew apple wine is a traditional drink in some parts of the world, and it is known for its sweet and fruity taste. Another popular value-added product made from cashew apples is jam or jelly. The fruit can be cooked down with sugar to make a thick, sweet spread that can be used on toast, bread, or as a filling for pastries. Cashew apples can also be dried, which makes it possible to preserve the fruit for longer periods of time. Dried cashew apples can be used as a snack or as an ingredient in a variety of sweet and savory dishes. Cashew apples can also be used to make a traditional sweet called 'fenny' in some parts of India. It is made by fermenting the juice of cashew apples with added jaggery or sugar and is commonly consumed in Goa and Karnataka. Cashew apple can also be used to make chutneys, pickles, and curries. Furthermore, the cashew apple can be used to make a cosmetic product, a face pack and hair conditioner, due to its high vitamin C content. The juice is also considered to have medicinal properties and is used to treat various illnesses such as fever, diarrhea, and constipation. Overall, cashew apple offers a wide range of potential uses as a value-added ingredient in a variety of food and non-food products. With proper processing, preservation and packaging, the cashew apple can be transformed into a range of value-added products that can be enjoyed all year round.

Conclusion

In conclusion, cashew nut and cashew apple are both valuable and important crops that offer a wide range of benefits and potential uses. Cashew nut is a good source of nutrition and plays a significant role in the global economy. The cashew industry provides employment opportunities and a sustainable source of income for farmers. Cashew nut can also be processed into a variety of value-added products such as cashew butter, cashew milk, cashew flour, cashew cheese, and roasted and salted cashew nuts. Similarly, cashew apple can be used to make a variety of value-added products such as juice, wine, jam, jelly, dried fruit, traditional sweets, chutneys, pickles, curries and cosmetic products. Both cashew nut and cashew apple are versatile ingredients that can be used in a variety of food and non-food products.

DAMINI

LIGHTNING ALERT MOBILE APP

About Author

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A Mobile App "DAMINI" on Lightning Location Network has been developed by IITM (Indian Institute of Tropical Meteorology) Pune. Lightning is a phenomenon that has not only fascinated but also scared mankind. Each second about 50 to 100 lightning strikes occur over the Earth. Over the recent years, lightning is identified as the single most killer in India compared to all other natural disasters. Annually more than 2500 people die due to lightning as per the report released by National Crime Records Bureau. In 2019, there were 2,876 deaths due to lightning strikes, compared to fewer than 1,500 on an average, annually, between 1968 and 2004. There was a brief period of three to four years in between when lightning strikes killed more than 1,500 people, but the larger trend held. It is pertinent to mention that the frequency of lightning is on the rise due to rise in climate extremities like global warming, deforestation, environmental degradation, sudden change in weather leading to cloudbursts, thunderstorms frequent cyclonic storms, etc. as is evident from the death toll of 2018 which was more than 3000. Lightning fatalities are also accompanied by loss of livestock, livelihood, and property. Thunderstorms and lightning being the quickly evolving meteorological phenomenon, the exact forecast of these events is a challenge. Indian Institute of Tropical Meteorology, Pune an autonomous Institute under the Ministry of Earth Sciences has installed a Lightning Location Network with about 48 sensors over various parts of the country and is connected to the central processing unit at IITM, Pune. This network provides exact information about lightning strikes and the movement of thunderstorm paths.

The network is being expanded with the addition of more sensors to increase accuracy and reliability. Using this network, ESSO-IITM has developed a Mobile App, DAMINI LIGHTNING. This App gives the exact location of current lightning strikes, probable locations of impending lightning around an area of 40 sq. km, and the movement and direction of a thunderstorm. DAMINI also lists precautionary steps to be taken during lightning and some general information on lightning DAMINI-App would indeed help in getting advance information about impending lightning activity. Lightning kills more people in India than any other natural disaster.

Monsoon break created conditions for killer strikes

Normally, lightning strikes are high in frequency during the pre-monsoon season, and when the monsoon is about to make an onset over Bihar, Uttar Pradesh, and neighbouring states. This is the time when moisture levels increase, and the surface temperature is high, creating favourable conditions for the development of thunder clouds. This year, however, there have been massive lightning strikes and associated casualties in mid-July, mainly due to the long monsoon "break" when surface temperatures were very high in the absence of rain.

SD Pawar, project director, Thunderstorm Dynamics, Indian Institute of Tropical Meteorology, Pune," explained "There has been around a ten-day break in monsoon.

How to download the Damini app

First of all, go to the Google Play Store of your mobile and in the search bar

⇓

Type damini

⇓

After that click on Damini, wait for a while

⇓

After download click on open

⇓

After that, your app will open

⇓

After that click on registration for register

⇓

Name

⇓

Mobile number

⇓

Pin code

⇓

Occupation

⇓

For whom the friend/farmer himself should click on the registration and your registration will be done.

There has been significant surface heating during this period. As the monsoon is reviving, moisture levels have also increased. This is the most favourable condition for the development of thunder clouds and collision of ice particles which leads to charging and lightning strikes Thunder clouds require heat and moisture to form. They are also required to be deep, around nine to 10 kilometres for a collision of ice particles to take place. And that's what is happening now.

Advantages of Damini App

1. By getting timely information about celestial electricity, farmers can save lives by going to a safe place.
2. Animals can be protected from impact by lightning by tying them in a safe place.
3. By downloading the mobile app, you can save life and property from the information of lightning and thunderstorms.

Be careful when strikes lightning

1. Do not use umbrellas.
2. Stay away from high tension wires and towers.
3. Do not use the field, under trees, hilly areas to avoid lightning.
4. If you are in the open, then sit in the open space with your ears closed on your knees.
5. use Rubber-soled shoes and car tires, however, do not offer protection from lightning.
6. Please keep away from utility lines (phone, power sockets, etc.
7. Don't take a selfie at the time of lighting in your mobile phone.

If you absolutely cannot get to a safe building or vehicle, here are some last resort choices:

1. Wait out the storm below an overpass: Do not touch steel girders. Move away from your bike. Remain on dry surfaces if possible. Overpasses are engineered structures and are likely to be properly grounded. Although an overpass is likely to be higher than the surrounding landscape, if it is struck by lightning, the electrical current will likely be channelled safely into the ground.

2. Look for a bridge: Stay away from water. Stay away from any metal surfaces. Be alert for rapidly rising water if under a bridge.

3. High tension wires: If high voltage electrical tension wires cross the road, you may want to seek shelter directly underneath these wires. Do not get too close to the large metal towers that holdup these wires. Stay at least 50 feet away. Electric companies design these high-tension wires for lightning strikes. If lighting should strike the wires or towers, the current is designed to safely go deep into the ground.

■■■

FOOD AND NUTRITIONAL SECURITY IN CLIMATE CHANGE ERA PROBLEM AND SOLUTION

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Climate Change Era

Climate change is a present-day reality. We take 1961-90 base mark period for measurement and assessment of global warming and pattern of climate change. Global warming is the processes of continued raising or average earth temperature. It was earlier estimated that the average temp of earth may raise upward from 1.6^0C to 4^0C even more till the end of 21st century. It was estimated that the earth temperature enhancement reached 1.1^0C from 1850-2015. It was recorded that 1816 was the coolest year and on the other hand, 2016 was warmest one in the millennium. Simultaneously, ocean temperature is also raising which impact would be deterioration of coral reef, flora, fauna and microbes in marine ecosystem.

The global warming is heavily and positively correlated with amount and rate or emissions of greenhouse gasses. The main greenhouse gasses are:

a) CO_2 and other carbon derivative.
b) Methane in marshy condition.
c) Nitrous oxide and nitrogen derivatives - nitric oxide, nitrate etc.
d) Ozone gas.
e) CFCs- Chlorofluorocarbons- from automobiles, refrigerators, AC etc.
f) Water vapour to form cloud- especially above Indian ocean with combination of smokes, smog, aerosols etc.

Climate change due to global warming:

(i) Raising of earth temperature, which is estimated effect the depletion of aretaic and Antarctic region - glaciers causes further raising of sea water level upto 1.00 metre by the end of 21st century.
(ii) Raising of sea level would make the severe and disastrous effect on coastal areas of India and the world.
(iii) Land surfaces are heating faster than ocean surface causing frequent and severe heat waves, wild fire and expansion of deserts.

(iv) Increasing evaporation and atmospheric energy causes more intense storms, cyclones, tornado etc.

(v) It enhances weather extremes, producing both drought and floods at same time but different region of the world. The impact of such natural calamities is heavy on consumers and producers both due to quality loss and yield.

(vi) Retreat of glaciers including Gangetic and Yamunotri, it could be estimated dried of Ganga and Yamuna rivers in future.

(vii) Ozone layer depletion causes skin cancer and other skin problems.

(viii) These disastrous are devastating lives and are causing the world's billion $ properties damage.

(ix) A sever climate change reduces the individual/community economic losses, increase migration of populate at safe places, occurrence of diseases which further reduces the per capita income and Human Development Index (HDI).

(x) Loss of biodiversity of flora, fauna and microbes, some species of them would be extincted.

Food and Nutritional Security:

We consume food and get nutrition from intake of foods. If foods are available from organic farming and in neutral soil, free from significantly metals concentrations-like arsenic, lead, etc., it would be treated healthy food. The country is mainly suffered from deficiency of PEM, Vit-A, Folic acid and iron. A person should take a balance nutritional diet for his healthy and happy life. It means an adequate amount of protein, carbohydrate, fat, vitamins, minerals, fibre and ash should be available in human diet.

Food security should be a fundamental right of each and every citizen of the world. But, its in reality, the worlds' expenditure on food is less than a half of expenditure done on environment. The food security should be maintained at four level.

1) World Food Security
2) National Food Security
3) Family Food Security
4) Individual Food Security.

1. World Food Security:

The world population in 1900 AD was 1.40 billion which is the expected Indian population in 2021 census. Today world's population is above 8 billion as estimated by U.N. in November, 2022. It showed a massive increase of world's population within a period of 120 years. About one-third population of earth reside in China and India. In contract of Malthus population theory, the FAO has the capacity to maintain the world food security through green revolution and other means, provided that political and administrative systems work.

2. National Food Security:

India, after the green revolution in 1968, does not have any food shortage. But it is a need to provide a nutritional diet to each and every citizen. The Government of India passed a National Food Security Act in 2013 to provide cereals in subsidized price through targeted PDS to about 2/3 of households.

3. Family Food Security:

It is a need to maintain the family food security it means each and every house holds of the country should have nutritional and sufficient food available. Though, sometimes, a discrimination was also observed against female members of the family in food distribution, especially of milk and meat. This can be maintained by diversified farming of crops, vegetables and fruits, animal husbandry, poultry and fish at almost at each family level especially in rural areas.

4. Individual Food Security:

The availability of food does not mean individual guarantee of food for this purpose. Each and every citizen must be aware about his/her own nutritional diet. They should avoid fast food, trans fat, soft drinks, high salt derivatives, high sugary products. The details of nutritional security would be discussed by other speakers.

Problems of Climate Change:

As discussed earlier about problems of climate change suffer by inter-continental population.

Solutions:

As per advance of global warming, the UNO/World has organized for discussing the problems of global warming and climate change in form of an UN body IPCC (Inter-governmental Panel of Climate Change). This has framed on an other committee UNFCCC (United Nations Framework Convention on Climate Change) for facilitating the functioning of IPCC through providing scientific and sound facts, knowledge about global warming and climate change during discussion and negotiations among state heads.

The 'Paris Agreement' signed in 2015 is an agreement with signatories of 189 countries around the globe to reduce the global temperature from raising upto 2^0C till 2036. It advised for reduction of risks and impact of climate change by adapting 20/20/20 strategies. The strategies are-

(a) Reduction of CO_2 upto 20%.

(b) Increase renewable energy market upto 20%.

(c) Increase energy efficiency by 20%.

These can be achieved in India and world to adopt these practices-

1. Reduction of CO_2 and other global warming gasses in developed and developing countries through cheap and improvised industrial but environment friendly technologies.
2. Reduction of deforestation and increase of afforestation and reforestation process.
3. Increase of solar energy umbrella, hydropower and atomic energy production; instead of thermopower plants.
4. Reduction of automobiles connectivity operated through diesel and petrol fuel. This can be achieved by electric and CNG operated technologies.
5. Strictly implementation of BS-6 auto technology in India and use of high-quality fossil fuels in it.

6. Pool transportation in form of rail, bus, aeroplane. Avoid individually two, three and four-wheeler vehicles by each one in office and market.
7. Use of energy efficient home consumer products viz., bulbs (LED), freeze and ACs. These should be allowed to use where its necessity.
8. Carbon credit system must be implemented throughout the world.
9. Avoid rice and sugarcane cultivation in India at maximum they had used 67% total water for irrigation in India and cause flooded field for a long time which release methane.
10. Avert non-veg population into veg population because non-veg increases the global warming due to high energy demand in various forms.
11. Water harvesting, food processing at cheap rate should be implemented.
12. Increase the timely disastrous forecasts to minimize the life and property loss through IMD in India.
13. Provide rescue operation timely and enhance of purchasing power of affected peoples especially in rural areas by direct cash transfer.■

BREATHTAKING MIRACLE

'MIGRATION MYSTERY OF MONARCH'

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The seasonal movement of insects, particularly that of species of dragonflies, beetles, butterflies, and moths, is known as insect migration. Sometimes those who move in one direction don't come back, and the following generation migrates in the opposite direction. Every bug moves to some degree but for other insects like locusts, butterflies, and dragonflies, it can be thousands of kilometers. The definition of migration is therefore particularly difficult in the context of insects. It depends upon some temporary inhibition of station-keeping responses but promotes their eventual disinhibition and recurrence.

Orientation

Migration is typically characterized by clearly defined destinations that require direction and navigation. An insect in flight must adjust for crosswinds. Numerous migratory insects have been shown to detect the direction and speed of the wind and correct themselves accordingly. Insects that fly during the day largely use the sun for orientation.

Monarch migration

The occurrence known as the "monarch butterfly migration" occurs mostly in North America every summer and fall as the subspecies *Danaus plexippus* moves between locations where it spends the winter, such as mountainous areas in Central Mexico or the West Coast of California. From September through October, the monarchs start moving south. From their southern Canadian and American breeding grounds, they migrate to overwintering locations in central Mexico. In November, the butterflies arrive at their roosting locations. Throughout the winter, they stay in their roosts, and in March they start to migrate north.

Direction of migration

➢ **Southward**

The population of monarch butterflies migrates to the refuges of the Mariposa Monarca Biosphere Reserve in the Trans-Mexican Volcanic Belt pine-oak forests in the Mexican states of Michoacán and México by the end of October, but the exact dates vary each year. There are two migratory flyways across North America. A minor flyway runs along the eastern North American seaboard and one in the Central states connects to the Mexican overwintering

grounds. Around August, the migration starts at the northernmost summer range.

Monarch diapauses- When mature butterflies migrate south, most of them enter diapause, although unlike other insects in this state, they continue to be active. The butterflies gather and store lipids, proteins, and carbs when diapause begins. When monarch butterflies migrate to Mexico, they store more lipids than when they migrate to California.

- **Northward**

In the spring, there is a migration to the north. During these journeys, female monarchs produce eggs for the following generation. The initial wave of the monarch migration may be the progeny of monarchs that have overwintered in Florida and along the northern Gulf Coast. The first generation migrates only as far north as Texas and Oklahoma after leaving the overwintering locations. In the spring, the second, third, and fourth generations return to their northern nesting grounds in the United States and Canada. Rising temperatures and longer days influence the start of the northward migration.

Population and migratory study method

Direct observation was initially the major approach used to measure monarch migration. Since 1975, more complex approaches have been developed. Year to year, population counts "dramatically" change. The variances are attributable to natural occurrences, differing techniques of counting migrating butterflies, and man-made habitat changes.

- Tagging
- Tagging and recapture
- Butterfly counts
- Aerial and satellite observations.

Conclusion

Monarch butterflies are thought to respond to several cues that encourage the fall migration south. These include changes in the direction of the sun's rays, the ageing of larval host plants, the lengthening of the day, and a drop in temperature. Fall flower combinations seen along the monarchs' migration route are thought to fulfil a large amount of their nectar needs. This drop is most likely caused by illegal logging at Mexican overwintering locations, climate change, and agriculture-induced loss of milk weed host plants. Conservation initiatives to minimize these decline-related risks are ongoing. As a result, it is our obligation as humans to protect endangered species such as the monarch butterfly and all other species on the planet.

MUTATION BREEDING

FUTURE APPROACHES FOR CROP IMPROVEMENT

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There are currently about 3220 officially released mutant cultivars in 210 plant species. Mutant traits are employed in breeding to improve breeding goals such as increasing yield, quality, and disease pest resistance, as well as tolerance to abiotic challenges, post-harvest degradation, and novel usage. Physical mutagenesis-based mutation breeding in plants is being used efficiently in breeding programmes. It is used as a starting point for plant mutant breeding, which combines certain fundamental and sophisticated methodologies with other approaches for agricultural plant genetic improvement. Mutations are caused by a variety of mutagens (physical, chemical, and biological). Future possibilities of mutant breeding in crops are mainly focused on yield increase with high nutritional value and intelligent crop varieties, and this strategy can lead to global food security. With the aid of

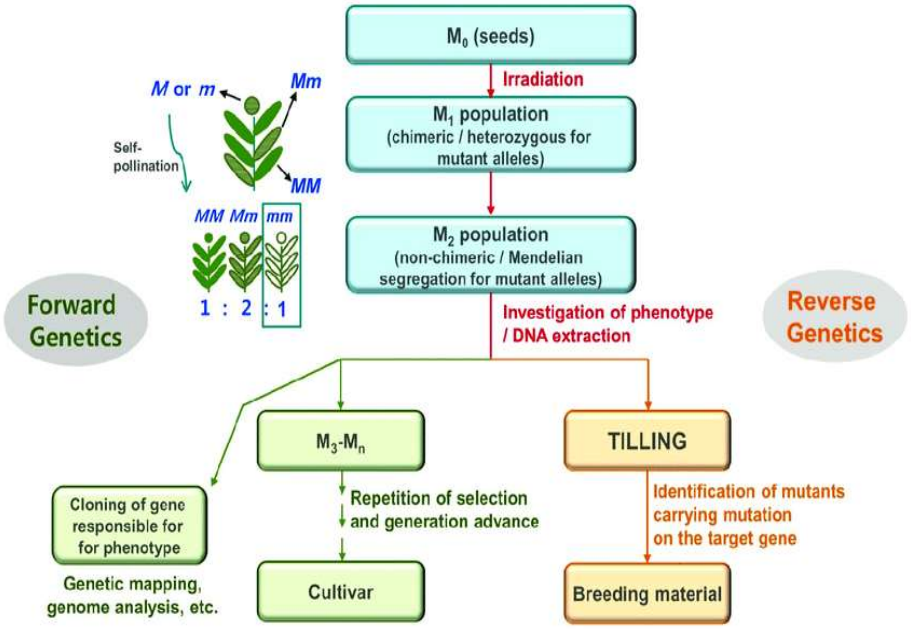

Figure 1. General procedure of mutation breeding

marker-assisted mutant breeding, bio prospecting and allele mining of genes for biotic and abiotic stressors can be accomplished. The technique is being utilised to find novel genotypes for use in subsequent breeding programmes in a variety of crops, including rice, wheat, soybean, and peanut.

Introduction

Strategies for crop enhancement through mutations were first developed a long time ago. In the early 1940s, mutation breeding for crop genetic enhancement was progressively included into modern plant breeding. Out of 170 different plant species, 3222 legitimate plant mutant variations have been made public across 60 nations. Numerous scientists are still working on the produced varieties, which directly contribute to the protection and utilisation of plant genetic resources by increasing biodiversity and providing breeding material for traditional plant breeding. Mutation breeding has been effectively used for crop development as well as to support the work done using conventional plant breeding techniques. Other than traditional plant breeding processes, induced mutation has made it simple to change genes. The effectiveness of mutant genes may rely on the genotypic background, according to experience. It is illogical to assume that mutant genes and genotypic background interact. In order to produce both positive and negative interactions, mutants with valuable or desirable features should be crossed with a variety of strains and types. Because of this, choosing genotypes that represent mutant genes is simple and without side effects. Annual diploid and allopolyploid self-fertilizing crops are the main uses of mutation breeding, but cross-pollinating species experience significantly greater difficulty.

As early as 1942, the first disease resistant mutant was reported in barley. In cereals 1468 and legumes 370 varieties and majority of cultivars came from rice (434), barley (269) and wheat (197). The induction of mutation has already been recognized as a potential technique for crop improvement since the discovery of mutation effects of X-rays.

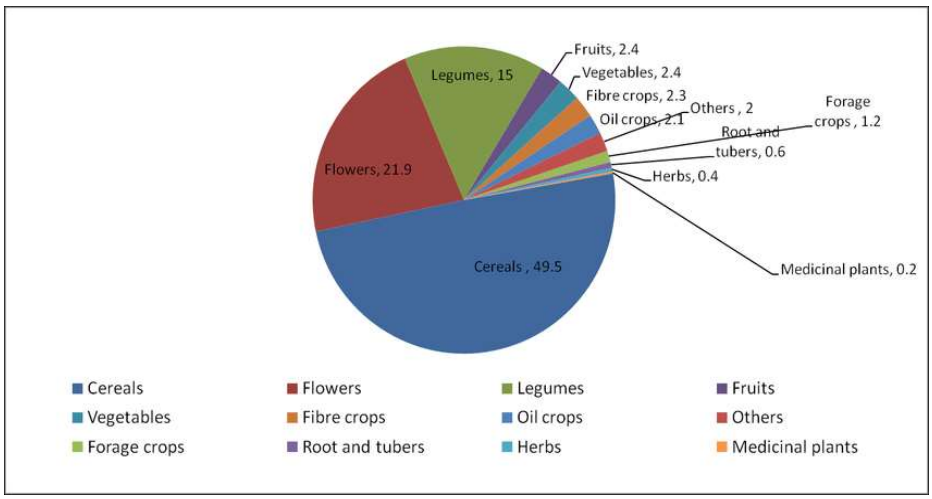

Figure 2. Mutant varieties in different crops

Current status of mutation breeding

Induced mutations have been used for new and valuable alteration in plant features considerably for the goal of high yielding crops for 80 years. The main goals of mutant breeding are to increase the incidence of viable mutations, as well as the frequency and spectrum of mutations. The goal of mutation has created varieties by changing traits including seed size, disease resistance, and maturity for boosting yield and traits connected to yield. Around the world, more than 800 different types of rice have been created by induced mutations or by mating these mutants with other breeding lines. Abiotic and biotic stressors, maturity and flowering times, and other yield-contributing traits have all been improved through mutant breeding. Mutation breeding plays a well-established role in boosting food output and ensuring sustainable nutrition. The list of mutant cultivars developed in cereals and legumes shows that both cereals and legumes have taken use of this possibility. Nowadays, transgenesis and plant gene mapping are both done using RFLP, a microsatellite-based DNA fingerprinting technique.

In China (1957) the first rice varieties KT 20-74 and SH 30-21, developed through induced mutation were released and the first variety Yenhsing-1, developed by a cross-breeding programme with a mutant. Soon afterwards, Japan released the semi dwarf mutant Reimei which have significantly increased yield because of their lodging resistance. In Pakistan, a new variety 'Kashmir Basmati' was derived from induced mutation in Basmati 370which matures early and has cold tolerance and retains the aroma and cooking quality of the parent. The induction of thermo sensitive genic male-sterile (TGMS) mutant in Japonica rice mutant PL-12, which is controlled by a single recessive gene has an immense contribution in designing the strategies for the production of hybrid rice varieties. In China '26 Zhaizao' was developed by gamma ray irradiation of indica rice.

Future appraisal of mutation breeding

In recent years, our interest in mutation research has been rationalised since induced mutagenesis is gaining importance and preference in plant molecular biology as a beneficial technique for identifying and isolating genes to explore their properties. These findings will undoubtedly have a significant impact on future crop improvement programmes, crop improvement, and the development of global food security. Day by day, the in vitro mutagenesis technology has

increased agricultural productivity and improved resistance traits. This research will undoubtedly have a significant impact on future crop development programmes. To improve crop species, a small number of tissues and calli can be subjected to mutagenesis. In-vitro mutagenesis is being used sparingly; just a small number of plants, including banana and sugarcane, have been reproduced using this method. Due to its broad spectrum and high frequency, heavy ion beam irradiation has recently come to be recognised as an effective and efficient method of causing mutation in many plant species.

Conclusion

Induced mutagenesis is one of the most important methods for increasing genetic diversity in crops and avoiding bottleneck circumstances. Mutagenesis, a decades-old technology, has been shown to contribute to unlocking the potentials of plant genetic resources, providing plant breeders with the raw materials needed to create the desired smart crop kinds. Crop types created by mutation breeding are extremely beneficial and are used all over the world to regulate global food security.■

PARTICIPATION OF GIRLS IN AGRICULTURE EDUCATION AND ITS ADVANTAGE IN FUTURE AGRICULTURE FARMING

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The study focuses on women's participation in higher agricultural education in India. Barriers begin at secondary school where girls are less likely to take natural sciences, and negative perceptions of agriculture prevent girls and boys from perusing the subject. Women who select agriculture for higher studies received strong support from their families. Course selection in agriculture is highly gendered, along with participation in course activities. Challenges for women during studies were harassment, social pressure, lack of amenities and inadequate support of student mothers and pregnant students. There are some programmes addressing these barriers; however, effectiveness has been limited.

Introduction

The case studies of women in higher agricultural education confirm that high literacy rates and enrolment in primary and secondary education are basic requisites for access to higher education. Those countries with the highest female literacy and secondary enrolment rates also have the highest female enrolment rates in higher agricultural education, sometimes exceeding that of males. The converse is also true: the countries with low female literacy and secondary enrolment rates also have the lowest percentages of women in higher agricultural education. Efforts to improve women's access to higher agricultural education must, therefore, be part of the larger effort to improve the literacy and school enrolment of girls and women in basic education.

The percentage of women agriculture producers in a country does not necessarily affect the number of women entering higher agricultural education. The two countries studied with the highest percentage of women farmersalso had the lowest number of women studying agriculture. Major obstacles to women's access to agricultural education, in addition to low literacy and low levels of primary and secondary enrolment, are the undervaluing of women's contributions to agriculture and the perception of agriculture as a male domain. In these countries, a number of strongly-held traditions and customs hinder women tanners from having secure land title, access to agricultural extension and support services, and mobility.

Discussion

The share of women registering in farm universities remained over 43 per cent in the last five years. Maximum women enroll for agriculture education in universities of Kerala when compared to other states in the country. The share of women registering for agriculture education (including agriculture, horticulture, animal husbandry, agritechnology, dairying and fisheries) courses in Indian farm universities has remained over 43 per cent in the last five years. Interestingly, nearly three-fourths of the total enrolments every year in the

Thrissur-based Kerala Agricultural University (KAU) are t girls for the past five years. Of the 662 new enrolments in 2016-17, as many as 493 were that of girls. While the total enrolments went up to 1072 at KAU in 2020-21, girls' share of new enrolments also went up to 781.

The girls' enrolment has remained the lowest in Banda University of Agriculture and Technology of Uttar Pradesh. The average share of girls' enrolment in the total enrolments stood at 6.88 per cent for the five years starting from 2016-17.

Overall enrolments up

The data available in the answers given in the Rajya Sabha show that the enrolment in agriculture education has been growing in the country. The enrolment for agriculture education, which saw a growth of 3.84 per cent in 2017-18 over 2016-17, went up to 5.72 per cent in 2020-21 as against 2019-20. Increase in enrolment had gone up above 6 per cent during 2018-19 and 2019-20.The total enrolment in 73 agriculture universities in the country increased to a maximum of 48,793 in 2020-21 as against 39,297 in 2016-17. The share of girls enrolling for these courses increased to 21,804 in 2020-21 as against 17,297 in 2016-17.

Two States top

Agriculture education in the country is being spearheaded by two states – Maharashtra and Karnataka – in the country. Each of these states has been enrolling more than 10 per cent of the total enrolments in the country. Of the total enrolments during the five years between 2016-17 and 2020-21, the average share of Maharashtra stood at 11.20 per cent followed by Karnataka at 10.97 per cent. Each of these states have six farm universities to their credit.

Gujarat came third with the five-year average enrolment of 7.21 per cent, followed by Uttar Pradesh at 6.95 per cent, and Tamil Nadu at 6.58 per cent. While Uttar Pradesh has nine farm universities, Gujarat has five and Tamil Nadu has three farm universities. The data provided in Rajya Sabha answers showed that the Indian Council of Agricultural Research (ICAR) awarded 17559 scholarships / fellowships in these universities during last five years. It also said that 136 patents have been developed during the last five years in these farm universities.

Methods

For our research, we used multiple methods. We began with a systematic literature review of full-text articles from the service Agricola, following the methods of Jewson, Matheson, and Lacey (2011), using the search terms "agriculture + farming + higher education + India+ women + degree programs + majors". After reviewing the 3,544 results, we omitted all articles pertaining to locations outside the India and those published prior to 1991. We limited the research to the 17-year period 1991–2018 because that period reflected the agricultural learning environment during the time frame needed for a person to begin K–12 education, matriculate to college, graduate, and start a career. It also included enough time to show evidence of the changing role of women in the classroom, in the workplace, and in farming. These refinements reduced the number of relevant articles to 909. We screened those articles for eligibility according to the relevance of their subject matter as it pertained to the research topic. We also searched the Journal of Extension database for articles, using the same key words. These searches produced a total of 21 articles for the literature review. After reading the 21 articles, we incorporated additional relevant journal articles that were cited in those articles and met our inclusion criteria.

Conclusion

Agriculture sector employs 80% of all economically active women in India; they comprise 33% of the agriculture labor force and 48% of the self-employed farmers. In India, 85% of rural women are engaged in agriculture, yet only about 13% own land. The situation is worse in Bihar with only 7% women having land rights, though women play an important role in various agricultural activities. Economic Survey 2017-18 says that with growing rural to urban migration by men, there is 'feminization' of agriculture sector, with increasing number of women in multiple roles as cultivators, entrepreneurs, and labourers.Bihar's agriculture sector is highly feminized, with 50.1% of the total workforce engaged in farming activities being women ('Women in the informal economy of Bihar' – ADRI) 70% of all women engaged in cultivation are from households witnessing migration. (Report released in 2014 by IHD, New Delhi) About 60-80% food are produced by rural women.

■■■

ECONOMICS OF FARMING SYSTEM IN UTTAR PRADESH

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Dehradun

The agriculture system of household in Uttar Pradesh have been analyzed based. The data was composed by a sample of 196 farmers in 2004-05. Sugarcane based farming system is prominence has been found in the study are vegetable, grains, livestock, etc. Mainly vegetable, water melon, melon, cucumber, etc. are grow in Uttar Pradesh. Taking about the climate inside Uttar Pradesh on the base of agriculture it is divided into nine climatic zones this part is terai region vindhyanchal region, eastern plains, western part, north eastern plains, central plains, Bundelkhand and western par.

Taking about other major crops grow in Uttar Pradesh, it is the most important crop. It is understood about wheat that Uttar Pradesh ranks first in the production of wheat in the whole country. Uttar Pradesh alone measures 35% of the country total production. It is know that according to the fourth advance estimate pf the year 2019, the production wheat in Uttar Pradesh wa 32.59 tonnes. Talking about the maximum wheat producing districts in Uttar Pradesh, Hardoi, Aligarh, and buland come in these.

On the other if we talk about the production of rice Uttar Pradesh is second only to west Bengal in terms of paddy production as of 2019 Uttar Pradesh 15.52 million which was about 13.11% of the total rice production of the whole of India.

Talking about measure rice producing district in Uttar Pradesh shahjhanpur, Lakhimpur kheri, Barabanki, pilibhit, ajamgarh are among them come let`s talk. cash crops of Uttar Pradesh. It is a fruit in whose production Uttar Pradesh has a distinct identity. According to the figures of the year 2018 and 19, the area under sugarcane cultivation in Uttar Pradesh was about 2.22 million hectares. Sugarcane is grown on 13% of the total cultivable land of Uttar Pradesh. FRP is issued by the government for sugarcane. FRP i.e. Fair and Remunerative Price is a price that is decided by the Economic Affairs Committee of the Central Government with the objective of providing fair price to the sugarcane farmers.

There are two main sugarcane producing areas in Uttar Pradesh. One does not tell the Terai region and the other the Doab of Ganga-Yamuna. Let's go, that is, that area between two rivers. If we talk about other crops grown in Meerut, Ghaziabad, Sitapur, Maharajganj, Lakhimpur, Kheri, Gonda, Basti, Ballia Deoria, Saharanpur, Aligarh, Bulandshahr districts of Uttar Pradesh, then the main peanut Mustard, barley, millet, gram, cotton, lies and tobacco. In Uttar Pradesh, tobacco is mainly grown in Etah, Farrukhabad, Kasganj and is grown in Gonda. Here in Uttar Pradesh, there are 2 districts which are famous for opium cultivation in the whole country and that is Ghazipur and Barabanki, although Banaras is famous for eating Mahoba, Banda's Barhi Manpur and Lalitpur's Pali area are also famous for the production of betel. If we talk about fruit production in Uttar Pradesh, fruits like mango, guava, papaya, banana, lemon are mainly produced in the plains here. Pears, peaches and strawberries are also found in the Terai region. Uttar Pradesh has a different name in the whole country. Malihabad, the border area of Lucknow, is world famous for Dussehri mangoes.

Conclusion

The study disclose that 71% farmers were onward sugarcane based farming system followed by livestock based farming system 19% farmers. Farmer earning money 51% by the livestock farming system. It is highest sugarcane based farming sytem the total cultivated area varied from 0.71 ha of marginal farmer to 4.79 ha for large farmer. According to survey the major component of existing farming system is livestock. population of livestock varied from 1.65/ha in sugarcane based farming system to 6.43/ha in the livestock based farming system.

MIGRATION AND TYPES OF MIGRATION

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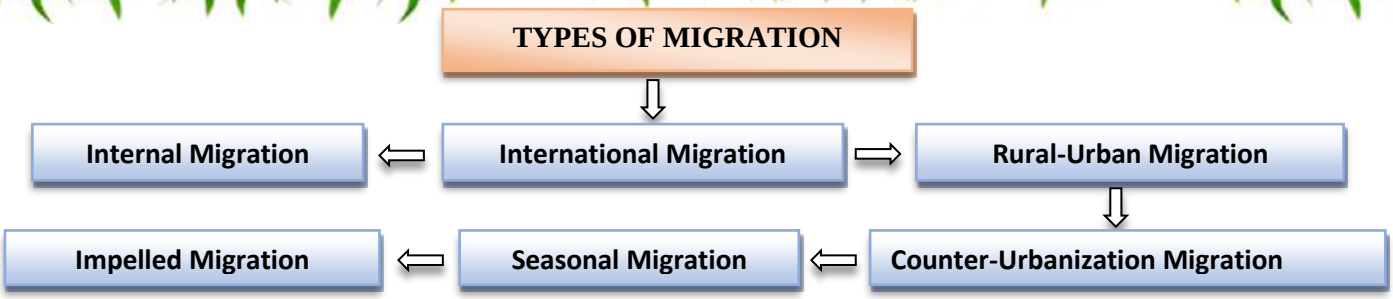
International migrants' day is celebrated on 18th December every year. The word "migration" is derived from the Latin word "migrate", which means to change one's residence.



Migration has been broadly defined as a spatial shift or "movement by humans from one locality to another, sometimes over long distances and in large groups". Migration is a process of movement of people from one region or country to another.

Types of migration:

1. Internal migration– Internal migration refers to the movement of people within the geopolitical boundaries of a country or nation. In the Indian context this form of migration happens when movement from one district to another or one state to another state takes place. Thus, internal migration is also called inter-state or inter-regional migration. Approximately one-third of India's population constitutes internal migrants. Internal migration is an easier process than international migration as mobility within a country is much more convenient and easier than between countries. There are fewer restrictions on citizens travelling or migrating within a country.

2. International migration– International migration takes place when the borders of a country are crossed. Migrants move to a different country, often in search of better economic facilities and a higher standard of living. Many Indians move to more developed countries for better and more wholesome educational facilities. This form of migration leads to both drain and brain gain. This is a more difficult form of migration as compared to internal migration. There are more mobility barriers in this type of migration, also called external migration.

3. Rural-urban migration– This form of migration happens when people from rural areas move to urban areas. This form of migration generally happens within a country. Urban areas are more developed than rural areas and thus provide more job opportunities. Excess rural-urban migration could lead to excessive urban growth and urbanization. This could result in overpopulation, pollution, a lack of basic facilities and poor living conditions. This could also indirectly lead to the expansion of urban areas and cities. This is a common phenomenon in underdeveloped and developing countries which face extreme poverty.

4. Counter urbanization migration– Counter urbanization migration happens when large numbers of people migrate from urban areas to rural areas. When urbanization and urban growth becomes too much, this form of migration takes place. This is caused mainly due to a high population density and pollution in urban areas and cities. It is literally the opposite of rural urban migration.

5. Seasonal migration– This happens when the work of migrant workers or laborers is vastly based on seasonal conditions. This causes people involved to migrate only for a particular season. Many farmers who have livestock or those belonging to pastoral communities often undertake this form of migration. This is mainly to protect their cattle from the extreme climatic conditions of summer, winter or monsoon. Once the season becomes favorable for them, these people along with their livestock return to their homelands.

6. Impelled migration – Impelled migration is not a forced migration. Rather, it is when people choose to leave their homes due to unfavorable conditions or situations. This migration can be caused by natural or man-made situations. War and hunger are some reasons for this migration.

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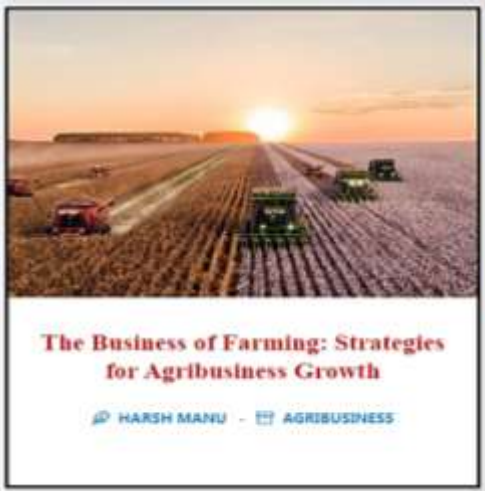

INDIA's PLANT PROTECTION REGULATION AND PESTICIDE MANAGEMENT BILL

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Regulatory bodies are organizations that are responsible for enforcing laws and regulations in specified fields. They are established by government or other entities to ensure that companies and individuals comply with rules and regulations related to their operations. These authorities are commonly setup to enforce standards and safety.

Key developments in plant protection in India

- **1901:** The Indian government establishes the imperial agricultural research institute (IARI) to conduct research on plant protection and other agricultural issues.
- **1948:** The Indian government establishes the central insecticides laboratory (CIL) to research and develop new insecticides and pesticides.
- **1960:** The Indian government establishes the Indian institute of horticultural research (IIHR) to conduct research on horticultural crops and plant protection.
- **1971:** The Indian government establishes the Indian institute of spices research (IISR) to conduct research on spices and their protection.
- **1980:** The Indian government establishes the national bureau of plant genetic resources (NBPGR) to conserve and utilize plant genetic resources for plant protection.
- **1992:** The Indian government establishes the Indian council of forestry research and education (ICFRE) to conduct research on forestry and plant protection.
- **2008:** The Indian government launches the national mission on sustainable agriculture (NMSA) to promote sustainable agricultural practices, including plant protection.
- **2020:** The Indian government launches the national bio-pesticides management centre to promote the use of bio-pesticides in agriculture and plant protection.

Agencies involved in regulation of plant protection in India

1. Directorate of plant protection, quarantine and storage.
2. Botanical survey of India.
3. National bureau of plant genetic resources.
4. Forest research institute.
5. National research centre on plant biotechnology.
6. National centre for integrated pest management.
7. National bureau of agricultural insect resources.
8. National bureau of agriculturally important microorganisms.
9. National plant protection organization.
10. National institute of plant health management.
11. Central insecticides board and registration committee.

Significant milestones of plant protection in India

a) **1914:** Destructive insects and pests act.
b) **1934:** Locust warning organization
c) **1968:** Insecticide act
d) **1971:** Insecticide rules
e) **1992:** Central IPM centres
f) **2003:** Plant quarantine order
g) **2008 & 2020:** Pesticide management bill.

What is plant quarantine for?

Plant quarantine is a practice used to prevent the spread of plant pests and diseases. It involves regulating the movement of plants and plant products across borders to ensure that they do not introduce harmful pests or diseases into a new area. This can include inspection, testing and treatment of plants before they are allowed to be imported or exported. It is often used by government agencies to protect the agricultural industry and natural ecosystems from the negative impacts of invasive plant pests and diseases.

Plant quarantine order of India (2003)

A plant quarantine order is a legal directive issued by the Indian ministry of agriculture and farmers welfare that regulates the import, export and movement of plants and plant products within India. The movement of plants and plant products within India requires a permit issued by the Director of plant protection, quarantine and storage. The order requires that all plants and plant products imported into India be accompanied by a phytosanitary certificate issued by the exporting country's national plant protection organization. The certificate must confirm that the plants or plant products have been inspected and found to be free from pests and diseases. In 1905, the United States passed its first quarantine act.

Pesticide management bill of India

Pesticides are used by farmers for a variety of crops, regardless of their approved purpose. The use of non-approved pesticides was noticed during

residue monitoring. Hence it is proposed as a piece of legislation that aims to regulate the use of pesticides in agriculture and other related industries. In February 2020, the Union Cabinet of India approved the Pesticide Management Bill 2020. The bill aims to improve the safety and effectiveness of pesticide use, while also protecting the environment and human health. Some of the key provisions of the bill include:

A. Establishing a national pesticide management program, overseen by a government agency to regulate the registration, sale and use of pesticides.
B. Requiring all pesticide products to be registered and applicators to be trained as well as certified by the national program before they can be sold or used in the country.
C. Imposing penalties for the illegal use or sale of pesticides, including fines and possible imprisonment.
D. Establishing a system for monitoring and reporting pesticide use and related incidents, such as accidental exposure or environmental damage.

Conclusion

Plant protection is crucial for India's agriculture sector, food security, biodiversity conservation, environmental protection and international trade. Effective plant protection measures can help to improve the livelihoods of farmers and ensure sustainable agricultural practices.

BIOCONTROL COMPOUNDS FOR THE MANAGEMENT OF PLANT DISEASES

About Author ...

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A potentially effective alternative strategy for controlling plant disease involves the employment of microorganisms as biological control agents. Microbes are an incredible source of biological activity due to their wide variety, intricate connections, and various metabolic pathways. The whole or partial eradication of the pathogen population by other species, which happens frequently in nature, is known as the biological control of pathogens.There are numerous instances of managing a variety of diseases where the pathogen is prevented from growing in specific regions because the soil has microorganisms that are hostile to the pathogens in question. Additionally, it was discovered that the plant affected by the infection had already received a natural inoculation with adversarial microorganisms either before or during the pathogen attack.As with hypo virulence and cross-protection, the antagonistic microorganisms can occasionally be comprised of avirulent strains of the same pathogen that kill or prevent the pathogen's growth.

Biocontrol agents' grouping

The parasitism of one fungus by another fungus is known as mycoparasitism. Mycoparasitism appears to be a complicated process that involves chemotropism to recognize plant pathogens, coiling around the pathogen, and appressorial formation, then the production of enzymes that break down cell walls and peptaibols, which is mediated by heterotrimeric G-proteins and mitogen-activated protein (MAP) kinases. Depending on how they feed, mycoparasites fall into one of two primary types according to Barnett and Binder (1973).

Destructive or necrotrophic mycoparasites

The antagonistic behavior of the mycoparasite in necrotrophic partnerships is very aggressive, and the

mycoparasites dominate the connection. In this relationship, mycoparasites kill their host as a result of their parasitic activity. The parasite's hyphae come into touch and develop alongside those of the host, occasionally coiling around them and frequently piercing. The host's cytoplasm may die before hyphal contact due to the secretion of exotoxins or enzymes that break down hyphal walls, or it may not die until contact has been made. Necrotrophic parasites are generally blatantly destructive, have a wide variety of fungi as hosts, and have a rather unspecialized mode of parasitism. For instance, they frequently discharge poisons and lytic enzymes into the environment. They also typically lack specialized infection structures.

Biotrophic mycoparasites

In this relationship, the living host helps the parasites grow for a long time, may not seem sick, and, at least at the beginning of the partnership, may appear to be minimally influenced by changes in growth rate, sporulation, and metabolism. The parasite appears to be very well suited to this manner of life, and the parasitic connection is physiologically balanced. Compared to necrotrophs, biotrophic mycoparasites typically have more constrained host ranges and frequently build specialized infection structures or host-parasite interfaces. In no biotrophic mycoparasitic relationship has exotoxin generation been shown.

Biocontrol agent that is opposite to the foliar pathogen

The formation of *Venturia aequalis* ascospores and conidia in fallen and growing leaves, respectively, is suppressed by *Chaetomium sp*. and *Atheliabombaciana*, two fungi that have been demonstrated to inhibit and antagonize various foliar fungal diseases of aerial plant parts. *Cronartiumrubicola*, the white pine blister rust fungus, are parasitized by *Tuberculina maxima*. Several rusts are parasitized by *Verticillium lecanii* and *Darluca filum*. Several powdery mildews are parasitized by *AmpelomycesQuisQualis*. The cucumber powdery mildew fungus is parasitized by *Tilletiopsis*. It has been reported that Alternaria is hostile to *Sphaerothecafuliginea* and Cladosporium herbarium. *Gliocladium virens* and *Trichoderma harzianum* sp. They are effective against *Pythium, Phytophthora, Sclerotium, Fusarium*, and several other fungi-caused damping-off, root rot, and wilt diseases of ornamental plants, vegetables, and grains.

Mechanism involved in antagonism

It is known that several processes, acting alone or jointly, are engaged in antagonistic interactions in the rhizosphere and phyllosphere. The main processes include nutrient competition, antibiosis, and mycoparasitism. Additional mechanisms include induced resistance and the disruption of enzymes linked to pathogens.

Antibiosis

The majority of fungi control plant diseases through an important process called antibiosis. The interaction between a low-molecular-weight substance or an antibiotic produced by a bacteria that directly impacts another microorganism has been described as the process. In biocontrol research, several fungi that produce antibiotics have been utilized. Examples include the antibacterial chemicals produced by the fungus *Epicoccum nigrum*, which are effective against *Botrytis cinerea* and *Sclerotinia sclerotiorum*, as well as the effective antagonists of *Venturia inaequalis*, *Monilinialaxa*, and *Chetomiumglobosum*. Gliovirin is produced by *Trichoderma virens*, which inhibits *Pythium ultimatum's* damping-off of cotton. *Chaetomium globosum*, *Trichoderma harzianum*, and Trichoderma spp. all produce chaetomin, peptaibols, and pyrones, respectively.

Competition

For microorganisms, the nutrition sources in the soil and rhizosphere are typically insufficient. A bacterium must successfully compete for the available nutrients for phyllosphere and rhizosphere colonization to be successful. Additionally, it is thought that nutritional competition is more important for soil-borne infections, such as *Pythium* and *Fusarium* species, which spread by mycelial contact rather than foliar pathogens, which sprout on plant surfaces and spread through appressoria and infection pegs. The main strategy *T. harzianum* employs to keep F. oxysporum f.sp. melons under control are competition for nutrients. *T. harzianum* can prevent *B. cinerea* from infecting grapes by invading blossom tissue and keeping the pathogen away from the grapes.Trichoderma is also more effective and competitive than many other soil microorganisms due to its high ability to mobilize and absorb soil nutrients.

Mycoparasitism

It appears that mycoparasitism is a complicated process that involves chemotropism to recognize plant pathogens, coiling around the pathogen, and appressorial formation, followed by the production of enzymes that break down cell walls and peptaibols, which are mediated by heterotrimeric G-proteins and mitogen-activated protein. MAP kinases to minimize sporulation, parasitism targets existing harmful mycelium.and thereby restrict the spread of the virus. fungus cell wall-degrading enzymes like chitinases Hyperparasites frequently produce and glucanases, while lytic enzymes secreted by them include 1,3-*Trichoderma* spp. was also reported to produce glucanases, proteinases, chitinases, and lipases. Mycoparasitism may also be significantly influenced by 1,6-g1ucanases and b-1,4-g1ucanases.Close contact between the antagonist and host, enzyme secretion, and active hyperparasite growth within the host are all necessary for parasitism. Fungal biocontrol agents, which represent the rich diversity of fungi, are currently being investigated as a possible key tool in the management of plant disease. Excessive use of chemical pesticides and fungicides causes environmental degradation, insect resistance, ecosystem disruption owing to the eradication of natural enemies, and health issues. Fungal biocontrol agents, therefore, have a great chance to take the place of manmade chemicals. Shortly, it is anticipated that the fungal bioagents will be quite effective at addressing some of the major illness issues.■

VERMICOMPOSTING

A STEP TOWARDS SUSTAINABILITY AND ENTREPRENEURSHIP DEVELOPMENT

About Author ...

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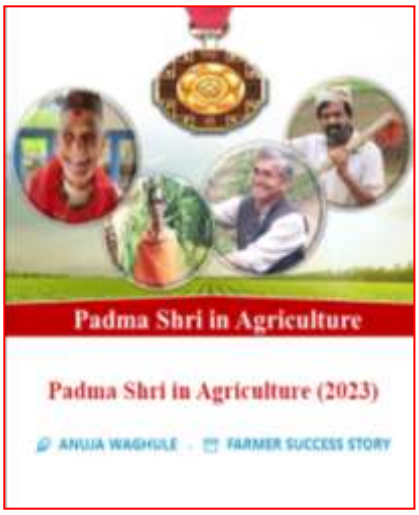
Global production of solid wastes as a result of various anthropogenic activities such as urbanization, economic growth, and so on has become a serious ecological concern. In developing nations including India, these massive quantities of waste are not thoroughly disposed of owing to the inadequacy of sophisticated technologies for cost-effective recycling. There are several solid waste management systems including waste minimization, reprocessing, waste to energy, landfill dumping, and composting. However, it has been documented that certain procedures entail significant environmental consequences such as groundwater contamination, greenhouse effects, the toxicity of soil and plants, and inhibition of soil microbial metabolism. Additionally, considerable unemployment aspects have emerged, which necessitate judicious exploration. Therefore, to address all of these challenges, specialized methodologies are essential, and vermicomposting is one of the reliable and cost-effective approaches.

Vermicomposting is a cutting-edge solution for coping with the surge in waste by transforming organic compounds into nutritionally enriched compost for soils instead of dumping it in landfills. Vermicompost is a dark brown, light weighed, and crumbly compound generated by the bio-oxidation and stabilization of organic material involving the combined activity of earthworms and microorganisms. It is a practical, environmentally sustainable process that converts solid waste into humus-rich manure, known as vermicomposting. *Eisenia foetida* (Red earthworm) is the preferred species of an earthworm because of its high multiplication rate.

The resulting fine-grained compost can be applied before sowing or as a top dressing after germination. It is primarily utilized for high-value crops, such as spices, sugarcane, vegetables, and orchards. It is a nutritive organic fertilizer high in humus, nitrogen, phosphorus, potassium, micronutrients, and advantageous soil microbes such as nitrogen-fixing, phosphate-solubilizing bacteria, actinomycetes, and growth hormones. It is employed to promote soil productivity while also lowering the financial investment and the amount of synthetic fertilizers. In addition, vermicompost can be used to produce two liquid formulations including vermiwash and compost tea, which have shown to be growth promoters and protectors for crop plants. Therefore, the adoption of such eco-friendly technologies would contribute to the prevalence of sustainability.

Entrepreneurship development:

Entrepreneurship development is attaining national prominence not only for industrialization but also due to its potential to address the unemployment crises and uplift the economically weaker sectors of society. The establishment of vermicomposting units could offer an alternative to joblessness concerns via effective waste utilization, as well as alleviate the socio-economic conditions of the rural dwellers. Generally, rural men and women are encouraged to adopt this technology since the demand for vermicompost has drastically increased owing to the notion of sustainability and the easy availability of components required for vermicompost production. In addition, farm women can enhance their economic standing by engaging in a variety of enterprises such as vermicomposting, value addition in fruits and vegetables, mushroom cultivation, nursery raising, backyard poultry, and so on. Furthermore, the notion of self-help groups (SHGs) and their establishment in rural regions have had a significant impact on the rural economy. The government has launched a variety of programs to provide financial assistance to business owners, including the Paramparagat Krishi Vikas Yojana (PKVY), the mission of organic chain development for the Eastern region, the mission for integrated development of horticulture, and the national project on soil health and fertility management. Therefore, greater emphasis should be placed on raising public awareness and developing the paradigm of employment and sustainability to secure the future.



BIOCHAR

A QUALITY ENHANCER FOR FRUIT CROPS

About Author ...

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Pyrolysis is the term for the heating of biomass, such as wood, plant or animal waste, or leaves, in a closed container with little to no available air. Biochar, a very inexpensive "input" in the production of horticulture, is the outcome of the pyrolysis of biomass. It can be generated from any ligno-cellulosic biomass, including brushwood, waste from the harvest of timber, crop leftovers like rice and wheat straw, weedy shrubs and grasses, as well as animal manure. In addition to highlighting the need for in-depth field research to completely understand how biochar affects biological N_2 fixation, this article highlights the potential for employing biochar in horticulture applications to improve N input and also show that biochar from biomass not only results in the production of renewable energy (synthetic gas and bio oil), but it also reduces the amount of carbon dioxide in the environment.

Advantages

1. The use of biochar in agricultural practises is a promising new technology with tremendous potential to maintain and enhance soil quality and nutrient cycling.
2. Biochar is a novel and intriguing supplement to increase yield on acidic, degraded soils with low fertility.
3. A potential successor termed as biochar has the ability to improve the physical, chemical, and biological properties of soil.
4. Adding biochar to the soil results in better soil pH, nutrient availability, moisture absorption, and carbon sequestration.
5. By stimulating soil microbial activity, biochar increases soil fertility and water-holding capacity, which in turn encourages crop growth and yields.

Effects of Biochar in fruit crops

Mango: Under saline environments, biochar helps plants grow and develop their physiological and biochemical characteristics. The crop production and productivity increased along with the plant height and potassium uptake when biochar was added to the saline soil. Additionally, it is done to alter the nitrogen cycle, lower emissions of nitrous oxide from the soil, and increase carbon sequestration. By improving the physical and chemical qualities through sodium filtration and lowering its concentration in the soil, it is also helpful in lessening the effects of salt stress. Due to its strong capacity to absorb contaminants, it may have a significant impact on soil CO_2 emissions and enhance the quality of polluted soil. Harhash *et al.* (2022) performed an experiment on the performance of mangos as impacted by the soil application of zeolite and biochar under salinity stresses. The results showed that the application of zeolite or biochar had a favourable impact on soil properties, which had an impact on the tree's trunk thickness, shoot length and width, number of inflorescences, yield in kg per tree, and fruit quality.

Citrus: Microorganisms are an essential aspect of the soil ecosystem and the primary catalyst for the physical and chemical processes that take place there. Biochar's unique physical and chemical characteristics enable it to offer nutrients as a food source and natural habitat for microbes. Zhang *et al*. (2022) studied on biochar amendment improved fruit quality and soil properties and microbial communities at different depths in citrus production. The application of biochar had a favourable impact on the citrus fruit indexes (peel, edibility, soluble solid-to-titratable acidity ratio, soluble solids) and soil physicochemical qualities (pH, organic matter, nutrient elements). Biochar considerably increased the richness, evenness, and variety of soil bacteria while decreasing the evenness of fungi in terms of microorganisms. Beneficial bacteria were enhanced by each biochar treatment. In addition, once biochar was applied, saprophytic fungi that can encourage nutrient cycling were greatly enriched.

Banana: Application of biochar as an amendment to salinesodic soil ameliorates the effects of potential stressors on plant performance and production**.** In an experiment on the effects of biochar on the vegetative parameters, leaf mineral content, yield, and fruit quality of the Grande Naine banana in saline-sodic soil, Ogiala (2018) came to the conclusion that higher biochar addition rates resulted in better growth, productivity, and fruit quality. With a wood sawdust biochar rate of 20 mg ha^{-1}, the pseudostem's length and girth, the leaf area, as well as the bunch, cluster, and finger weights, all saw significant increases.

Papaya: Biochar application significantly increased shoot and root growth as well as soil chemical characteristics in papaya plants. A rapid initial rise in plant height was made possible by the use of biochar and biochar combined with mucuna. Despite the enhanced N, P, K, Ca, and Mg accumulation and usage efficiency in the plants, it also revealed a clear N deficit. The combined application of mucuna and biochar increases plant height and

the P content of the leaves. The papaya plant grows and nourishes more readily when charcoal and mucuna are applied separately or together, and soil fertility is preserved.

Strawberry: According to Shang, 2019 concluded that although it was predicted that the application of wood-based biochar would boost strawberry yield and quality (average fruit weight, TSS, TPC, and antioxidant activity), the only thing this practise actually did was increase average fruit weight.The greater average fruit weight in biochar-treated crops may be attributed to an enhanced chemical sorption of essential nutrients such as N, P, and K to the wood-based biochar surface that improved nutrient absorption by plant roots during the fruit development and ripening periods.

Apple: Apple trees had larger trunk diameters and more shoots overall. However, there were no appreciable changes in the productivity indexes of fruitfulness, fruit weight, or starch pattern index.

Conclusion:

In a wide number of areas, biochar is developing as a very promising, ecologically beneficial material. As a result, it's essential to create standard biochar characterization techniques that incorporate the contributions of all scientists who have used biochar. As a first step, a global meeting that considers biochar's characteristics would be beneficial. Reclaiming the soil is crucial to overcoming wastelands. Therefore, the article on the use of biochar in fruit production offers a strong foundation for future research and might make it easier to use biochar to increase fruit production.

BIOSECURITY
IN SHRIMP FARMING

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Biosecurity is the practice of excluding specific pathogens from cultured aquatic stocks in the farms, for the purpose of disease prevention. It refers to actions taken to reduce the risk of infectious disease transmission by avoiding the entrance and/or spread of dangerous organisms (such as viruses, bacteria, etc.) to animals. By implementing biosecurity, the risk of pathological events will be reduced.

The biosecurity measures taken to prevent the entry of pathogens falls under 3 categories.

- Physical measures include installation of physical barriers, water treatment, and quarantine.
- Chemical measures involve treating all components before they enter the facility. Chlorination and ozonisation are often used to treat incoming water.
- Biological measures include the use of SPF shrimp, which are readily available commercially.

Pillars of biosecurity:

- **Bio-exclusion** aims at the prevention of disease introduction and depends on external biosecurity procedures.
- **Bio-containment** focuses on averting the spread of disease within a farm or group of animals and it depend on implementation of internal biosecurity practices.

Disease prevention in biosecurity of animals

Disease prevention depends on:

- avoiding contact between the disease-causing agent and the host.
- early detection of disease through surveillance.
- rapid implementation of biocontainment policy.

Biosecurity measures before stocking in the farming facility:

- **Seeds:** Use of Specific Pathogen Free (SPF) seeds helps to prevent entry of pathogens into the farming facility.
- **Water:** Managing water is an important aspect of maintaining the biosecurity in shrimp farm. Water treatment involves physical, chemical and aging methods to eradicate the pathogens.
- **Pond environment:** The installation of various screenings, crab protection walls, and bird scaring lines are few biosecurity measures that can be done to stop predatory animals from entering the pond area.

Biosecurity measures during the culture activity:

SPF shrimp could remain free of pathogens only if they are maintained in the bio secured environment. The pillars of biosecurity and the various measures in biosecurity is as shown in figure 1. Management practices that may be implemented to reduce the risk of introduction of pathogens include:

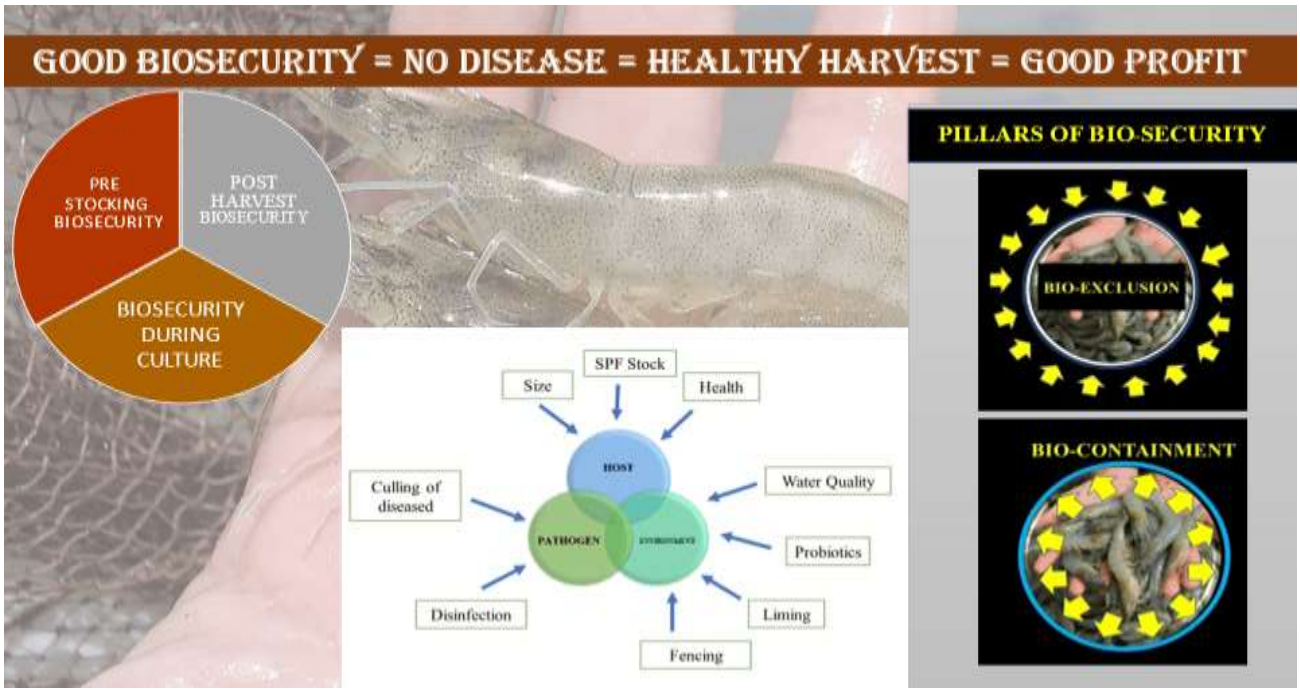

Fig.1: Biosecurity measures in aquaculture

1. Access to culture area and reservoir pond should be restricted to a minimum number of well-trained individuals.
2. Washing hands, hand dip and foot dip at the entrance of each and every section.
3. Check tray should be cleaned on after use.
4. Disinfect wheels of delivery vehicles when they come onto the facility.
5. Culling dead and weak shrimp is a very important strategy that can reduce the spread of pathogens from shrimp to shrimp.
6. Improving the resistance of fish to pathogens by proper nutrition, probiotics, immunostimulants etc.
7. Sludge that accumulates on pond bottoms needs to be removed by siphoning.
8. Water exchange should be minimized during operations to minimize the possible introduction of viral particles.
9. Maintaining the physical, chemical and biological (probiotics) parameters of the water.

Biosecurity measures post-Culture:

1. Disinfection and removal of water.
2. Effluent treatment and disposal of water.
3. Proper drying of ponds before the next culture.

Biosecurity measures during disease outbreak:

In the case of a disease outbreak, a quarantine protocol needs to be followed strictly to prevent the virus from spreading to other ponds or farms.

- The pond must be quarantined and prevent entrance to the pond area.
- Make sure all inlet and outlet gates to and from the pond are securely closed.
- The pond must be chlorinated with a higher dosage than normal as soon as possible.
- All dying or dead shrimp must be collected and burned or buried.
- Stop operating all aeration equipment, but do not take it out of the pond.

Conclusion

Biosecurity can be applied to shrimp aquaculture production systems through a variety of management strategies. It addresses methods for both prevention and control of disease. Reliable stock sources, adequate diagnostic and detection tools for excludable diseases, means of disinfection and pathogen elimination, best management practises, and practical and acceptable laws are the main components of biosecurity. Disease control and prevention relies on the interrelated processes of bio-exclusion, surveillance, and biocontainment. Implementation of strict biosecurity and quarantine protocols are important to prevent outbreak of diseases in the farming system. Disease outbreaks among farm animals can cause significant economic damage. However, the impact can be limited through proper biosecurity measures.■

SEAWEED SAP

AN INTRODUCTION TO AGRICULTURAL CROP PRODUCTION

About Author ...

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The demand for food, oil and fibre is increasing with the increasing population. As a result application of chemical fertilizer also increases for more yield and production. The excessive use of chemical fertilizer cause serious health hazards as well as pollute the environment. Therefore, in recent years many plant extracts have been used in agriculture. Around 700 species of marine algae are present in both the intertidal and deep-water regions of the Indian coast and approximately 60 of them commercially important.

Seaweed extracts are marketed as liquid fertilizers and bio-stimulants because they contain multiple growth regulators such as cytokinin, auxin, gibberellin and various macro and micronutrients necessary for plant growth and development. It helps in promoting the growth of beneficial soil microorganisms developing tolerance to environmental stress.

Seaweed sap

It is an organic fertilizer made from seaweed that is used in agriculture to increase soil fertility and plant growth. *Kappaphycus alvarezii* (K sap) and *Gracilaria edulis* (G sap) are two main seaweed sap commonly used in crop cultivation.

Significance in agriculture

Now a days seaweed extracts are used in agricultural practice and are already commercialized. Seaweed liquid fertilizers (SLF) are available as manure, foliar spray, soil conditioners and soil drench also granular and powder. In many commercial crops, foliar spraying with seaweed extract is a popular practice to increase yield. The aim of recent research is to implement new methods for preparing various seaweeds, such as mixed consortiums, for use in agricultural fields and to increase yield. It is noticed that seaweed produce beneficial effects on cereals, pulses, and many flowering plant. The advantage of seaweed manure is that it is free from weed seeds and other pathogenic fungi. Seaweed extracts are bioactive at low concentrations (diluted as 1:1000 or more). Seaweed extracts have been commercially available in recent years under various names as Sagarika, Maxicrop and Seacrop-16 etc.

Effects on germination

Seeds soaked in lower concentrations (5%) of both seaweed saps displayed a higher rate of germination shoot, root length, and seedling vigour index (mainly in rice, wheat, maize), while seeds soaked in higher concentrations (15%) of extracts inhibited germination. In case of low concentrations of seaweed extracts, an increase in germination and seedling vigour may be due to the presence of growth promoting substances such as auxin, gibberellin, and phenylacetic acid and other micro-nutrients. Development promoting factors such as IAA and IBA

Fig-01 Different seaweed products in market

Gibberelin (A & B), micronutrients, vitamins, and amino acids, which have a significant impact on crop germination, could explain the higher germination percentage at lower concentrations.

Effects on crop growth

Proper application with suitable concentration of different seaweed seems most effective for growth in different crops. Those are given below-

- With higher concentrations of seaweed extract, rice yield attributing characters such as the number of panicles per hill and number of effective grains per panicle increased, and the highest value was obtained for 15% K sap, which was statistically comparable to 10 and 5% K sap concentrations. Furthermore, the application of both K sap and G sap at the same concentration improved the absorption of N and P by grain.
- Applications of 15% seaweed extract from K sap is recorded 57% higher grain yield in soybean due to increased plant height, number of pods per plant, number of grains per plant, number of branches and also improved the nutrient uptake by plant. It also increases the nodule number in legumes.

Effects on yield

Similarly yield potential is different for different crops. Result of

the experiments on different cereals, legumes, oilseeds, fibres along with other miscellaneous crop are here-

- Application of 10% K sap results 30.11% higher seed yield in maize due to increase in yield of cobs, weight of pods as well as seed yield per plant.
- 15% G sap along with recommended dose of fertilizer (RDF) recorded 38.97 and 33.58% higher grain yield, respectively compared to the control in green gram.
- Prescribed fertiliser dose with extracts of either K sap or G sap at 10% concentration at 30 and 60 days interval after planting recorded higher tuber yield and total soluble solids of the potato tubers.
- The yield of wheat grain increased significantly by 19.74% and 13.16% with the application of 7.5% and 5.0% concentrations of K sap and G sap respectively.

Effects on nutritional quality of grains

Application of 15% K or G saps significantly increased the protein content in rice grain also 7.5 and 5.0% concentrations of K and G saps increased the protein content by 15.64 and 13.09% in wheat. Increase in protein content with the application of seaweed extracts has also been reported in *Vigna catjang* (cowpea subspecies). This might be due to promotive effects on root growth and higher uptake of N, P and sulphur needed for protein synthesis. Application of seaweed extract also increased the micro-nutrient content in rice grains like Cu and Zn up to 10% concentrations and Fe and Mn upto5% concentrations. Similar results were also reported in okra and wheat.

Conclusion

In crop production, seaweeds and seaweed products are becoming more common. The mechanism of action of seaweed extract-elicited physiological responses, on the other hand, is largely unknown. Since the genomes of a variety of plants have now been sequenced or are close to being sequenced, researchers will investigate the effects of seaweed extracts and components on the whole genome of plants to better understand the mechanisms of action of seaweed-induced growth response and stress alleviation. Recent research has found that seaweed extracts protect plants from a range of biotic and abiotic stresses and they may be used in the field.

LUMPY SKIN DISEASE

DOES IT AFFECT MILK WE CONSUME ?

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Lumpy skin disease is caused by the lumpy skin disease virus (LSDV), which belongs to the genus capripox virus, a part of the poxviridae family (smallpox and monkeypox viruses are also a part of the same family). The LSDV shares antigenic similarities with the sheep pox virus (SPPV) and the goat pox virus (GTPV) or is similar in the immune response to those viruses. It is not a zoonotic virus, meaning the disease cannot spread to humans. It is a contagious vector-borne disease spread by vectors like mosquitoes, some biting flies, and ticks and usually affects host animals like cows and water buffaloes. According to the United Nations Food and Agriculture Organisation (FAO), infected animals shed the virus through oral and nasal secretions which may contaminate common feeding and water troughs. Thus, the disease can either spread through direct contact with the vectors or through contaminated fodder and water. Studies have also shown that it can spread through animal semen during artificial insemination.

LSD affects the lymph nodes of the infected animal, causing the nodes to enlarge and appear like lumps on the skin, which is where it derives its name from. The cutaneous nodules, 2–5 cm in diameter, appear on the infected cattle's head, neck, limbs, udder, genitalia, and perineum. The nodules may later become ulcers and develop scabs over the skin. The other symptoms include high fever, sharp drop in milk yield, discharge from the eyes and nose, salivation, loss of appetite, depression,

damaged hides, emaciation (thinness or weakness) of animals, infertility and abortions. The incubation period or the time between infection and symptoms is about 28 days according to the FAO, and 4 to 14 days according to some other estimates. The morbidity of the disease varies between two to 45% and mortality or rate of death is less than 10%, however, the reported mortality of the current outbreak in India is up to 15%, particularly in cases being reported in the western part (Rajasthan) of the country.

Background

The disease was first observed in Zambia in 1929, subsequently spreading to most African countries extensively, followed by West Asia, Southeastern Europe, and Central Asia, and more recently spreading to South Asia and China in 2019. As per the FAO, the LSD disease is currently endemic in several countries across Africa, parts of West Asia (Iraq, Saudi Arabia, Syrian Arab Republic), and Turkey.

The spread in South Asia first affected Bangladesh in July 2019 and then reached India in August of that year, with initial cases being detected in Odisha and West Bengal. The FAO points out: “The long porous borders between India, Nepal and Bangladesh allow for a significant amount of bilateral and informal animal trade, including cattle and buffaloes.” This, the UN body says, may have contributed to the spread of LSD in July-August 2019 between Bangladesh and India. While the 2019 outbreak later subsided, the recent spread in India began in June this year.

Is it safe to consume the milk of affected cattle?

Studies say that it has not been possible to ascertain the presence of viable and infectious LSDV virus in milk derived from the infected animal. FAO notes, however, that a large portion of the milk in Asia is processed after collection and is either pasteurised or boiled or dried to make milk powder. This process ensures that the virus is inactivated or destroyed.

Notably, Joint Director at the Indian Veterinary Research Institute (IVRI) told PTI that it is safe to consume milk from cattle infected by Lumpy Skin Disease, as it is a non-zoonotic disease.

"It is safe to consume milk from the infected cattle. There is no problem in the quality of milk even if you have it after boiling or without boiling," Mr Mohanty said.

Economic implications

The spread of the disease can lead to “substantial” and “severe” economic losses according to FAO and the World Organisation for Animal Health (WOAH). The disease leads to reduced milk production as the animal becomes weak and also loses appetite due to mouth ulceration. The income losses can also be due to poor growth, reduced draught power capacity and reproductive problems associated with abortions, infertility and lack of semen for artificial insemination. Movement and trade bans after infection also put an economic strain on the whole value chain.

A risk assessment study conducted by the FAO based on information available from 2019 to October 2020 revealed that the economic impact of LSD for South, East and Southeast Asian countries “was estimated to be up to $1.45 billion in direct losses of livestock and production”.

The current outbreak in India has emerged as a challenge for the dairy sector. India is the world’s largest milk producer at about 210 million tonnes annually. India also has the largest headcount of cattle and buffalo worldwide.

In Rajasthan, which is witnessing the worst impact of the lumpy skin disease, it has led to reduced milk production, which lessened by about three to six lakh litres a day. Reports indicate that milk production has also gone down in Punjab owing to the spread of the disease. According to FAO, the disease threatens the livelihoods of smaller poultry farmers significantly. Notably, farmers in Uttar Pradesh and Punjab have incurred losses due to cattle deaths and are seeking compensation from their state governments.

Preventive measures

The FAO has suggested a set of spread-control measures for LSD, which involves vaccination of susceptible populations with more than 80% coverage, movement control of bovine animals and quarantining, implementing biosecurity through vector control by sanitising sheds and spraying insecticides, strengthening active and passive surveillance; spreading awareness on risk mitigation among all stakeholders involved, and creating large protection and surveillance zones and vaccination zones.

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Impact of E20 fuel on agriculture

TIMES OF AGRICULTURE · AGRI NEWS

Posts by Times of Agriculture

POTENTIAL USE OF BENEFICIAL MICROORGANISMS IN CLIMATE SMART AGRICULTURE

About Author ...

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Climate change (CC) is one of the most dangerous natural hazards that significantly impair the agricultural production of India. Among the various greenhouse gases, the concentration of carbon dioxide (CO_2) was increased at steady state (280 ppm) till the pre industrial period (1850). It is rising since then at the rate of 1.5 to 1.8 ppm per year. India is a global agricultural powerhouse. It is the largest producer of milk, pulses, spices, and cattle (buffaloes) in the world, and it is heavily reliant on the climate change. So there is a great deal of concern about future climate changes and their potential direct or indirect effects on India's agricultural production.

Indian Council of Agricultural Research (ICAR) under taken vulnerability assessment of Indian Agriculture to climate change. This evaluation covered nearly 573 rural Indian districts (excluding the Union Territories of Andaman and Nicobar Islands, Lakshadweep). According to the vulnerability research, 109 of the 573 rural districts are classified as "extremely high-risk" districts, while 201 are classified as risk districts. Therefore, it is anticipated that the overall effects of climate change on agriculture would be detrimental and pose a threat to future global food security.

Climate smart agriculture

According to the estimations, agricultural production will need to rise by 60% in order to fulfill the estimated demand of food and animal feed in future. Moreover, threats to crops, livestock, and fisheries are anticipated to rise in the next decades as a result of climate change. So transformation and reorientation of agricultural production under the new realities of climate change gave rise to concept of climate smart agriculture (CSA).

Food and Agricultural Organization (FAO) of the United Nations defines CSA is an integrative approach of agricultural production that aims at sustainably increasing efficiency, enhancing adaptation with mitigating GHG emission where possible and enhancing achievement of national food security goal. The goal of CSA is to offer universally applicable guidelines for managing agriculture for food security in the context of climate change.

Role of microbes on climate smart agriculture

Microorganisms are the most crucial components of agricultural ecosystem without which agriculture and food production would be impossible. Application of beneficial micro-organisms in agriculture would serve as a great alternative pathway under the changing climatic scenario. The wide variety of microorganisms offers an undiscovered possibility for increasing agricultural production efficiency, adapting to and mitigating the consequences of climate change, and attaining goals of climate smart agriculture. In order to mitigate the climate change effect, microorganisms of agricultural importance represent key ecological strategy for integrated management practices such as nutrient management, disease, pest and abiotic stress management.

Nutrient management

Numerous papers emphasized the significance for better environm-entally friendly agricultural techniques for sustainable crop production under climate change circumstances. In this context, the use of bio-fertilizers could be a best alternative strategy for nutrient management to sustain the crop productivity. Bio-fertilizers are cost effective, eco-friendly and agriculturally important microorganisms that can able to colonize the plant roots. As a result, they improves the nutrient uptake, productivity and crop yield as well as improve plants tolerance to stress and resistance to pathogens through mechanisms such as the mobilization of essential elements by production of various organic acids and siderophores, lytic enzymes, antibiotics and plant growth hormones.

Biotic stress management

Changing pattern of disease and insect pest incident due to climate change has warranted the necessary for improved eco-friendly methods for sustainable crop production. Beneficial bio-inoculants are one of the efficient solution to overcome the challenges faced with biotic stresses. Bio-inoculants are an environmentally safe and effective means of reducing pathogen/pest populations by altering their ecological status. It plays an important role in crop productivity through diminishing the biotic stresses via production of certain chemicals such as 1-aminocyclopropane-1-carboxylate, deaminase, IAA, phytohormones, anti-oxidants, proline, extracellular polysaccharide, siderophores, anti-biotics, and volatile organic compounds (VOCs), etc. Such multifaceted action of microorganisms makes them strong,

viable and vital options for biotic stress mitigation in crop plants.

Abiotic stress management

Crops are subjected to a variety of abiotic stresses such as high salinity, extreme temperatures, flooding, heavy metals, radiation and drought that negatively impact the plants growth by affecting their metabolic processes. According to the FAO's 2000 assessment, major abiotic stress like salinity, cold and drought affect around 6, 54 and 64 % of the entire earth's land, respectively. Different tactics like development of stress-resistant varieties, plant genetic engineering, bio inoculants and chemical control are employed to combat the different types of abiotic stresses. Among the different approaches, application of helpful microorganisms as bio inoculants could be a viable alternative for abiotic stresses management. With their potential intrinsic metabolic and genetic capabilities, bio-inoculants help to alleviate abiotic stresses in several crops.

Conclusion

Adaptation and mitigation to climate change are pose a challenge in agriculture nowadays and in the near future. The use of beneficial microorganisms in agriculture may not only aid in the crop nutrition, biotic and abiotic stress management but also employ in mitigation of climate change effect on agriculture. The future of earth will vastly depend on the beneficial microorganisms in shifting environmental conditions.

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AUTOMATION FARMING

A FUTURISTIC APPROACH IN AGRICULTURE

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Automation farming covers all the practices that help with planting and harvesting with the aid of machines and other devices. These devices can be found on the farm itself, such as machinery to perform tasks more quickly and efficiently, or machines that help with precision and accuracy.

Here are few examples listed below of automation farming-

a) Irrigation drones:

Drones in agriculture can be used for several purposes, such as measuring soil quality and mapping out the size of the fields. Drones can be used for irrigation as well as for controlling water flow by precisely determining how much water is needed in each spot in the field.

b) Planting robots:

Robots can also be used to help farmers with planting. By placing the seed in the soil, a robot can speed up the planting process, ensuring that the seeds are planted at the proper depth and in the right places.

c) Analytical and Monitoring Farming Tools:

Analytical farming tools can help determine the conditions of the soil and other materials like fertilizer and seeds. By using a variety of sensing equipment, farmers can get insight into the status of their fields and make decisions accordingly. This can help prevent the growth of the disease and maximize the yield of a harvest.

d) Automated tractors:

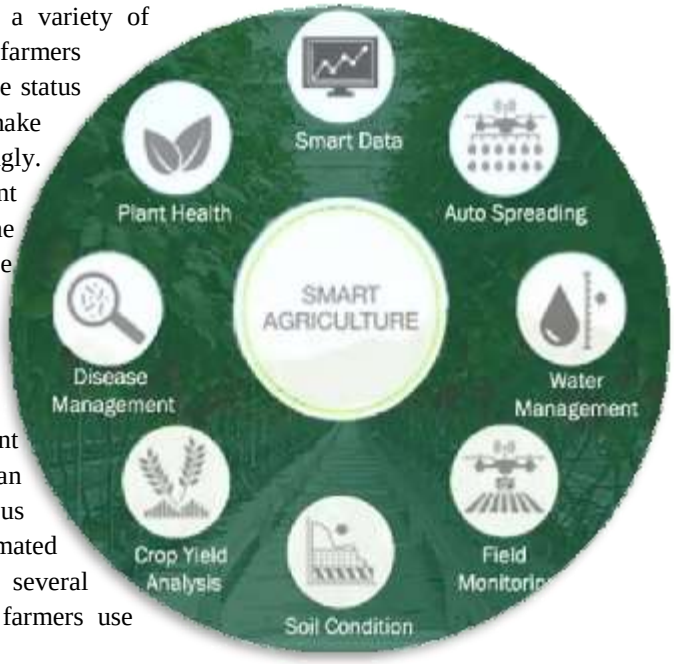
Generally, tractors are a significant part of farming but can be incredibly laborious to wield. Automated tractors use several technologies to help farmers use the tractors more efficiently and with a lot less back-breaking effort. Tractors can be outfittedwith tracking devices to help the driver and the farmer keep track of the tractor's location in the fields.

e) Crop tracking:

They can also be used for crop assessment, which is a process that detects disease and pest infestations in crops. This can help farmers keep a close eye on the produce and address problems early before escalating.

f) Automated harvesters:

These harvesters are allowing farmers to save on labor costs. These machines can pick more fruits and vegetables than a whole team of workers in a shorter time.



Advantages

a) **Reduce in cost of production:**

When farmers undertake the task of farming manually, they need to pay several employees to do the work for them. With automation, the entire production process canbe computerized and significantly farmer work will not be laborious and there is decline in production cost.

b) **Improved safety:**

These machines can work for long hours and in dangerous situations without being affected by rain, sleet, snow, or any other adverse weather conditions. Hence, it will be a boon for farmers when they have to be in field in adverse weather conditions.

c) **Consumer benefit**

People don't pay for the machine, they pay for the products it makes. Automation could reduce prices and increase the availability of products, lowering the costs of consumer goods.

d) **Accurate field evaluation:**

By tracking production rates, farmers are able to accurately predict future crop yield.

Disadvantages:

- **Expensive**- It costs a lot of money to make or buy robots.
- **High maintenance**- They need maintenance to keep them running.
- **Worker displacement**- with the more adoption of technologies there will be a risk ofreplacement of farmers with those machines.

SUSTAINABLE FOOD PRODUCTION USING HYDROPONICS

About Author ...

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Fig 1. Hydroponic farming

Our current agricultural system is capable of handling a massive task: by 2050, food production would need to expand by nearly 70% in order to fulfil the caloric needs of a population of 9.8 billion people, 68% of whom are expected to live in cities. By 2050, we would not have reached this level of growth even if we projected a linear increase in yield from the agricultural output of the previous five decades. Around the world, agriculture accounts for 70% of water use, largely as a result of irresponsible irrigation techniques. Food is currently grown on 38% of the planet's non-frozen land. If current trends continue, by 2050, 593 million hectares of land will need to be converted to agriculture in order to supply the predicted calorie needs of the entire world population. The various factors responsible for declining the food production. In order to meet the expanding need for food, we must discover alternatives to the agricultural system. Many of the negative aspects of the world's present agricultural issues can be addressed via hydroponic farming.

Hydroponic farming

Plants can be cultivated hydroponically, a farming technique that eliminates the need for soil and allows plants to thrive in nutrient-rich water. Hydrophonic farming is also referred as controlled environment agriculture. Hydroponics involves growing plants in a soil less medium, usually perlite, rock wool or gravel, using a small pump to circulate nutrient-laden water through the root system.

Need of hydroponic farming

- Climate change, dangerous infectious diseases, rising urbanization, and the depletion of natural resource deposits are just a few of the pressing concerns facing humanity today. These issues are dramatically altering our worldwide lifestyles.
- In regions with severe droughts and poor soil quality, hydroponically

farmed crops have the potential to deliver fresh, local food.

- By maximising the quantity, quality, and timing of the inputs to the plants, farmers are able to guarantee the maximum yield under hydrophonics techniques.
- Protection against hazardous pests and diseases is another advantage of the hydrophonic farming.

Advantage of hydroponic farming

- Superior taste, quality, appearance, uniformity and extended shelf life of hydroponic vegetables.
- No sterilization of growing media
- Plant nutrition is easily and completely controlled within the nutrient reservoir.
- No weeding, no cultivation, no soil borne diseases or insects.
- Allows uniform water availability to plants.
- Closer plant spacing is possible and movable plant channels allow greater production from equal areas.
- Less water required and less fertilizer needed and root zone heating and cooling is made possible.

Disadvantage of hydroponic farming

- Application on commercial scale requires technical knowledge and higher initial capital expenditure.
- Great care is required with respect to plant health control.
- Finally energy inputs are necessary to run the system
- Considering the significantly high cost, the soil-less culture is limited to high value crops of the area of cultivation.

Table 1. Crops suitable for hydroponic farming

Type of crops		Name of the crops
Cereals	:	Rice, Maize
Fruits	:	Strawberry
Vegetables	:	Tomato, Chilli, Brinjal, Green bean, Cabbage, Cauliflower, Bell pepper, Cucumber, Melons, Radish and Onion
Leafy vegetables	:	Lettuce, Kang Kong
Condiments	:	Parsley, Mint, Sweet basil, Oregano
Flower crops	:	Marigold, Roses, Chrysanthemum
Medicinal crops	:	Aloe vera and coleus
Fodder crops	:	Sorghum, Alfalfa, Barley, Bermuda grass and Carpet grass

Economics and challenges of hydroponic farming

For small, new farmers, transitioning to hydroponic farming can be expensive due to rental fees, mortgage payments, construction requirements for a building or space to fit the hydroponic structures, and upfront material costs. Hydroponic farms have the potential to transform vacant buildings into farming to benefit the community and generate employment, despite the high entry costs. In order to ensure a profitable and secure hydroponic farm, further obstacles must be addressed after these initial costs are met.

Conclusion

Soilless culture is rapidly gaining momentum and popularity and fastest growing sector of agriculture. A more sustainable food ethic that prioritizes the health of our food, bodies, and environment without using a lot of pesticides is possible with the help of hydroponic farms. Hydroponic farming is already being quickly incorporated into the current food networks, far from being a pipe dream.

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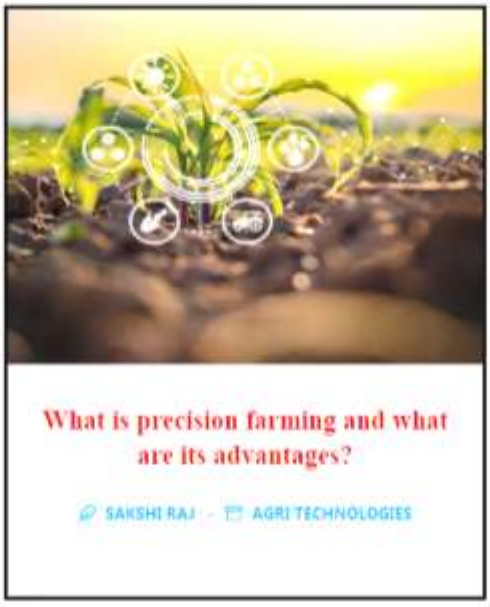

HYDROPONICS

About Author ...

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Hydroponic which is also known as nutriculture, soilless culture, aquaculture or tank farming. Cultivation of plants in water which are enriched in nutrients with or without the mechanical support of an inactive medium such as sand, perlite, or gravel. Plants have long been grown with their roots preoccupied in solutions of water and fertilizer for scientific studies of their nutrition.

The fertilizer solution is composed of various agricultural or horticultural fertilizer-grade chemical compounds containing varying amounts of NPK—the elements which is crucial for plant growth and various trace or minor elements such as sulfur, magnesium, and calcium.

Hydroponic crops are permit to be certified as organic in many places, including in the United States. Analyzer have pointed out that hydroponic plants lack connection with a soil microbiome and have discuss that soil health is a critical part of the organic farming movement. Some examples of hydroponic plants are lettuce, spinach, strawberry, bell peppers, herbs.

Why hydroponic farms are trending?

Hydroponics is moderately obtaining popularity in India and attracting or increasing number of farmers. Hydroponics is a type of horticulture and a group of hydro culture, which is referred as a method of growing plants, usually crops without soil by using mineral nutrient solutions in a liquified solvent. Hydroponic farming, which is soil-less and water-based farming operations may even be done in a minute space such as a balcony. Hydroponics which means a water-saving technique of growing pesticide-free produce on rooftops and terraces, is becoming popular between urban farmers.

Advantages of hydroponic:

- **No soil involved**- Hydroponic farming relates growing crops without soil, it is a perfect option for anyone who has limited availability to land.
- **Optimal use of location-** Since every requirement of the plant is provided for and appropritely maintained in a structured system, Hydroponic Farming can be carry out anywhere. So, if you live in a space crunched apartment, you can always think about hydroponic farming where the plants will be grown in your bedroom or balcony.
- **Complete control over climate-** As with greenhouses, hydroponic growers have complete control over the climate. They can regulate the temperature, the intensification of light, and the humidity levels according to their requirements.
- **Saves water-** The plants grown in a Hydroponic system hardly use around 10% of the water when compared to the conventionally field-grown plants.
- **Faster growth rate-** Another important benefit of the Hydroponic system is that it assure a faster growth rate. Here, you are completely in control over the environment required for the plants growth.

Disadvantages of hydroponics:

- **Time consuming-** While the procedure of Hydroponic Farming might seem possible and convenient, it is slightly time-consuming as well. The plants growing in soil may be ignored for days or even weeks as both nature and soil ideally balance everything. On the other hands, such is not the case with Hydroponics.
- **Require some expertise-** The procedure of Hydroponic farming depends on a range of equipment that requires proper expertise. Unless you know how to use this equipment, the plants won't grow or develop as much as you'd want them to.
- **Expensive-** Unlike conventional soil-based farming, Hydroponic Farming require expensive equipment (at least for the first installation). unconcerned of the kind of system, you plan to build, you will require containers, high-standard lighting, an exact timer, and quality nutrients.
- **Waterborne diseases-** Hydroponically grown plants are grown in water alternatively of soil, waterborne diseases are greatly higher. In maximum cases, a waterborne disease can kill all the plants in a hydroponics system within hours.
- **Problems affect plants quicker-** Soil protects the roots from supreme temperature changes, slows diseases and pests from attacking, and regularly deliver and absorbs nutrients. Without soil to act as a buffer, plants grown in hydroponics systems behave negatively to problems like disease much quicker and nutrient deficiencies.

Future scope of hydroponic:

- It exceed conventional soil-based agriculture in the matter of yield.
- Growing media are reusable and recyclable.

- Hydroponic plants have powerful insect resistance, lower the need for pesticides.
- These produce taste better and are significantly healthier than soil-based items.
- This technology allow food to be produced in regions where soil cannot support crops.
- It is good for the environment since it reduce land degradation as well as air and water pollution.

Environmental Benefits of Hydroponic

Water conservation

The hydroponic system utilize ten times less water than traditional soil-based farming. This is because it is dissimilar from field crop watering, where water has to be sprayed untill the soil absorbs it.

Less contamination

Using herbicides in traditional farming commit to air pollution and soil contamination. Hydroponic systems remove the issue of weed growth which in turn means zero herbicides use.

Reduced waste

Hydroponic gardeners can recycle the nutrient solution in hydroponics indefinitely, although the nutrients themselves need replacing as depleted. They assemble the solution as it drips into a nutrient reservoir from the channels. Also, farmers can obtain nutrients from several sources. One technique, aquaponics, uses fish faeces as a nutrient source.

Sustainability

Hydroponic growing can happen all year long as seasonality does not limit it like traditional crops from soil-based farming. This means that seasonal food shortage due to snowfall or no rains can be reduced or eliminated. It gives a chance to improve the food supply.

Land conservation

Hydroponics does not need large cost of land like traditional farming. With hydroponic growing, we can process food locally without occupying agricultural land.

Conclusion

Hydroponics is the most perfect system recommended for many growers because of the awareness situated on the environment and ecosystem. It is a form of soilless agriculture that gives great advantages when compared to other agricultural practices. In the designing of a functional system, hydroponics is completely adapted to suit the needs and outcomes as needed by those investing in it. Proper background education is needed alongside a successful project planner, highlighting the purpose, perception, goals, objectives and sources of advantage that will lead about successful production. Hydroponic farms offer a pathway towards a more sustainable food morals that prioritizes the health of our food, bodies and environment without the large use of chemicals.

The motive is to determine if the use of a water and nutrient solution instead of soil will produce a healthier plant. With no molecules of useless material hindering a plant's roots, the nutrients may be absorbed faster allowing the plant to grow faster and healthier. Due to the use of a continous feeding of nutrients and water, the hydroponic plants have grown much taller and produced more leaves faster than the plants growing in normal soil.

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