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VERTICAL FARMING

A Silent Revolution in Agriculture

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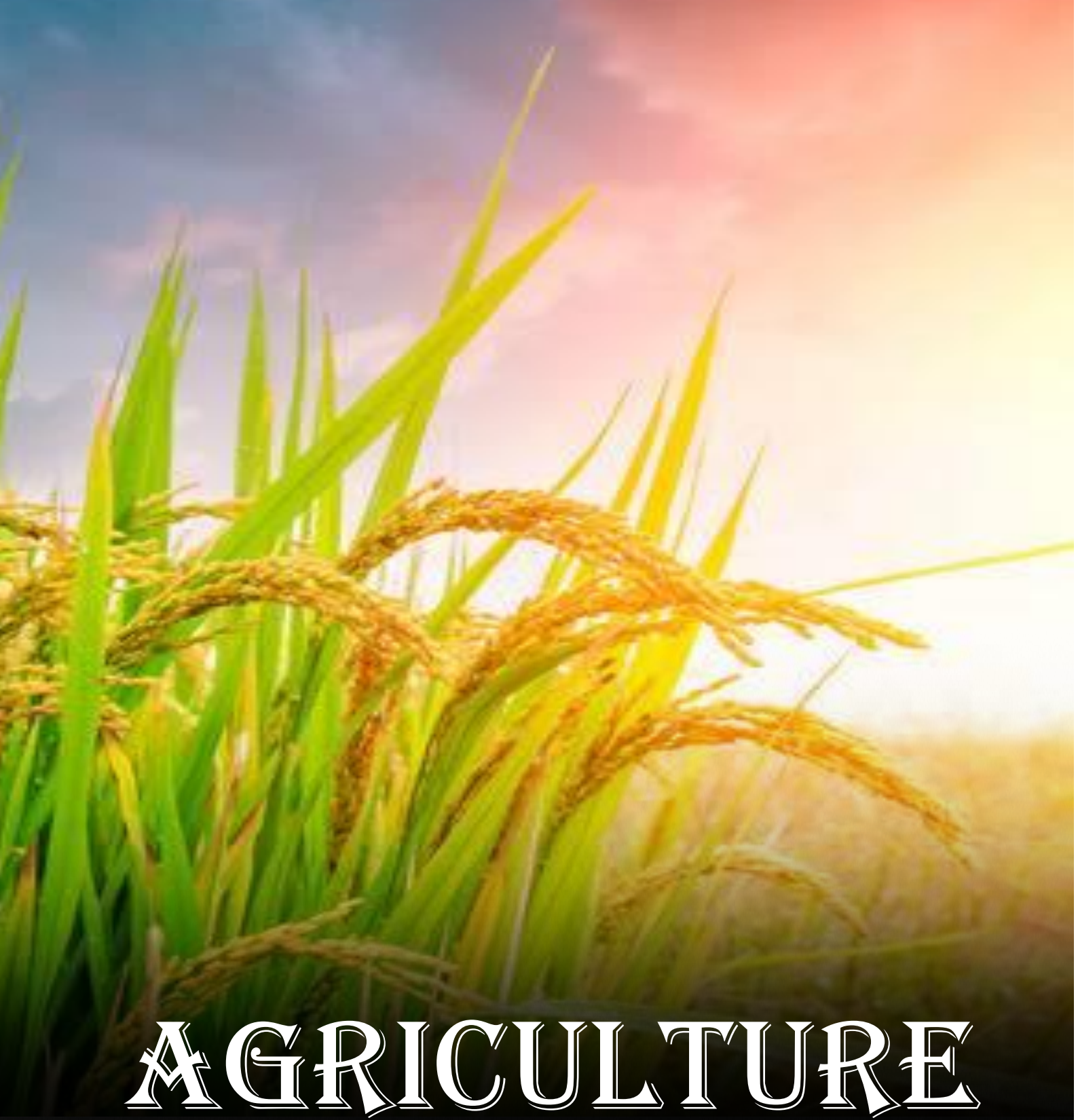


AGRICULTURE UPDATES

India ranks top in the list of Organic Farmers

India topped the list of the number of organic farmers and in terms of the total area under organic farming, it ranked 9th. North Eastern state Sikkim set a record by becoming the first fully organic state in the world and other states like Tripura and Uttarakhand have set similar targets.

Cabinet increase in sugarcane FRP by Rs 10

The Centre decided to increase the minimum price sugar mills pay to sugarcane growers by Rs 10 to Rs 285 per quintal for the next marketing year starting October 2020. The decision to increase the Fair and Remunerative Price (FRP) of sugarcane for the 2020-21 marketing year (October-September) was taken in the meeting of the Cabinet Committee on Economic Affairs (CCEA) held here. The government had fixed sugarcane FRP at Rs 275 per quintal for the current 2019-20.

Organic Waste Converter (OWC) Plant

National Fertilizers Limited (NFL), a PSU under the Department of Fertilizers, Vijaipur (MP) is going to set up an Organic Waste Converter (OWC) Plant. The project aims to recycle around 2000 Kg per day of the biodegradable waste generated in township including the horticulture waste and convert it into ready to use compost. The unit plans to utilize this compost as manure thus substituting consumption of fertilisers/ manure used for developments of Parks or Public places. The compost can also be used by the residents in their Lawns and Kitchen Gardens.

Poultry Research Institute to be set up in Namakkal

Tamilnadu Chief Minister Edapadi K Palanisami has announced that a Poultry Research Institute will be set up in Namakkal. Speaking to press persons after chairing a Covid 19 and Development Schemes review meeting, he said that the institute is being planned on the lines of the High Security Animal Research Institute Bhopal and Poultry Management Institute Pune. This assumes importance against the fact that Namakkal is one of the most important poultry breeding centres in South India. The Chief Minister also said that an Arecanut Research Station will be set up in Paramathi Velur in the district

Niti Aayog panel recommends linking sugarcane prices to sugar rates

A Niti Aayog task force has recommended linking sugarcane prices to sugar rates to keep the industry in sound financial health. It has also pitched for a one-time increase in minimum sugar price to Rs 33 per kilo to help sugar mills cover the cost of production. The report of the panel on 'Sugarcane and Sugar Industry', headed by Niti Aayog Member (Agriculture) Ramesh Chand, was finalised in March 2020.

Govt to make purchase of bio-fertilisers compulsory with urea to reduce use of chemicals

The government is likely to make purchase of bio-fertiliser compulsory for every bag of urea a farmer buys to promote organic nutrients and slash the use of chemical fertilisers. A task force constituted for promoting balanced and sustainable use of chemical fertilisers has suggested bundling bio-fertiliser with urea bags.

PM Modi sends Rs. 17,000 crore directly into bank accounts of farmers

Prime Minister Narendra Modi released the sixth instalment of financing facility under PM-KISAN scheme via video conferencing. Under the sixth instalment of PM-Kisan scheme, Rs. 17,000 crore of PM-Kisan Samman Nidhi has been deposited into bank accounts of 8.5 crore farmers with a single click. Under the PM-KISAN scheme, the government is providing annually ₹6,000 in three equal installments to 14 crore farmers. The amount is directly transferred into the bank accounts of the beneficiaries through direct benefit transfer (DBT) mode.

Kharif crops: 44% more and Pulses: 2.5 times more in 2020

The sowing area of Kharif crops has increased by 44% and that of pulses has increased by 2.5 times. It is expected to increase in the coming weeks. This is mainly because, India received 18% above normal rainfall this monsoon season. In June, the country received 196.2 millimeters of rainfall.

FSSAI launches 'Verified Milk Vendor Scheme'

The Food Safety and Standards Authority of India (FSSAI) has launched 'Verified Milk Vendors Scheme' in Gujarat with an aim to cover milk producers and milk vendors under the regulation net. Under the new scheme, all the unorganised milk producers and vendors in Gujarat will be issued identity cards by taking their registration. For the first time, monitoring will be done for the raw and loose milk suppliers. Till now the focus has remained on the dairy products and the dairies.

VERTICAL FARMING

A SILENT REVOLUTION IN AGRICULTURE

The term vertical farming is readers to the system of growing of crops in skyscrapers, to maximize the use of land by having a vertical design whereby plants, animals, fungi and other life forms are cultivated and used for food, fiber and fuel by using artificially stacking them vertically above each other.

In India Vertical Farming has been introduced in 2019. ICAR is working on techniques and adaptations to introduce in the market. However, it has still not found its application at wider level.

In other language vertical farming is the practice of growing crops in vertically stacked layers. The concept of vertical farming was proposed in 1999 by Dickson Despommier, a professor of Public and Environmental Health at Columbia University.

The most special feature of Vertical Farming is that its goal is to provide optimal growing conditions throughout the development of the plants, conditions that are almost optimal for each individual plant. The closed environment gives protection from outdoor influences and gives more ways to control the many uncertainties that cannot be controlled when growing crops outdoor. Modern vertical farming facilities can regulate lighting, humidity, temperature and nutrients with sophisticated sensors and climate control systems.

The main aims of the verticals farming is to optimize the plant growth and soilless farming techniques such as hydroponics, aquaponics and aeroponics. Some common choices of structures to house vertical farming systems include buildings, shipping containers, tunnels, and abandoned mine shafts. Instead of farming vegetables and other foods on a single level, such as in a field or a greenhouse, this method produces foods in vertically stacked layers commonly integrated into other structures like a skyscraper.

Need of Vertical Farming:

- According to the United Nations, the global population is to reach 10 billion by 2050 and therefore food production should increase by 70%.
- Hence, there is a need for technological innovation in the farming process and Vertical farming is one among those innovations.

Advantages of Vertical Farming

Following are some of the major benefits of vertical farming:

1. **Preparation for Future:** By 2050, around 80 percent of the world population is expected to live in urban areas, and the growing population will lead to an increased demand for food. The efficient use of vertical farming may perhaps play a significant role in preparing for such a challenge.

2. **Increased And Year-Round Crop Production:** Vertical farming allows us to produce more crops from the same square footage of growing area. In fact, 1 acre of an indoor area offers equivalent production to at least 4-6 acres of outdoor capacity. According to an independent estimate, a 30-story building with a basal area of 5 acres can potentially produce an equivalent of 2,400 acres of conventional horizontal farming.
3. **Less use of water in cultivation:** Vertical farming allows us to produce crops with 70-95 percent less water than required for normal cultivation.

4. **Not Affected By Unfavorable Weather Conditions:** Crops in a field can be adversely affected by natural calamities such as torrential rains, cyclones, flooding or severe droughts—events which are becoming increasingly common as a result of global warming. Indoor vertical farms are less likely to feel the brunt of the unfavorable weather, providing greater certainty of harvest output throughout the year.

5. **Increased Production of Organic Crops:** As crops are produced in a well-controlled indoor environment without the use of chemical pesticides, vertical farming allows us to grow pesticide-free and organic crops.

6. **Human and Environmental Friendly:** Indoor vertical farming can significantly lessen the occupational hazards associated with traditional farming.

Limitations of Vertical Farming

Following are the major limitations of vertical farming:

1. **No Established Economics:** The financial feasibility of this new farming method remains uncertain. The cost of building skyscrapers for farming, combined with other costs such as lighting, heating, and labor, can easily outweigh the benefits we can get from the output of vertical farming. And while vertical farms will be attractive to locate close to cities, the high price of real estate will impede the financial viability of urban locations.

2. **Difficulties with Pollination:** Vertical farming takes place in a controlled environment without the presence of insects. As such, the pollination process needs to be done manually, which will be labour intensive and costly.

3. **Labor Costs:** As high as energy costs are in vertical farming, labor costs can be even higher due to their concentration in urban centers where wages are higher, as well as the need for more skilled labour. Manual pollination may become one of the more labour-intensive functions in vertical farms.

4. Too Much Dependency on Technology: The development of better technologies can always increase efficiency and lessen costs. But the entire vertical farming is extremely dependent on various technologies for lighting, maintaining temperature, and humidity.

Process involve in vertical farming

Vertical farms come in different shapes and sizes, from simple two-level or wall-mounted systems to large warehouses several stories tall. But all vertical farms use one of three soil-free systems for providing nutrients to plants: hydroponic, aeroponic, or aquaponic. The following information describes these three growing systems:

1- **Hydroponics:** This is the technique of growing crop plants without soil. In this system, the roots of the crop plants are submerged in the nutrient solutions that contains macronutrients as well as micro nutrients in trace amount. Some other materials are also used to provide support for the roots of the plants. The nutrient solution is supplied and recycled frequently at prescheduled time by electric pumping system to maintain nutrient level in running liquid solution. This techniques are widely used in high-tech research based organizations. It insures the produce free from diseases, insect pests or other weed plants. Hydroponics include higher crop yield per unit area and reduce water usage than other conventional system of farming.

2- **Aquaponics:** The term aquaponics is made of two words: aquaculture, which refers to fish farming and hydroponics- growing technique of crop plants without soil. It means growing of plants and aquatic organisms (fish) in the same ecosystem. Although aquaponics is used in smaller-scale vertical farming systems, most commercial vertical farm systems focus on producing only a few fast-growing vegetable crops and don't include an aquaponics component. This simplifies the economics and production issues and maximizes efficiency. However, new standardized aquaponics systems may help make this closed-cycle system more popular.

3- **Aeroponics:** Aeroponics does not require any solid or liquid medium for growing of the plants, while, a nutrients rich liquid solution misted in an air chambers where plant roots are suspended. Aeroponics is the most sustainable technique uses up to 90% less water than the other vertical farming techniques. There is no requirement of growing medium replacement. It is an energy saving system saves energy as gravity force drains away the excess water, while, hydroponics system requires water pumps for circulation of water in whole system at frequent interval and not widely adopted.

4- **Trailing:** Some plants like cucurbits, other flowering and ornamental plants that grow more in the vertical space than the horizontal by using baskets, vertical bed, pots, broken containers etc. This need some kind of support to grow vertically. In this technique, more number of plant population can be grown per unit area that increases yield and quality. Occurrence of soil borne diseases is very less because of no contact of any plant parts with soil. It also increases beauty of kitchen garden. Trailing plant usually produce fruits that are heavier, therefore, some extra support may be necessary because these plants spread laterally but can be easily trained on vertical structures.

5- **Stalking:** Stacking is the most important technique of vertical farming for doubling the farmer's income in less period of time. In this technique the crop plants are supported with the help of sticks, wires etc. Staking improves quality of fruits by keeping fruits and branches off the soil surface and facilitate a better coverage for spraying of agrochemicals. This system provides easier harvesting of fruits than non-stacked crop. Staking not only improve the quality of fruits and increases crop yield but also mitigate the diseases by fungal infection. Plants are supported by pols or strings with galvanized wire tied with pols in side of the ridges. In case of untimely heavy rain, fruits remain in air and resulting in negligible loss of fruits and leaves by fungal attack. It consists of a series of wooden or iron poles with twine woven around the stakes for training the plants to grow vertically.

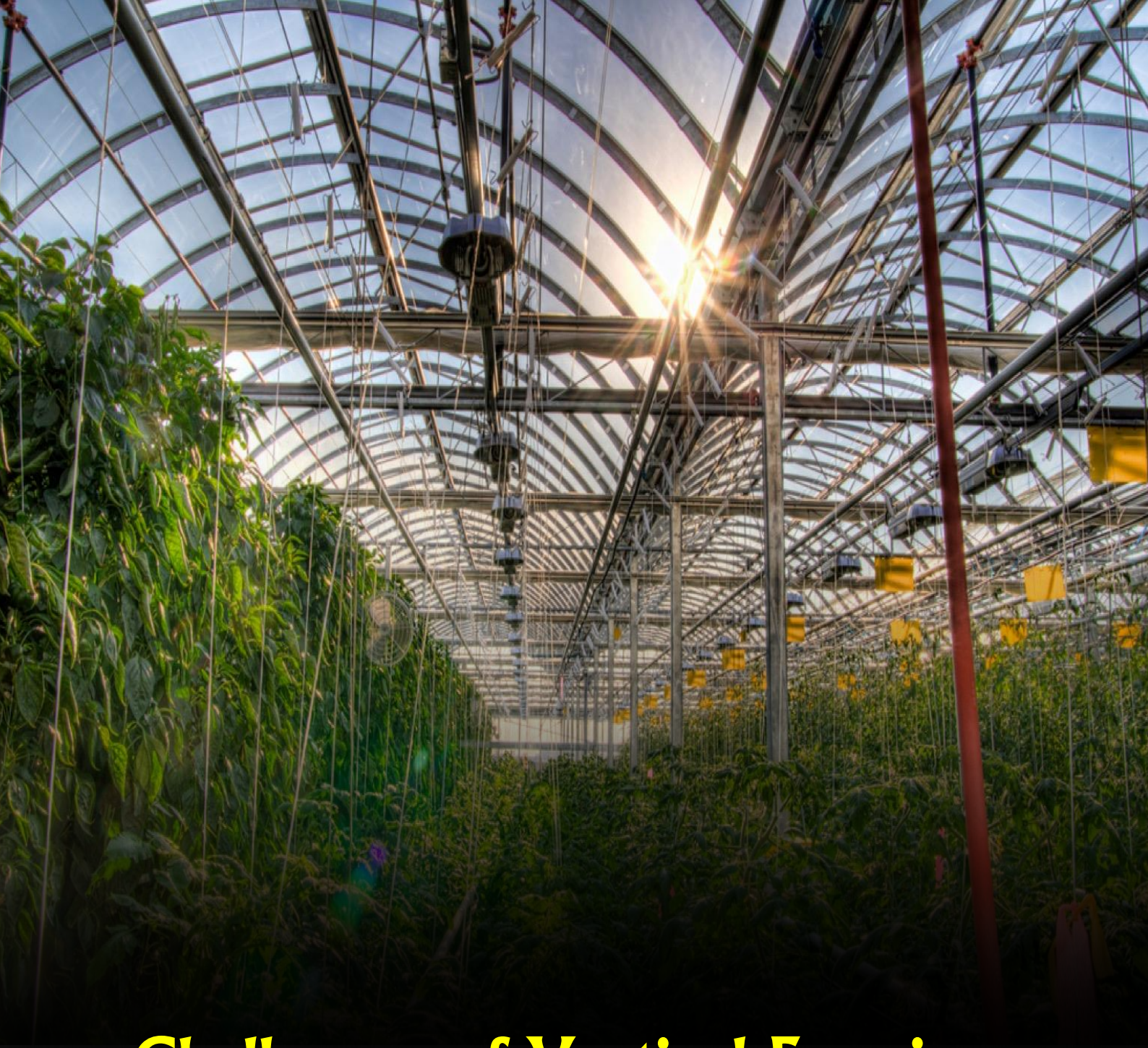
Types of vertical farm

- **Building based farm:**

  Abandoned buildings are often reused for vertical farming. However, new builds are sometimes also constructed to house vertical farming systems.

- **Shipping container:**

  Shipping containers are very popular option for housing vertical farming systems. The shipping containers serve as standardized, modular cabin for growing a variety of plants, and are often equipped with lighting, vertically stacked hydroponics, smart climate controls, and monitoring systems.



Challenges of Vertical Farming

Vertical farms come in different shapes and sizes, from simple two-level or wall-mounted systems to large warehouses several stories tall. But all vertical farms use one of three soil-free systems for providing nutrients to plants: hydroponic, aeroponic, or aquaponic. The following information describes these three growing systems.

1. **Challenges of lighting**: Over two-thirds of the global energy is consumed in cities. A critical point and disadvantage often highlighted by the adversaries of VF is, how will plants growing inside a building be provided with sufficient amount of energy needed for plant growth. The system make use of both natural light as well as artificial light as the main source of energy within the building for photosynthesis as well as the structure of plants. Since vertical farms within buildings have less access to natural light, there is a need for artificial lighting which is often provided by LEDs, which is comparable to greenhouse farming.

2. **Challenges of Heating**: An issue closely linked to lighting is, the temperature it produces. More than the brightness, lighting devices produce heat, which especially in summer would disrupt or interfere with the air conditioning system. Two other crucial requirements for healthy plant growth indoors, are humidity as well as air conditioning which require meticulous control and monitoring and involves high energy costs. Still another major prerequisite and cost is in the building of the towers.

3. **Challenges of Water Demand:** It is estimated that approximately, 3000 liters/person/day of water is regularly used just for producing food. Out of the total water consumption of human beings, 24-30 % of it is used for watering and producing rice. A key factor in this system is the transport of water especially high loads to higher floors in tall buildings. The fluid provision system needs to be standardized both in the growing floors as well as the others, exactly like an industrial unit.

is referred to as monoculture, whereas in VF, multiple types of crops can be produced simultaneously on different floors.

5. **More "Land Use" Opportunities:** If agriculture is moved indoors to form vertical farms, it will not only save space but will also provide a variety of food products, and crop output per acre of land will be maximized. Therefore, it is not just the horizontal space that can be used effectively as in traditional farming. The biggest advantage of VF over conventional farming is that it is not restricted to one plane. If outdoor farming goes indoors, there will be a 20 time reduction in land use, there will be a 1/20 ratio of improvement in land consumption or 95 % of savings therefore, there seems to be no reason why not to use VF. As an instance, if one floor is added, there will be a 1/40 advantage or 97.5 % of savings, as compared to only 95 % of savings realized through a greenhouse.
6. **Challenges of Food Nutrition**: Foods rich in vitamins, proteins and minerals are increasingly in demand nowadays, as more countries are moving towards the trend of their developed counterparts. Contrary to Engel's law which perceives a negative correlation between spending on food and higher income, the consumption style of such countries is changing. Although fecal matter is an effective fertilizer, it also comes with some unfavorable factors, such as parasites, infection, and disease
7. **Reduction of Fossil Fuel-** The United Nations Environment Programme (UNEP)'s Emission Gap Report of 2019 says that Agriculture and Transportation

are among the five world's biggest emitters of greenhouse gases. On the other hand, the carbon print of Vertical Farming is very less. With adaptation of nano cost climate control, low-carbon electricity, high-efficiency lighting, vertical farming achieves low carbon foot print easily.

Status of Vertical Farming in India:

- In India Vertical Farming has been introduced in the year 2019.
- Indian Institute of Agriculture Research (ICAR) is working on techniques and adaptations to introduce in the market. However, it has still not found its application at a wider level.

Role of Minimum Support Price (MSP) in Indian Agriculture

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"Minimum support price is an important part of Indian agriculture price policy as it's declaration before the sowing time assures farmer agriculture besides providing a clear price signal."

Introduction

Minimum support price is the price set by the government to buying crops from the farmer, whatever may be the market price for the crop. Minimum support price is an important part of India's agriculture price policy as it's declaration before the sowing time assures farmer agriculture besides providing a clear price signal.

The MSP helps to encouraged the farmers and thus insures adequate food grain production in the country. It gives sufficient remuneration to the farmer, provides food grain supply to buffer stock and support the food security program through PDS and other programs.

Objective of MSP

The government agriculture policy has three important components -the MSP buffer stock and issue of food grain through the PDS. The interrelation between the three is very clear. MSP, FCI helps in procurement of adequate food grain through state agencies and cooperative. The PDS network extends this to the weaker sections through the issues price policy.

The MSP price is set by the government of India to protect farmers against excessive drop in during year of bumper production. Minimum support price are the guaranteed prices for their produce form the government.

The objective of the MSP is thus to insure remunerative prices to producers by encouraging higher investment and production. It aims to bring a balanced realization of the needs of adequate food production and consumption to insure adequate and affordable food grain for all people. Thus, the minimum support price is amide to:

(i) Availability of food grain by motivating farmer to increase production and assured remuneration and relatively stable price environment to increase production.
(ii) Improve the economic access of food to the people.
(iii) Develop a production pattern that suits the overall needs of the economy.

History of MSP in India

- The MSP system in India was introduced in the mid-1960s amid food storages. The idea was to create a conducive environment and encourage farmer to increase production by adopting ‘’high yield variety’’ seeds and technology for grain such as wheat and rice.

- The main reason for adopting MSP policy in India was food storage and price fluctuations, which were provoked by drought, food and international prices for exports and import. In the policy was directed towered ensuring faire food prices for consumers by providing by food grain in general through the public distribution system (PDS) and increasing yields by providing price support mechanism through the minimum support price (MSP) system. Inspired to adopt new technology.
- The **L.K. Jha** committee recommendation was established in the **January, 1965** (designated as the commission for agriculture costs prices in 1985) to provide farmer with an assured price for their crops and to encourage them to adopt advanced technology to increase production. On the role of the agriculture price commission is to advise the government on the agriculture price policy.

- Minimum support prices were first announced by the Central Government in **1966-67** for wheat after the Green Revolution and extended harvesting, to save farmers from running out of profits. Since then, the MSP scheme has been extended to many crops.

Purchase price

Sometimes, the government purchases at a higher price than the MSP. Here, the price will be referred to as the purchase price. The purchase price will be announced immediately after harvest. Generally, the purchase price will be higher than MSP, but lower than the market price. The price at which purchase and buffer stock of food grain are made available through PDS is called the issue price.

Statutory minimum price (SMP)

The statutory minimum price (SMP) is announced by the central government based on the cost of farming and Commission for Agricultural Costs and Prices (CACP). This is the basic price that sugar mills essential to pay sugar cane producers.

Minimum support price in 2020-21

Commodity	Variety	MSP for 2019-20 (Rs. per quintal)	MSP for 2020-21 (Rs. per quintal)	Increase over previous year (Rs. per quintal)
Kharif crops				
Paddy	Common	1815	1868	53
	Grade A	1835	1888	53
Jowar	Hybrid	2550	2620	70
	Maldandi	2570	2640	70
Bajra		2000	2150	150
Maize		1760	1850	90
Raagi		3150	3295	145
Arhar (tur)		5800	6000	200
Moong		7050	7196	146
Urd		5700	6000	300
Cotton	Medium staple*	5255	5515	260
	Long staple**	5550	5825	275

Groundnut in shell		5590	5275	185
Soyabeen	yellow	3710	3880	170
Sesasmum		6485	6855	370
Sunflower seed		5650	5885	235
Niger seed		5490	6695	755
Rabi crops (2019-20 season to be marketed in 2020-21)				
Wheat		1840	1925	85
Barley		1440	1525	85
Gram		4620	4875	255
Masur (Lentil)		4475	4800	325
Rapeseed & Mustard		4200	4425	225
safflower		4945	5215	270
Toria		3560	3900	340
Other crops				
Copra (2020 crop season)	Milling	9521	9960	439
	Ball	9920	10300	380
De-husked coconut		2571	2700	129
Raw jute (for 2019-20 season)		3950		

*staple length (mm) of 24.5-25.5, **staple length (mm) of 29.5-30.5

Note -sugarcane statutory minimum price (SMP) announced by the center government 2019-20 is Rs 275 per quintal.

Data source: https://farmer.gov.in

Calculation of MSP

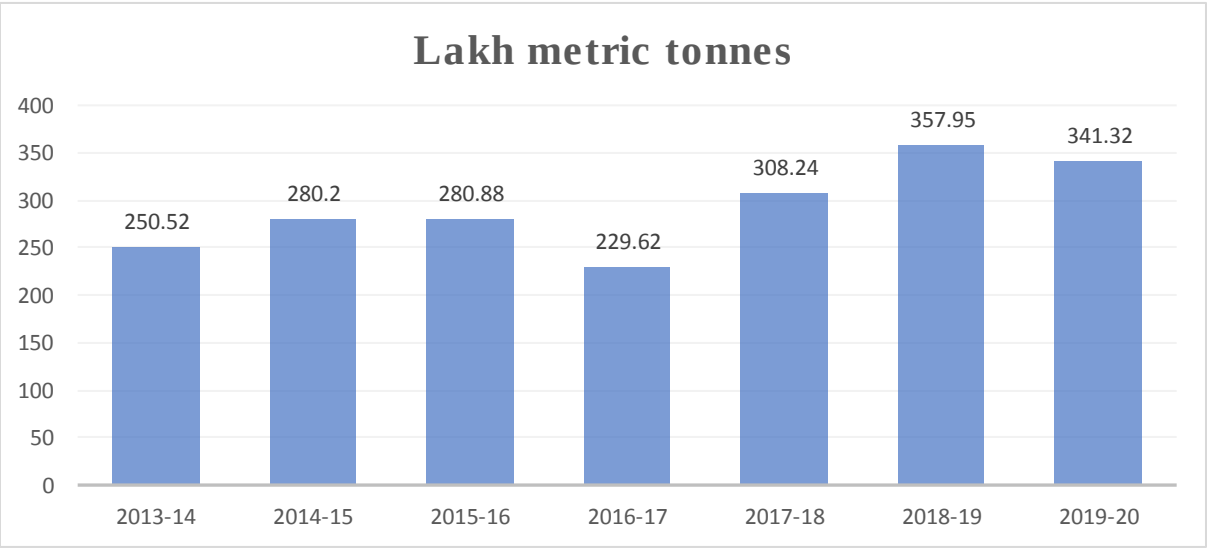
The CACP in determining the MSP for many crops takes into version a lot of comprehensive factors including the supply and demand issues of each crop.

- **Crop related factor**- Cost of production, input price, input output price parity, past market price, demand and supply, cost of living, price level/inflation, international prices.
- **Supply factor**- area under crop, yield, productivity, import and export scenarios, processing cost, transportation and distribution cost, taxes and fees, domestic stock availability.
- **Other factor**- Parity between price paid and price received by the farmer, Issue prices, Subsidies impact.

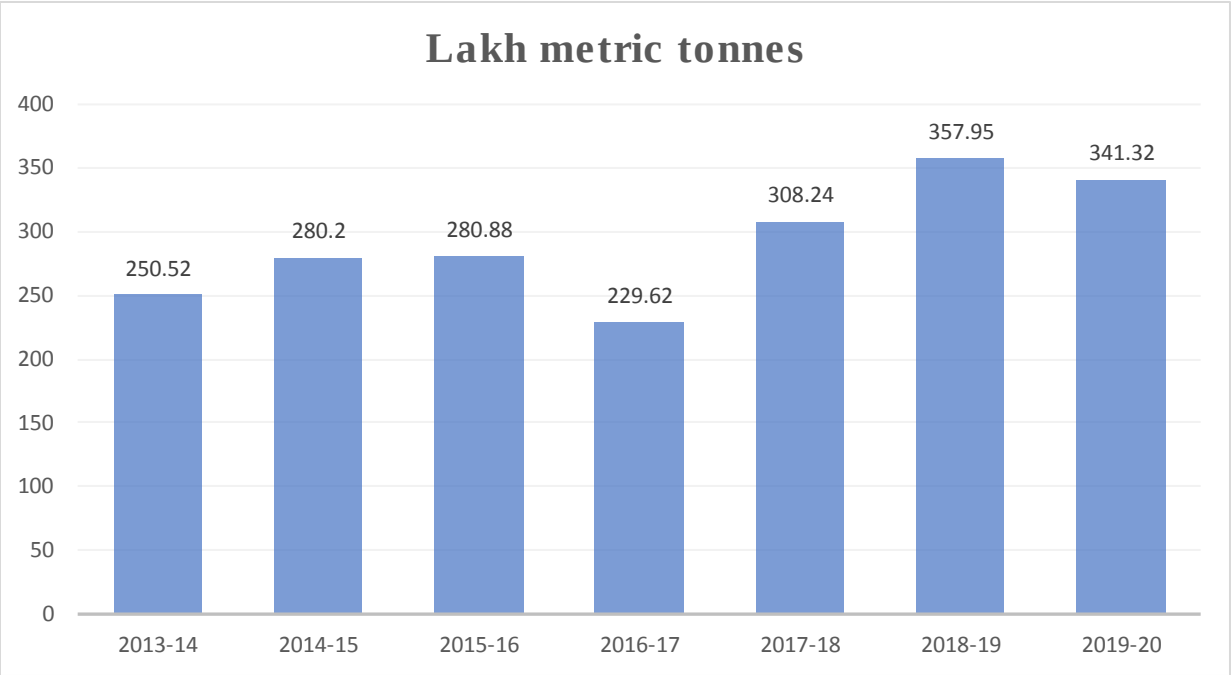
Disadvantages of MSP

- Less than 6% of farmers sold their produce at MSP. According to a survey by the National Sample Survey, many small and marginal farmers are unaware of the concept of minimum price and benefit from large farmers.
- The yield per hectare is the lowest in economies with a large agricultural area. So, there is a need to improve agricultural productivity, only MSP is not enough, we need a lot of interventions.
- Even though there is a steep increase in MSP for pulses, there is no visible relationship between high MSP and area under pulses.
- Paddy and wheat are mostly procured regularly and in bulk by government agencies to meet the obligations under the National Food Security Act (NFSA, 2013). The procurement is irregular for all others, so there is no incentive or bank capacity for the farmer to produce other crops.
- As declared MSP by the central government, most states do not have funds for procurement of crops at rates announced by the Centre. Like: Assam was not procured for the last two sessions due to budgetary constraints.
- Since MSP is announced just before the sowing season, many of them may have already started practicing, so, in fact, changing the MSP or cropping patterns have a significant impact.
- Farmers have to wait for many days to get MSP money, sometimes the time increases in months and due to lack for marketing centre, farmer have to stay in marketing centre for many days.

FCI Rice and Wheat procurement throughout different years



Rice procured by FCI



Wheat procured by FCI

Role of Extension to improve MSP and MSP related issues

- An extension agent plays a role of intermediate between government and farmers.
- Extension agent can do baseline and pilot surveys with other departmental officials to obtain information regarding major crops, minor groups who are good in production and can be included under MSP.
- PRA methods can be used to increase the participation of local leaders, small, marginal and large farmers and farm women to discuss their felt needs towards MSP.
- Extension agent can provide accurate information to the farmers related to government markets nearer to them without get into touch with any middleman and paying unnecessary money to him.
- Extension agent helps farmers and farm women in decision making to shell their produce and get proper MSP.

CONCLUSION

- Minimum support price is a very important for farmers and is also a good way to protect them from middleman, landlords etc. Through MSP farmers can sell their produce directly to the government owned marketing centre at a good price.
- Farmers can spend their earned money in acquiring innovative agriculture resources and can fulfil their needs sufficiently.

- It leads to encouragement to the farmers that they are getting income what they deserve to have according to their efforts in producing the produce.
- Due to MSP, price of food grains (wheat and paddy) in the market is stable or towards inclining slowly. Otherwise due to lack of storage, farmers are forced to sell their produce at cheap rates to the big zamidars (contractor), who then sell the produce at high price to gain profit.
- MSP is mostly provide for few crops only, the oil crops & fruit crops and those crops which are good in production should also cover under MSP.
- As GOI had mission of doubling farmer's income, it could be possible if MSP amount increased for the staple crops and when other crops will also consider for MSP.
- Extension personnel plays a major role in providing information to farmers and farm women

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DESERT LOCUST: A threat to Agrobiodiversity

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> "Damage are considerably noticed on all type of the crops (annual rain-fed crops as well as perennial crops), tree cultivation and irrigated crops which are even more sensitive since they are exposed throughout the year. The invasions can result in the abandoning of crops and rural migrations. Invasion may also lead to the destratification"

The Desert Locust is while not a doubt the foremost terrible individual from the family Acrididae, undermining associate exceptionally huge range of countries. At the nearby level, crop losses can be aggregate in only a couple of hours. This locust was answerable for some starvations in the past in nations where intrusions occurred, the latest having been recorded in Ethiopia and in Sudan in the 1950's. At the point when an intrusion happens, a wide range of vegetation are liable to assault. Harm can be extensive on a wide range of harvests: yearly rain-fed crops as well as perennial crops, tree cultivation and irrigated crops which are even more sensitive since they are exposed throughout the year. The intrusions can bring about the surrendering of harvests and rural migrations.

Introduction

Schistocerca gregaria is a short-horned grasshopper, which undergoes a behavioral change when their population builds up rapidly. They can travel up to 150 km per day by forming a huge swarm, the 'gregarious phase'. They eat up every bit of greenery on their way feeding on a large variety of crops causing crop failure and starvation

If not controlled, locust swarms can threaten the food security of a country. One of its main characteristics is that it's a developed migratory capability over long distances, creating the issue.

The losses due to locust attack are not much evaluated. However, some data are incontrovertible. In Algeria, in 1866, losses were calculable at 19,652,981. In 1941, locusts totally destroyed one million vine-plants in Libya, 55,000 tons of cereals in 1954 in Sudan and 16,000 tons of millet in 1951 in Senegal. At the time of the last invasion in 1987-1989 in Mauritania, estimated losses were 60%.

Impact on agriculture and humans

Damage are considerably noticed on all type of the crops (annual rain-fed crops as well as perennial crops), tree cultivation and irrigated crops which are even more sensitive since they are exposed throughout the year. The invasions can result in the abandoning of crops and rural migrations. Invasion may also lead to the destratification. The major threat is to food safety and to the social solidity of many rural populations as well as it is highly costly to control for many countries who are facing a major challenge in the strategy to fight poverty.

Control measures

To control desert locust two types of organizations are intervene:

1. The national locust control units which ensure the monitoring and control operations in their own territory.
2. Regional organizations in charge of coordination, information dissemination and promotion of research and training activities.

In the event of a Desert Locust invasion, large-scale chemical management still remains the sole reliable technique to prevent this plague, despite the various technical

advances that are created in recent years and also the chance of victimization some biological ways (i.e. mycopesticides) within the close to future.

Outbreak of locust swarm in India in the year 2020

Heavy rain triggers the growth of vegetation in arid areas where locusts can grow and breed. The locusts are immature not fully grown. Immature locusts have the capacity to cause more harm having longer lifespan. In the search of food, they entered India were about 10-12 days old migrated from the neighboring countries the Middle East to Iran, Pakistan. Originally, the locusts began migrating from the Horn of Africa. In India, they attacked on the regions of states including Rajasthan, Punjab, Uttar Pradesh, Madhya Pradesh, Bihar, Orissa, Andhra Pradesh, Tamil Nadu. The danger from the swarms is not now, but after July when they will breed with the new kharif crop. However, The Food and Agriculture Organization has warned that the more attacks along both sides of the India- Pakistan border. The locusts are controlled mainly with the spray of organophosphate chemicals in a small concentration by aerial spray in the state like Rajasthan. In some regions, local villagers have been asked to make noise by beating 'thalis' and bursting crackers.

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Herbs and spices

Used for boosting immunity to fight against coronavirus

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> "Herbs and spices have many properties which includes antioxidant, antimicrobial and anti-inflammatory as well as potential protection against cardiovascular diseases, neuro degeneration, type 2 diabetes and cancer. Adding herbs and spices is one of the simplest ways to supercharge your diet"

Herbs and spices and have historical importance and were once the source of great power and wealth herbs and spices have been used for centuries as both food flavouring. Due to their health benefits they also been used in medical practices since ancient times. They have many properties which includes antioxidant, antimicrobial and anti-inflammatory as well as potential protection against cardiovascular diseases, neuro degeneration, type 2 diabetes and cancer. Adding herbs and spices is one of the simplest ways to supercharge your diet. Let's take a look at some of the healthiest herbs and spices to boost your immune system.

1. Turmeric

Turmeric is an aromatic medicinal plant was known to Indian since ancient times. It contains compounds with medicinal properties, the most important of which is curcumin per it is the main active ingredient in turmeric. It has powerful anti-inflammatory effects and is a very strong antioxidant that helps boost immunity. It helps the body naturally cleans the respiratory tract.

2. Garlic

Garlic is a herb that is grown around the world in many countries garlic has been used medicinally for centuries. It may have a range of health benefits both raw and cooked. It has significant antibiotic properties. It is used as an antiseptic, antibacterial and antifungal agent. It may help the body resist or destroy viruses and other microorganisms by boosting the immune system.

3. Ginger

Ginger is a flavouring plant whose rhizome, Ginger root or Ginger, is widely used as a spice and a folk medicine. It is antibacterial so it helps support the immune system and it can help to prevent nausea and soothe an upset stomach. It is also a natural blood thinner and contains a phenolic anti-inflammatory compound called Ginger all that may be responsible for relaxing blood vessels.

4. Clove

Cloves are the aromatic flower buds of a tree in the family Myrtaceae, *Syzyguim aromaticum*. They are best known as a sweet and aromatic spices, but they have also been used in traditional medicine. Close are low in calories but a rich source of manganese. They contain high amount of antioxidants, which aid the immune system in fighting off oxidative damage and free radicals. The antibacterial property of cloves helps minimise the spread of bacteria inside the mouth.

5. Black paper

Black paper is the most pungent and flavourful of all types of peppers and is available as whole or cracked pepper corns or ground into powder. It contains not only anti-inflammatory and antioxidant and antibacterial actions, but also immune system and enhancing benefits. It improves digestion by helping in the breakdown of proteins. A colon friendly spice, it also protects the intestinal tract against bacterial growth.

6. Tulsi

Tulsi is also known as holy basil, is a medicinal herb used in Ayurveda, a form of alternative medicine that originated in India. It acts as a natural immune system boosted and keep infections at bay. It protects against nearly all infections from viruses, bacteria and protozoa. Tulsi4 leaves extract increases the t helper cells and natural killer cells activity boosting the immune system.

7. Cinnamon

Cinnamon is a spice obtained from the inner bark of several tree species from the genus Cinnamomum. It is an antiviral, antifungal and antibacterial medicine, so it does more than just boost the immune system, it actually fights the pathogens that cause illness. It helps you fight of those fall colds as an immune stimulator, it also prevents blood platelet clumping, inhibits, inflammatory and can regulate blood sugar.

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Agriculture Monitoring Through Space Technology

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"Promotion of agriculture should be seen as a priority that is why we are introducing modernity in the field of agriculture by using different types of technologies. In this sequence, agriculture plays a different important role in various applications of space technology and this is possible through remote sensing techniques."

In India, agriculture alone contributes about 17% of GDP. Indian agriculture occupies an important place in the agricultural sector of the world. India accounts for 140.13 million hectares of the total sown area of the world, 198.30 million hectares of gross sown area, 275 million tonnes of food production and more than 300 million tonnes of horticulture. In view of this, the Indian space program, especially the Indian Earth Observation Program, has been carefully observing the field of agriculture and focusing its attention on the essential needs since its time.The main three types of space technology include remote sensing (remote sensing), satellite communication and global navigation satellite systems that have a direct impact on agricultural applications.

Important aspects of space technology are that through remote sensing we can see the earth for monitoring of agriculture. Through this we harvest the crop. Applications such as crop type, production estimation, cropping system analysis, agricultural water management, draft management and monitoring, prime agricultural development, precision construction, soil resource mapping, forecasting of catchment area, impact of climate on watershed development agriculture are included.

In this process, we can see the surface of the Earth through the light emitted by different wavelengths (blue, green, red, infrared, microwave, etc.) at constant time intervals

through the sensor mounted on satellites orbiting the Earth. Photographs are collected and through that also various types of requirements in agriculture are monitored.

The process of mapping of agricultural resources, land use / land cover, soil, faults, surface water bodies etc. is accomplished through remote sensing in the use of space technology. By remote sensing, special attention is paid to the list of crops, monitoring the operation of crops, progress of sowing, progress of crop, crop health.

Remote sensing in particular plays an important role in weather-based agriculture, by which we use remote cessing images obtained in the early stages to estimate the progress of sowing. With this technology we also predict crop production.

Various types of procedures like drought assessment, kharif identification, crop intensity, crop insurance etc. can be easily achieved through remote sensing. During the last three decades, India has successfully built and flown several remote sensing satellites that provide data at different levels and once in five days. India has also built a satellite with satellite ephemeral radar, a microwave sensor that can easily monitor crops even during cloudy conditions.

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Implementation of Artificial Intelligence in Agriculture Field

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"According to UN Food and Agriculture Organization, the population will increase by 2 billion by 2050. However, only 4% additional land will come under cultivation by then. In this context, use of latest technological solutions to make farming more efficient, remains one of the greatest imperatives. While Artificial Intelligence (AI) sees a lot of direct application across sectors, it can also bring a paradigm shift in how we see farming today. AI-powered solutions will not only enable farmers to do more with less, it will also improve quality and ensure faster go-to-market for crop."

Artificial intelligence technology is supporting different sectors to boost productivity and efficiency. AI solutions are assisting to overcome the traditional challenges in every field. Likewise. AI in agriculture is helping farmers to improve their efficiency and reduce environmental hostile impacts. The agriculture industry strongly and openly embraced AI into their practice to change the overall outcome. AI is shifting the way our food is produced where the agricultural sector's emissions have decreased by 20%. Adapting AI technology is helping to control and manage any uninvited natural condition.

Advantage of implementing AI in Agriculture

The use of Artificial intelligence in agriculture helps the farmers to understand the data insights such as temperature, precipitation, wind speed, and solar radiation. The data analysis of historic values, offers a better comparison of the desired outcomes. The best part of implementing AI in agriculture that it won't eliminate the jobs of human farmers rather it will improve their processes.

- AI provides more efficient ways to produce, harvest and sell essential crops.
- AI implementation emphasis on checking defective crops and improving the potential for healthy crop production.
- The growth in Artificial Intelligence technology has strengthened agro-based businesses to run more efficiently.
- AI is being used in applications such as automated machine adjustments for weather forecasting and disease or pest identification.
- Artificial intelligence can improve crop management practices thus, helping many tech businesses invest in algorithms that are becoming useful in agriculture.
- AI solutions have the potential to solve the challenges farmers face such as climate variation, an infestation of pests and weeds that reduces yields.

The areas where the use of Artificial Intelligence can benefit agriculture are given below:

1. Drone technology

Drone technology in development involves machine learning. Improving Artificial Intelligence (AI) in drones is important to be able to make them more useful to smaller farmers in developing nations. Current drone technologies are more effective in monitoring well known crops like corn which are planted in large monocultural field patterns. Drone monitoring programs, as they stand, have a hard time recognizing areas with increased crop diversity, less well known produce, and grains which look similar throughout their growth stages and so are less effective in monitoring crop growth and health. More work is needed to be able to train AI systems to recognize less common crops and more diverse planting patterns.

2. Precision Farming

The phrase "Right Place, Right Time, Right Product" sums up precision farming. This is a more accurate and controlled technique that replaces the repetitive and labor-intensive part of farming. It also provides guidance about crop rotation. Key technologies that enable precision farming are given below:

- High precision positioning system
- Automated steering system
- Geo mapping
- Sensor and remote sensing
- Integrated electronic communication
- Variable rate technology

3. Robotics

Agricultural robots automate slow, repetitive and dull tasks for farmers, allowing them to focus more on improving overall production yields. Some of the most common robots in agriculture are used for:

- Harvesting and picking
- Weed control
- Autonomous mowing, pruning, seeding, spraying and thinning
- Phenotyping
- Sorting and packing
- Utility platforms

Harvesting and picking is one of the most popular robotic applications in agriculture due to the accuracy and speed that robots can achieve to improve the size of yields and reduce waste from crops being left in the field.

Challenges in AI adoption in Agriculture

Though Artificial Intelligence offers vast opportunities for application in agriculture, there still exists a lack of familiarity with high tech machine learning solutions in farms across most parts of the world. Exposure of farming to external factors like weather conditions, soil conditions and presence of pests is quite a lot. So what might look like a good solution while planning during the start of harvesting, may not be an optimal one because of changes in external parameters.

AI systems also need a lot of data to train machines and to make precise predictions. In case of vast agricultural land, though spatial data can be gathered easily, temporal data is hard to get. For example, most of the crop-specific data can be obtained only once in a year when the crops are growing. Since the data infrastructure takes time to mature, it requires a significant amount of time to build a robust machine learning model. This is one reason why AI sees a lot of use in agronomic products such as seeds, fertilizer, pesticides and so on rather than in-field precision solutions.

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Micro propagation in vegetable crops:
An overview

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> "It is a widely adopted technique for rapid multiplication of some vegetable crops. Vegetable crop species have been extensively used in tissue culture research. The main advantage of this technique is it produces disease free and quality planting materials"

Introduction

The practice of rapidly multiplying stock plant materials to produce many progeny plants using modern plant tissue culture is called micro propagation. It is a widely adopted technique for rapid multiplication of some vegetable crops. Vegetable crop species have been extensively used in tissue culture research. Notable examples include carrot cell culture and embryogenesis research and potato protoplast manipulation and regeneration studies. Specifically multiplication of plants by *in vitro* techniques (organogenesis, embryogenesis and non-adventitious shoot proliferation) are reported in many vegetable species. The main advantage of this technique is it produces disease free and quality planting materials. In 1960, Morel presented this concept for production of virus free cymbidiums. But during 1970s and 1980s the establishment of micro propagation as an industry became a reality. Three types of vegetative propagation constituted the micro propagation *i.e.* somatic embryogenesis; adventitious shoot production and axillary shoot production, which gives an excellent scope for production of a number of vegetable crops.

Successful application of micro propagation has been reported for meristem culture, protoplast culture, embryo culture, genetic embryogenesis and somatic embryogenesis etc.

Application of micro propagation in production of vegetable crops

Micro propagation is most advantageous when it costs less than traditional methods of multiplication. The various applications of micropropagation are as follows:

1. Use of *in vitro* technique in *Capsicum* spp.

Capsicum annuum, is the economically important, most popular and genetically diverse species of genus *Capsicum* whereas, *Capsicum chinense* and *Capsicum frutescens* are genetically very close to *Capsicum annuum*. So, annuum-chinense-frutescens complex can be made by inter-crossing these species. Incompatibility problem such as abortion of embryo hamper the use of inter-specific crosses for transfer of different traits. Along with this the capsicum breeder faces a major challenge *i.e.* long breeding cycle. To overcome this problem isolation and *in vitro* culture of zygotic embryo is very much helpful. This technique is also helpful to overcome seed dormancy, so as to get a haploid material for micro propagation. To prevent post fertilization genetic barrier we can use *Capsicum annuum* x *Capsicum frutescens* and *Capsicum annuum* x *Capsicum baccatum* crosses. The embryos beyond torpedo stage are providing satisfactory results.

2. *In vitro* growing of sweet potato cuttings on florialite

Development of root and shoot is inter dependable so, poor root development in a crop is affects its shoot development. It has been reported that plants growth in *in vitro* is increased by the use of various fibrous material such as cellulose, rockwool and vermiculite. Similarly, florialite is a mixture of vermiculite and paper pulp, which has the capacity to absorb nutrient solution up to 71% of its own volume. The plantlets obtained from floriated shows better growth than that of vermiculite because of addition of paper pulp with vermiculite. Another advantage of it is that its handling is more convenient and precise as compared to agar or vermiculite. Therefore, the cuttings of sweet potato were grown in *in vitro* photoautotrophically in vermiculite mixed with paper pulp supporting material. Vermiculite mixture with 30% paper pulp stimulates leaf, stem and root growth and also the fine lateral roots emerge from the main adventitious roots.

3. Micro propagation in pointed gourd by cuttings

The perennial nature and non-availability of adequate planting material in pointed gourd gives an opportunity to get desirable and suitable clones through this technique. Therefore, as compared to multiple shoot production path way, *in vitro* layering is more advantageous where single shoot coupled with rooting are produced by micro cuttings. Initiation of culture, multiplication and rooting in all genotypes is facilitated by a single medium formulation. Further, the left over rooted stumps after the sub-cutting of nodes can be used for establishment of plantlets ex vitro.

4. *In vitro* tuber yield and multiplication rates of potato

For enhancing multiplication rate in potato micro propagation of tubers can be a successful tool. Researchers have been found that under laboratory condition the multiplication rate goes 10-25 folds per 8 weeks. It can provide the desired quantity of plantlets in short period of time. Some scientists had also reported that the capacity of *in vitro* plants to produce more but small sized tubers than plants grown from *in vitro* tubers.

5. Morphogenesis in *Capsicum annuum*

The effort reported primarily addresses the role of polarity of explants that are exogenously administered auxin transport inhibitor TIBA, PG along with BA and IAA on direct adventitious shoot formation in variety Arka Abhir and Arka Lohit that are recalcitrant. Moreover, various studies were also carried out on the role of light in presence of exogenously fed GA3 and AgNO3 in elongation of shoot buds.

6. *In vitro* regeneration protocol in tomato

For *in vitro* regeneration of tomato plant several protocols have been published. But formerly reported methods are time consuming, variable efficiency, high production cost and time consuming. Media containing growth regulators are implicated in all cases of regeneration system. For an effective, rapid and high frequency plant regeneration method of normal tomato plant a protocol has been established which works independent of exogenous growth regulators in culture medium. Among the regenerated plant there is absence of chromosomal and morphological variations (Rout *et al.* 2018).

7. Production of super male in Asparagus

Micropropagation offers the advantage of increasing the numbers of propagules attainable in a given period as well as advantages unique to each of these crops. Asparagus is an example of tissue culture techniques being effectively utilized for cultivar development and multiplication of a dioecious species. Specifically, male haploids can be generated from anther culture that, when doubled, yield the super-male (YY) genotype. These plants can be micro propagated and used as parents in seed production of all male F_1 hybrid asparagus seed. Additionally, the perennial nature of asparagus affords an opportunity for cost effective commercial micro propagation of superior clonal genotypes.

8. *In vitro* development of synthetic seeds in cauliflower

Due to high cross pollination and self-incompatibility nature of cauliflower it is very difficult to produce inbred lines. For cauliflower propagules production an effective protocol was designed from fractioned and graded curds. Then sodium alginate is used to encapsulate these propagules. The major aim was to produce synthetic seeds in cauliflower from hypocotyls for cell suspension. These seeds give successful germination viability and regenerate into a complete plantlets. These viable vegetative propagules can be stored for longer period of time.

Conclusion

Micro propagation has the potential of great profit making. It can also give high quality and disease free planting materials. So, to increase the vegetable production and to develop new cultivars of vegetable crops this technique can be regarded as a boon to full fill the requirements of growing world population.

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Beneficial Insects:
Nature's Pest Control

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"The first step is to identify the beneficial insects for ecofriendly insect pest management. It may be more useful to attempt to conserve the natural predators already present in the area. We must encourage and prepare the conditions for an increase in insect predator populations."

Introduction

With the ecological mistakes of humans becoming more apparent, it is reassuring to know that nature can establish certain controls that prevent some destructive insects from overpopulating the environment. We can encourage and prepare the conditions for an increase in insect predator populations. The first step is to be able to identify the beneficial insects. Some predatory insects such as ladybird beetles and praying mantids are available for sale. Ladybird Beetles purchased in the spring have likely been collected during their winter hibernation, and upon release will soon fly away, often far from their release site. Buying predatory insects for releasing in the home garden in order to control insect pests is likely to result in disappointment. It may be more useful to attempt to conserve the natural predators already present in the area.

Lady Beetles (Ladybird Beetles; Ladybugs); Family: Coccinellidae

Lady beetles are small, oval, convex and often brightly colored. Most of this family are predaceous both as larvae and adults, and feed chiefly on aphids. They also eat scale insects and mealybugs. Ladybird Beetles are found frequently on vegetation where aphids are numerous. They hibernate as adults, commonly under leaves and debris in large aggregations. One of the native species is the Two-spotted Lady Beetle, which is orange-red, with one black spot on each wing cover.

A species often seen on houses in the autumn and indoors over winter is the Multicolored Asian Lady Beetle, which varies in color and number of spots.

Ground Beetles; Family: Carabidae

The family Carabidae (Ground Beetles) has many hundreds of species that vary in size, shape and color. Most of these insects are somewhat flattened, dark brown or black, and shiny. They may be found under stones, logs, bark, debris or running about on the ground. Most of them hide during the day and feed at night.

Nearly all are predaceous on other insects and many are beneficial by feeding on pest insects. There are also some Ground Beetles that feed on slugs and snails.

Praying Mantids; Family: Mantidae

Adults and the immature (nymph) stages of the praying mantis look similar. These are highly predaceous insects that feeds on a variety of other insects. The mantids wait to ambush their prey with the front legs in an upraised position that gives them their name. Praying mantis egg cases may be found on tree twigs and in fields, and for some fun, you may wish to watch them hatch in your own garden next spring. Eggs cases may be gathered by cutting the twig you find them on, then tying the case to a branch in your garden. The young come tumbling out of their case by the hundreds in the spring. Praying mantids are cannibalistic and will eat one another. Only a few will survive under home garden conditions.

Dragonflies; multiple Families in the Order Odonata

Adult dragonflies can be seen actively hunting flying insects, but tend to be more common closer to water. The adults hunt for insect prey using their large eyes and scoop it up with their spiny legs, all while flying. Many small midges, gnats, and mosquitos are eaten, but generally not enough to fully control their populations. Sometimes larger prey are captured, such as butterflies.

The immature dragonfly stages (the nymphs) live underwater, and feed on whatever they can catch, including aquatic insects and sometimes even small fish.

Hover Flies; Family: Syrphidae

Hover Flies are also known as Syrphid Flies or Flower Flies. They may be brightly colored, and many resemble wasps and bees hovering over flowers. However, these flies do not sting. The larvae of most species are predaceous, feeding on aphids or the young of termites, ants, or bees.

Not all Hover Flies are beneficial: the Narcissus Bulb Fly has larvae that damage bulbs of daffodil and related garden flowers.

Lightning bugs; Fireflies; Family: Lampyridae

The Fireflies or Lightning bugs are neither flies nor bugs, but are beetles. During the early summer the adults fly about in the evenings and are conspicuous by their blinking yellow light. The larvae are beneficial by feeding on various smaller insects, slugs, and snails.

Antlions; Family: Myrmeliontidae

Also known as doodlebugs, antlion larvae have long sickle-shaped mouthparts which they use to grab their prey. The larva makes a pit in sandy soil and lies in wait underground at the center. When an ant stumbles in, the ant lion larva flicks sand at it until it slides down the pit into its jaws. Antlions are most common in dry sandy soils.

Lacewings; Families: Chrysopidae and Hemerobiidae

Lacewing adults are about three-quarters of an inch or less in length, with delicate, gauzy, green or brown wings. Some species have jewel-like golden eyes.

The larvae are grayish brown, with sharp curved jaws that extend beyond the head. Larvae crawl along the leaf surface in search of aphids, scales, mealybugs, thrips, mites, and insect eggs. Full-grown larvae can consume 100 or more insects a day

Parasitoid Wasps; Families: Brachonidae, Ichneumonidae, and others

There are hundreds of species of parasitoid wasps that can be important in controlling populations of other insects. The most commonly noticed ones are Braconid and Ichneumonid wasps. Many other parasitoid wasp species are much smaller, only a few millimeters long. The wasps typically have a larval stage that feeds on the inside of the host insect, and the larvae slowly devour the host, which eventually dies. Some of the wasps emerge to pupate on the outside of the host, others develop into pupae inside and emerge from the host as adults.

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Dry Flowers:
A new approach to employment through Interiorscaping

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> "The dry flower industry and interiorscaping is labour intensive and provides ample employment opportunities for thousands of unemployed men and women, however, only if various trainings on the methods of flower drying and their value addition are provided to unemployed men and women, especially rural housewives."

Interiorscaping, as one can say it is a "landscaping" in indoor spaces. It is an inspiring and unique area of interest because it blends the science of floriculture with the aesthetics of interior design. A well-planned interiorscape can spruce up an area without tons of money on an antique vase or an upscale oil painting. In the present era of ecoconciousness, use of natural products like dry flowers has become the premier choice of interior decoration. Future prospects of the dry flower industry are expected to contribute million's to the country's economy as compared to the fresh cut flowers. Dry flowers have tremendous potential as a substitute for fresh flower for interior decoration also as for a spread of other aesthetic and commercial uses. On many occasions like birthday, anniversary or the other special days , flowers add a charm in such occasion and that they look wonderful but the sad part as these flowers look great first few days at the foremost the flower didn't add charm, they loose their beauty and in deep regret one need to toss them out. But what if you don't need to throw them away. What if you'll keep them for years rather than days? Sure, they could not look precisely the same but one can preserve their colour and even their shape. Dry flowers add everlasting beauty to the inside, preserving the memories even after the flowers die. Today, interest in dried flowers is enjoying resurgence in popularity. Dried flowers provide a beautiful option for urban dwellers that may have little time, interest or space to grow garden.

Everyone knows about drying flowers but many of us don't realize all the creative uses for dried flowers. Majority will admit that we all know about dried flowers arrangements and potpourri but that's about it.

Benefits of dry flowers

- Fresh flowers though quite attractive, very expensive and short lived also as available only during a specific season, dried flower products on the opposite hand are long lasting and retain their aesthetic value regardless of the season.
- Dried ornamental plant parts are generally less costly and are looked for their everlasting and attractive appearance.
- Dried flowers are eco-friendly, Less maintenance and care
- Comparatively low cost on account of cheap unskilled labour and availability of diverse plant produce in abundance.
- There is an outsized sort of dried flowers available to be used to decorate a home or office.

Flowers suitable for drying are Acroclinium (*Helipterum roseum*), African Daisy (African daisy), Ageratum, Amaranth (love-lies-bleeding), Ammobium (*Ammobium elatum*), Anaphalis (*Pearly everlasting*), Annual Statice (*Limonium sinuatum*), Achilia (*Achillea filipendulina*), Armerias (*Armeria maritime*), Boxwood (common box), Brome Grass (*Bromus madritensis*), Blue Salvia (*Salvia farincea*), Broom Bloom (common broom), Bunny Tail (*Lagurus ovatus*), Anthemis (*Anthemis kelwayi*), Artemisia (*Artemisia albula*), babies'-breath, Blue Globe Thistle(*Echinops ritro*), Blue Hydrangea (fall-blooming hydrangea), birdseed grass (canary grass), Lemon leaf (*Gaultheria shallon*), Lavender (*Lavandula adentata*),Larkspur (*Delphinium consolida*), Everlasting (*Helichrysum bracteatum*).

Essential precautions during dehydration:

For insuring better results and quality products the following points should be considered:

- Collect material after the dew and surface moisture has evaporated.
- Collection should be made in dry season and on a sunny day.

- Material should be collected after irrigating fields a day or two.
- Fresh material should be collected.
- All stages of flower development in an inflorescences should be collected, which have sufficiently harden as immature shrivel very fast.
- Material should be embedded immediately after plucking.
- One type of flowers and foliage should be embedded at one time.
- Undesirable plant portions should be cut before embedding.
- Spread uniformly all plant parts/ petals in herbarium press.
- The plant parts should be harvested when highest possible quality product can be harnessed.

Methods of drying

Several methods are practised for drying or dehydration of different plant parts. It includes;

1) Air Drying:

This is an inexpensive method of drying, also known as 'Upside Down' or 'Hang and Dry' drying method. Flowers of good quality and should be selected for drying in a slightly immature stage. First, the flowers are tied into bunches and hung upturned. Air drying requires a warm, clean, dark and properly ventilated area with low humidity. This method takes 1-2 weeks to dry depending on moisture content, temperature and humidity. Crisp flowers texture Acroclinium, Anopheles, Helicrisum, Delphinium, Oregano, Rumex etc. are suitable for drying in this method.

2) Press Drying:

This is one of the simplest, easiest and cheapest methods of drying. In this method, the specimen is placed in between the newspaper, blotting paper or old notebooks, etc., and then a weighted object is placed on top. The time required to press varies with the type of flowers and the water content of the tissue; however, it should be completed within 4 weeks. This drying time can be reduced if the flowers folded in sheets and are kept in the oven at a suitable temperature. Suitable plant materials for pressing are Canditoft, Chrysanthemum, Pansy, Rose, Daisy, Phlox, Statis, Ginnia, Ferns, Silver Oak, Thuja, Coxcomb etc.

3) Hot air oven drying:

Temperature plays an important role in drying flowers and other plant parts and in the hot air oven, the specimens are kept under controlled temperature conditions for a fixed period of time. Drying in a hot air oven or microwave takes less time compared to other methods such as air drying and water drying, however, the duration and drying temperature vary depending on the size, texture, moisture and cutting phase of the plant. Normally a temperature of 40-50°C is suitable for drying in a hot air oven. Plant materials for drying in hot air oven and microwave should be embedded in desiccants, otherwise shrinkage may be observed in the dried material. Suitable plant materials for hot air oven drying are Paper flower, Gerbera, Chrysanthemum, China Aster etc.

4) Microwave drying:

It is a quick method of drying that also produces a small amount of heat. Based on the principle of liberating moisture by agitating water molecules in organic substance with the help of electronically generated microwaves. Microwave oven dried flowers look fresher and more colorful than any other method. Drying in the microwave only takes 5-10 minutes to dry. After being removed from the microwave the flower containers should be kept at room temperature for a certain time so that the moisture evaporates and the plant material dries completely. This is called the 'setting time' which varies from species to species. This method is best for drying flowers with many petals, such as Marigold, Rose, Carnation and Ginnia.

5) Embedded drying:

Embedded drying is useful for delicate flowers with high moisture content, which will shatter or misshapen when the air dries. This method of drying is usually preferred over air or oven drying because it reduces the problem of petal shrinkage. In embedded drying, the water content of the flower is fully absorbed by the surrounding desiccant material. Commonly used desiccants are silica gel, borax, corn meal, etc., which remove moisture from the flowers faster than air drying, retaining the flowers in their natural form. The fine white sand (river sand) found on the beach can be used for embedding due to easy maintenance and availability. Silica gel is the best desiccant to get the excellent quality of dried flowers that retains colour and shape. Therefore, bleaching does not cause shrinkage or brittleness to the flower petals even if it is embedded for a long time. It is called a gel because it is granular in shape and is a xerogel of silicic acid. Silica gel (60-120 mesh) is best absorbed to remove moisture from flowers. Pink, Aster, Carnation, Marigold, Dahlia, etc. are suitable for drying by embedding technique.

6) Glycerine preservation:

Ornamental plant parts are usually preserved by treatment with 'humectants'. 'Humectants' are hygroscopic chemicals that help maintain the sensitivity of dried plant materials by attracting water vapor from the surrounding environment. Therefore, preserved plant material is little brittle than dried material, which is less prone to crumbling and mechanical damage. The difference between other methods of care and drying is that the treated parts are actually preserved and not completely dried. Different humectants are used to preserve plant components such as glycerin and polyethylene glycol, however, the most commonly used is glycerin. 1 part glycerin mixed with 2 parts hot water is a suitable mixture for dehydration. The duration of treatment varies from 2 to 6 weeks, depending on the shape, size and texture of the leaves and twigs. Plant materials are not allowed to stand in solution for long as a result of glycerin bleeding. Plant materials suitable for glycerinization are Anthurium, Aspidistra, Lemon, Eucalyptus etc.

Conclusion:

Parts of dried or dehydrated plants are natural, relatively inexpensive and have everlasting value per year around availability without disturbing their colour and appearance. Not every method of drying every flower or plant parts is suitable because the material method chosen for drying is unique and must be dried with appropriate technology, otherwise it will affect the quality of the dried material.

The dry flower industry and interiorscaping is labour intensive and provides ample employment opportunities for thousands of unemployed men and women, however, only if various trainings on the methods of flower drying and their value addition are provided to unemployed men and women, especially rural housewives. Interiorscaping is another way of interior designing in today's digital world. Therefore, there is a need to focus on this important aspect of the floriculture industry so that it not only enhances the overall export of floriculture products from India but also helps in providing employment to the rural people on their different aspect also. Interiorscaping is popularing day by day.

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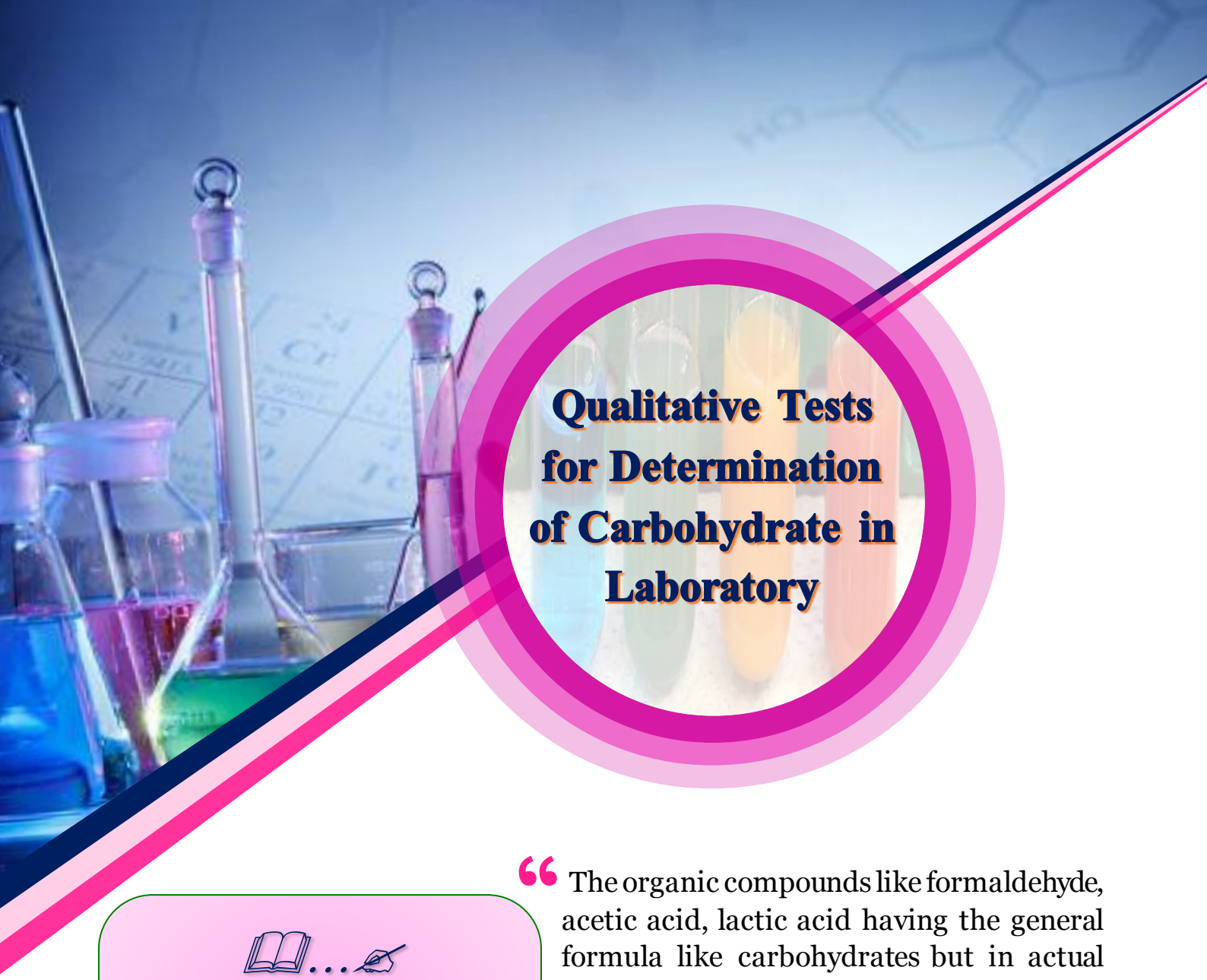

Qualitative Tests for Determination of Carbohydrate in Laboratory

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> "The organic compounds like formaldehyde, acetic acid, lactic acid having the general formula like carbohydrates but in actual they are not carbohydrates. Some other carbohydrates like rhamnose, digitoxose do not correspond to the general formula of carbohydrates. Monosaccharides and oligosaccharides are optically active while polysaccharides are optically inactive"

Introduction

Carbohydrates are richest source of energy and basic component of our food. Carbohydrates are widely distributed in plants and animal. They play structural as well as functional role in both plants and animals. In plant, carbohydrates are synthesised from CO_2 and H_2O during photosynthesis. Animal can synthesize a little carbohydrate from protein and fats, but the bulk of animal carbohydrates come, ultimately from the plants. Carbohydrates are the hydrates of carbon. They have carbon hydrogen and oxygen in the ratio 1:2:1. Carbohydrates have general empirical formula

$$C_nH_{2n}O_n \quad \text{or} \quad C_6H_{12}O_6$$

Carbohydrates are defined as polyhydroxyaldehydes or ketones or compounds which produce them on hydrolysis. Other organic compounds like formaldehyde, acetic acid, lactic acid having the general formula like carbohydrates but in actual they are not carbohydrates. Some other carbohydrates like rhamnose, digitoxose do not correspond to the general formula of carbohydrates. Monosaccharides and oligosaccharides are optically active while polysaccharides are optically inactive.

On the basis of basic carbon skeleton and hydrolysis carbohydrates divided in to three groups i.e. monosaccharide, oligosaccharide and polysaccharide.

(A) Monosaccharides:

Monosaccharides (mono= One, Sakcharon= sugar) are the simplest group of carbohydrates and are often referred to as simple sugar. It cannot be further hydrolysed. They are sweet in taste, crystalline and soluble in water. They are reducing in nature due to presence of aldehyde or ketone group in their structure. They have ability to reduce cupric ions to cuprous ion. Monosaccharides are classified into two categories, i.e. based on the functional group and based on the number of carbon atoms.

(i) Based on the functional group:

Aldoses: Monosaccharide having aldehyde as a functional group in their structure is called as aldose sugar. The aldehyde groups are always found at C no. 1 of the monosaccharide molecule. Such sugars are called as aldoses or aldose sugar. They are known as aldoses example Glyceraldehyde, Glucose.

Ketoses: Monosaccharide having ketose as a functional group in their structure is called as ketose sugar. The ketose groups are always found at C no. 2 of the monosaccharide molecule. Such sugars are called as ketoses or ketose sugar. Example- dihydroxyacetone, fructose.

(ii) Based on the number of carbon atoms:

Based on the number of carbon atoms monosaccharides are classified in the following types-

Name	Formula	Aldose	Ketose
Trioses	$C_3H_6O_3$	Glyceraldehyde	Dihydroxyacetone
Tetroses	$C_4H_8O_4$	Erythrose	Erythrulose
Pentoses	$C_5H_{10}O_5$	Ribose	Ribulose
Hexoses	$C_6H_{12}O_6$	Glucose	Fructose
Heptoses	$C_7H_{14}O_7$	Glucoheptose	Sedoheptulose

(B) Oligosaccharides:

Oligosaccharides (Gr. Oligo = few, saccharides = sugar) are the compounds which are formed of 2 to 10 monosaccharides. The oligosaccharides with two monosaccharide units are called disaccharides; similarly those with 3 monosaccharides units are called trisaccharides and so on. Disaccharides are the most common oligosaccharides, widely distributed in plant and animal tissues. During the synthesis of oligosaccharides, carbonyl group of one monosaccharides and alcoholic group of another monosaccharide condense together, forming a bond, called glycosidic bond with the loss of a water molecule. Oligosaccharides, mainly disaccharides are sweeter in taste. Hence they are referred to as sugars. These are crystalline solids. Disaccharides are also reducing sugar but sucrose, trehalose etc. are exceptions (as they have no free ketone or aldehyde group). Physiologically important disaccharides are sucrose, lactose, maltose, trehalose and cellobiose etc.

Depending on the number of monosaccharide units oligosaccharides are divided in to two categories i.e. disaccharides and polysaccharides.

Disaccharides: Disaccharides are composed of two monosaccharide molecule with chemical formula $C_{12}H_{22}O_{11}$. Sucrose, maltose and lactose are the best known example of disaccharides.

Trisaccharides: Trisaccharides are composed of three monosaccharide molecule with chemical formula $C_{18}H_{32}O_{16}$. Raffinose, gentianose are the best known example of trisaccharides.

(C) Polysaccharides:

Polysaccharides are the large macromolecules, which have structural and functional significance in all forms of life. Polysaccharides of biological importance are starch, glycogen, cellulose, chitin, mucopolysaccharides. Polysaccharides are the polymers of monosaccharides. Monosaccharides are held together by glycosidic bonds to form polysaccharides. Polysaccharides in living systems, serve two purposes – food storage and making the structures of cellular components. Thus, on functional basis, polysaccharides are two types-

Storage polysaccharides: These polysaccharides are used for storing the food by plants and animals are reserve food. Starch and glycogen are the two most important storage polysaccharides. Starch is the main storage polysaccharides in plants, while the glycogen is the main storage polysaccharides in animals.

Structural polysaccharides: These polysaccharides are not used for food storage; instead these are used for building the cellular structures, mainly walls of cellular components. Important structural polysaccharides are – Cellulose, chitin and pectin.

Laboratory test for carbohydrates determination:

1. Molisch's test for carbohydrate:

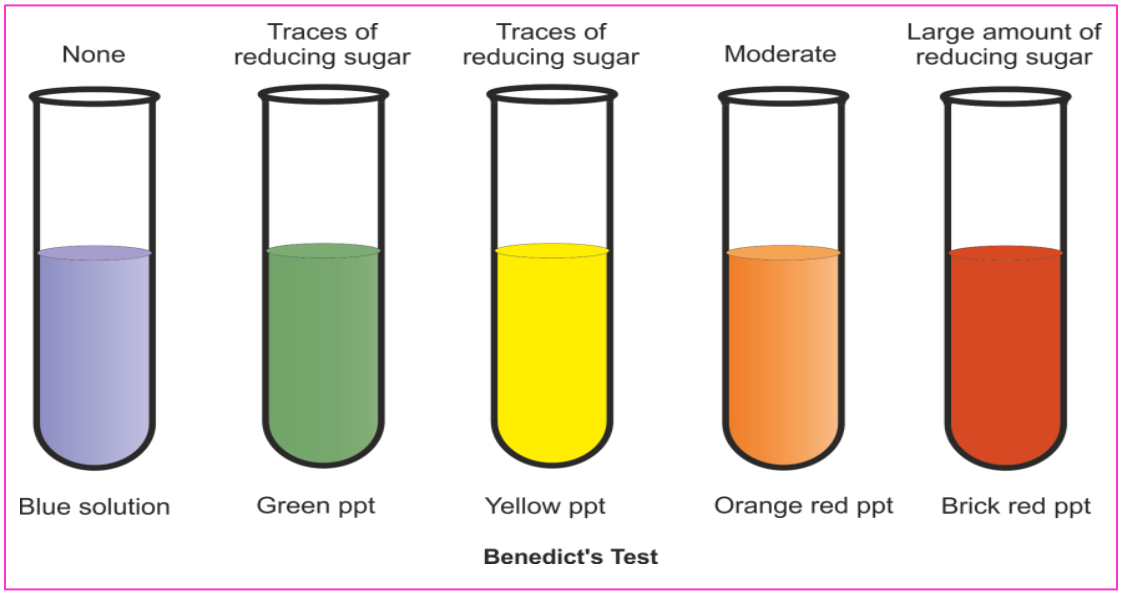
Experiment: Take about 2 ml of test solution or extract of test material in a test tube and add 2-3 drops of freshly prepared α-naphthol. Then add 1 ml of concentrated H_2SO_4 along with side of tube without mixing two liquid. Observe the colour at the junction of two liquids.

Observation: A violet ring / purple ring appear at the junction of two liquids indicates the presence of carbohydrate.

Inference: Concentrated sulphuric acid hydrolyses glycosidic bond to give the monosaccharides, further reaction with acid dehydrates to form furfural derivatives. These compounds combine with α-naphthol to give a purple coloured complex. All carbohydrates react positively with this reagent.

2. Benedict's Test

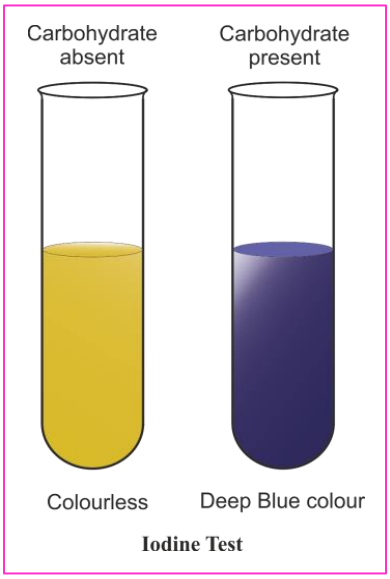
Methods: Add 5 drops of the test solution to 2 ml of Benedict's reagent and heat to boiling. Cool at room temperature.



Observation: If a reducing sugar is present a colour will form which may be red, orange, yellow or green depending upon the amount of sugar present in the test solution.
Inference: Carbohydrates with a free aldehyde or ketone group have reducing property in alkaline solution. Alkaline copper reagents when react with a reducing sugar give raise cuprous oxide, which depending on concentration imparts green, yellow, orange or red colour. This test is positive for all reducing sugars.

3. Iodine Test

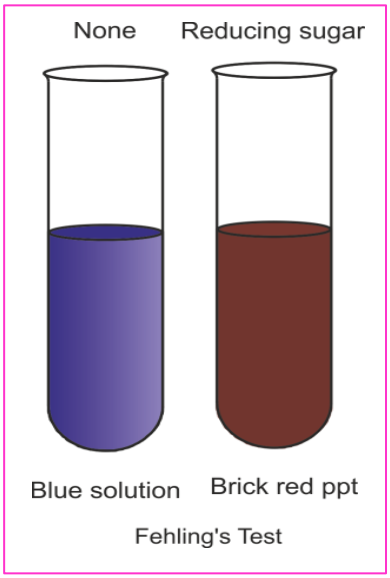
Method: Take 2 ml of test solution in a test tube and add a few drops of iodine solution. Mix and observe the colour change. Sometimes deep blue colour appears after acidifying test solution by adding 1-2 drops of dilute HCl.
Observations: The appearance of deep blue colour indicates the presence of starch in the test solution. A blue colour indicates the presence of starch, a reddish blue or purple for dextrin and wine red colour for glycogen.
Inference: Iodine test is performed to distinguish polysaccharide from mono and disaccharides. Iodine forms coloured adsorption complexes with polysaccharides. Adsorption is a surface phenomenon and it decreases with temperature and vice versa. That's why polysaccharide-iodine complexes lose and gain colour on heating and cooling respectively.



Iodine Test

4. Fehling's Test:

Method: Take 1 ml of Fehling solution 'A' in test tube, add 1 ml of Fehling solution 'B' mix and then add a few drops of test solution. Boil for a few minutes.
Observations: The formation of yellow or brown red precipitate indicates the presence of reducing sugar in the test solution.
Inference: The blue alkaline cupric hydroxide present in Fehling solution when heated in presence of reducing sugar is reduced to yellow or red cuprous oxide and gets precipitated.



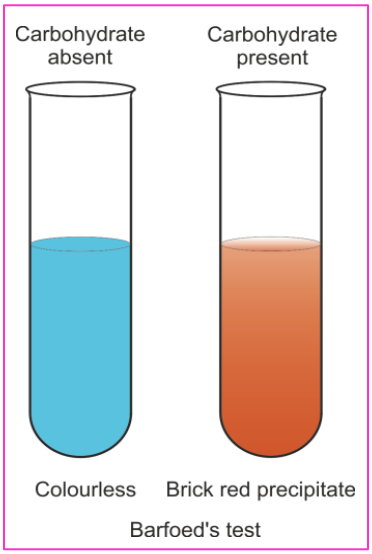
Fehling's Test

5. Barfoed's test:

Method: Add 1 ml. of test solution in test tube, add about 2 ml of Barfoed's reagent and boil for 1 minute and allow standing for a few minutes.

Observations: Formation of brick red precipitate indicates the presence of only monosaccharides in the test solution.

Inference: Only monosaccharides answer this test. Since Barfoed's reagent is weakly acidic, it is reduced only by monosaccharides. Prolonged heating may also hydrolyze disaccharides to give a positive result.

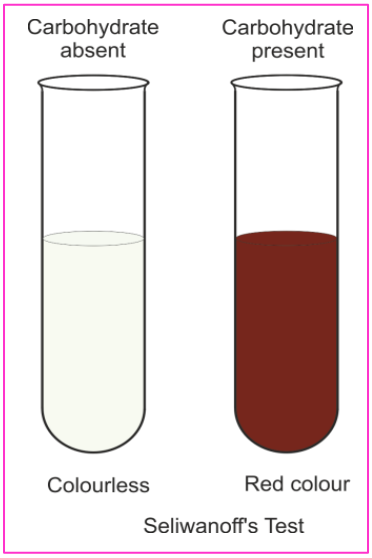


6. Seliwanoff's Test:

Method: Add 2 drops of test solution to 2ml of Seliwanoff's reagent. Heat the solution one minute for boiling. If a keto sugar is present a red colour will appear as in fructose. Sucrose also gives as positive test due to hydrolysis into glucose and fructose.

Observations: Appearance of deep red colour.

Inference: Ketohexoses react with acids much more rapidly than aldohexoses and hence give better yield of furfural derivatives, further furfural derivatives and forms complex with resorcinol to yield a red colored complex.



7. Bial's test:

Method: Take 4 ml of Bial's reagent add 2-3 ml of test solution and heat gently. When bubbles rise to appear on the surface then cool under the tap.

Observations: Appearance of green colour precipitate.

Inference: When pentoses are heated with Bial's reagent, furfural is formed which condenses with orcinol in presence of ferric ions to give a blue green colour. The colour is specific for pentoses, glucuronate and their polymers.

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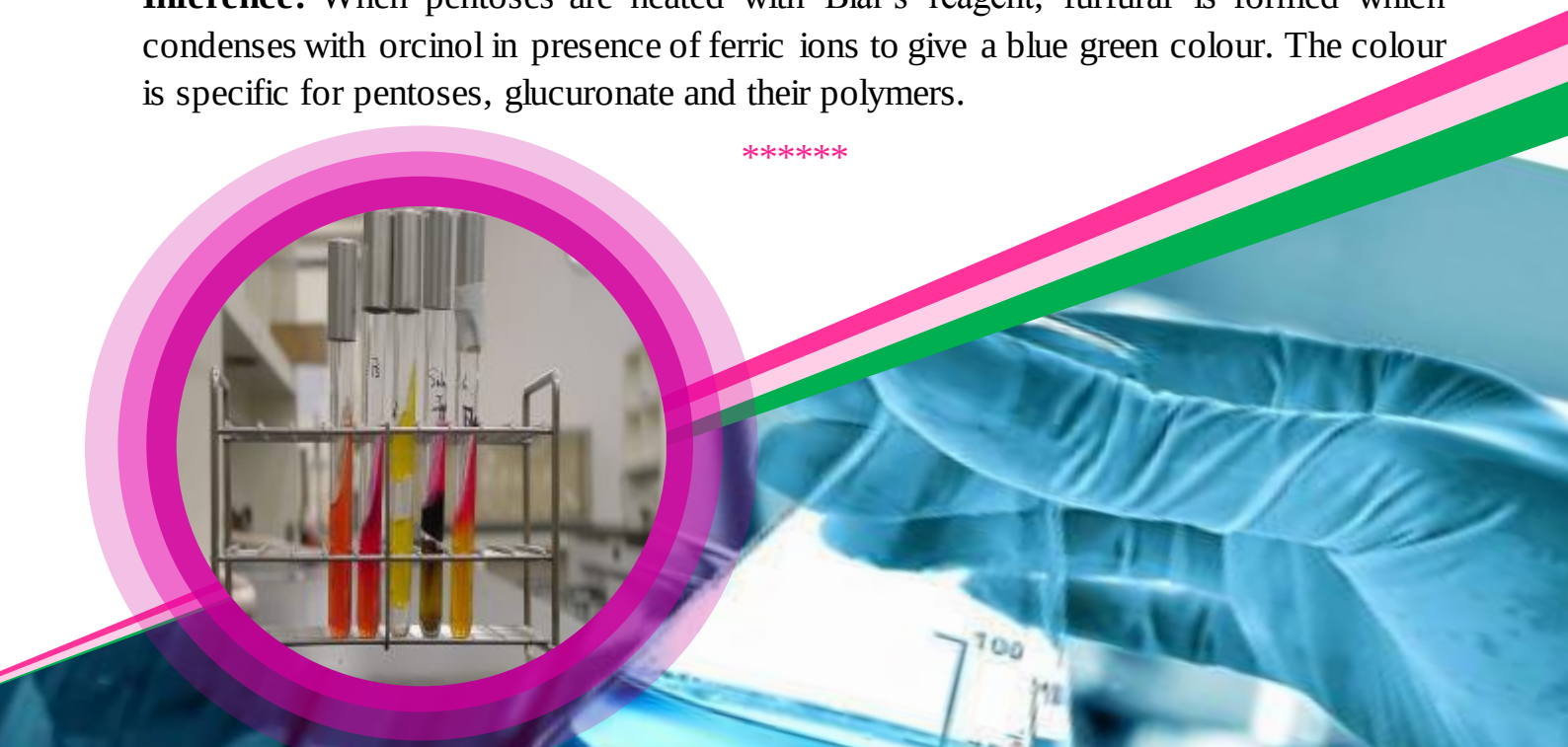

Seed village concept

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"To meet the potential challenge to meet the food needs of the 1.4 billion people of our country by 2025, the increase in agricultural production is very important and therefore the production and distribution of high quality seeds of improved varieties in the popular community."

Introduction

Seeds are the primary source of agriculture and hinder the final production of other inputs. Good quality seeds alone increase yields by 15-20 percent. To meet the potential challenge to meet the food needs of the 1.4 billion people of our country by 2025, the increase in agricultural production is very important and therefore the production and distribution of high quality seeds of improved varieties in the popular community. The increase in tropical agriculture as a result of improved resource development has posed a challenge to science and technology in terms of seed production under a variety of environmental conditions.

The seed program includes the participation of the national government, the SAU program, civil society, cooperative and private institutions. With the best efforts of all these structural elements, only 15 to 20 percent of the total quality seed requirement is met. Most, the type of seed, farmers rely on their stored farm to produce crops that require certain basic methods to choose the best seed for sowing. In addition, the crops are for sale and a small portion of the grain is sorted, stored and used as seed for the coming season which may not meet the quality criteria as the seed results in less field cultivation, eventually harvesting.

Quality seeds are the key to achieving a potential product. As the standard deteriorates in subsequent generations the old seeds should be replaced with more quality seeds. Ideally the seed should be replaced last year for reproduction every three to four

years of infertility. It is therefore necessary to improve the availability of high quality seeds to increase Seed Replacement Rate (SRR).

Apart from the implementation of a formal seed program, the seeding rate has reached only 15 percent and there is an alarming gap between demand and quality seed supply. The role of the private seed sector in the production and distribution of high quality seeds is well known in the Indian seed industry. However, they generally live in low-cost seed production, catering to the needs of only a select few farmers.

The distribution of high value seeds such as rice varieties, oilseeds and pulpins is in the public sector. The unavailability of high quality seeds in olive oil and spinach is one of the main reasons for the reduction of seed. The rapid increase in production and production of these carcasses can be achieved by the high distribution of quality seeds of new and high-yielding varieties.

There is a great deal of production and distribution of quality seeds in these carcasses where the concept of village breeding is a novel and very effective method and needs to be promoted to facilitate the production and distribution of times of the desired species at the village level. In this regard, the concept of seed pods that promote village satisfaction in the production and distribution of quality seeds is growing.

What is seed village?

The village, where a team of professionals is engaged in the production of 'seeds for a variety of crops and takes care of their needs, city planners and planners of nearby villages at the right time and at affordable cost are called **"seed village"**.

Concept

1) Organizing seed production in a group.
2) Instead of replacing existing local versions with new high-resolution modes.
3) Product growth
4) To meet local need, timely delivery and cost effective
5) Independence and self-reliance of the city
6) Increase seed germination rate

Features

1) Seeds are available at the door of the farms in good time
2) Availability of seeds at low cost and below market price
3) Increased confidence among farmers about quality due to a well-known source of production
4) Both the manufacturer and the consumer benefit from the same voice
5) It facilitates the rapid distribution of new varieties

Establishment of seed villages

The current seed village planning program has two phases:

I. Producing seeds for different crops: The idea of a seed village is to promote seed production for seed foundations and certified seed varieties. An area suitable for growing a particular crop will be selected, proposed for different varieties of a particular variety.

Choosing a location

The location with the following locations will be selected:

1. Irrigation facilities
2. Adequate climatic conditions to increase yields for more than one season
3. The abundant availability and knowledge of local farmers in that particular crop
4. Appearance or breakdown of pests and diseases
5. Past local history of eligibility to increase seed yield
6. Medium rainfall and distribution
7. The proximity of the urban area to the easy movement of seeds and other inputs.

Seed Supply

The ideal location for seed production will be identified by Science. Basic seed/ certified seed or seeded seed at the university will be provided by the University through the Krishi Vigyan Kendras (KVKs) and research institutes at a 50% subsidy fee to identified farmers in the area. Farmers will use these high quality seeds and make their own seed production in a small area (one hectare) for their own use. Crops are Rice, Pulses and Oilseeds.

Capacity building

In order to integrate technology between technology and public participation, the main focus is on building the capacity of the farmer to produce quality seeds. Training in seed production and seed technology will be provided to identified seed growers in seed areas to empower farmers in technology.

- ✓ Training time: 3 days
- ✓ First day training: During sowing
- ✓ Training: Special grade, planting methods, seed treatment, and other agronomic practices.
- ✓ Second training day: During flowering
- ✓ Training in: Off types identification and removal, seed site maintenance, crop protection methods, maturation and harvesting methods.
- ✓ Third training day: After harvest
- ✓ Cleaning training: Seed cleaning, grading, seed handling, stockpiling and storage, seed samples and sending to a seed testing laboratory for analysis.

A seed field will now be set up to strengthen technology and marketing.

A- Training at the time of sowing, **B-** Training at the time of flowering
C & D- Training at the time of harvesting.

II. Establishment of seed processing unit

Post-harvest seed handling is an important part of the complete technology to market good quality seeds of improved varieties. If the seeds are not made and handled properly, all previous attempts at production may be lost. Seed processing and packaging are therefore very important in seed production. The location of seed processing plants is based on available and easy-to-use infrastructure. Such an area will be well connected with roads and transportation. Each seed processing centre will have the following infrastructure.

Infrastructure need for seed processing unit

- Seed garden cum clearer
- Bag closer, trolleys, scales and furniture
- Building to house equipment
- Seed storage structure
- Seed threshing and drying yard
- Information centre

The information centre will have an online centre to provide information on seed demand and market practices, agricultural market index, weather forecast, crop protection measures.

A

Seed garden cum clearer

B

Bag closer

C

Trolley

Seed storage structures

Mud bin structure

Steel structure

Benefits of Seed Village Concept or Compact Area Approach

1. Remove the problem alone, especially from pollinated plants.
2. Mechanization is possible from sowing and harvesting.
3. Management of seed harvesting is easy.
4. Due to the unique variety, the problem of varietal mixing during processing, drying will be avoided.
5. The seed certificate officer will pay a large fee each time.
6. Completely reduces investment costs.
7. Seeds will have high genetic predisposition, physical hygiene.

ANTITRANSPIRANTS AND ITS ROLE IN PLANT GROWTH

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> "However, under arid conditions where soil moisture conditions are critical, water loss may not be very high from sandy soils after the drying of the top layer. Therefore, the chemicals which control transpiration either by filming the leaf surface or by the regulation of stomatal aperture or substance that is usually sprayed on plant surfaces like the leaves and stems to reduce transpiration and inhibit water loss called antitranspirants"

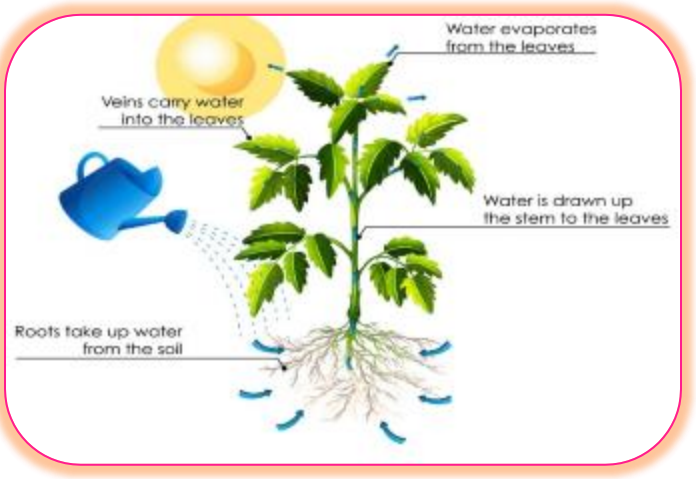
Introduction

The amount of water vapour lost to the environment accounts for 99% of the plant total water uptake and makes little direct contribution to plant growth. Soil water deficit and excessively high temperature are two of the most common yield-limiting factors in crops. Transpiration from plants and evaporation from soil surface are the two main sources of water loss from vegetated fields. Transpiration is the process of loss of moisture from leaf surface in the form of water vapour whereas evaporation is the loss of moisture from non-living surfaces. However, under arid conditions where soil moisture conditions are critical, water loss may not be very high from sandy soils after the drying of the top layer. In recent years only, more attention has been paid for exploring the possibility of reducing transpiration from plants by the use of some chemicals. These chemicals are known as antitranspirants that may control transpiration either by filming

the leaf surface or by the regulation of stomatal aperture. Substance that is usually sprayed on plant surfaces like the leaves and stems to reduce transpiration and inhibit water loss called antitranspirants. However, since the processes of transpiration and photosynthesis involve the passage of water vapor and carbon dioxide via the stomata, both processes may be affected when these stomata were narrowed or curtailed by antitranspirants application.

What are Antitranspirants?

Recently, efforts have been made to find substances, which when applied to the plant, reduce transpiration i.e. antitranspirant. Antitranspirants are the materials chemicals which decrease the water loss from plant surface. This can be done by different ways like by forming a waxy coating on leaves, reducing the size\number of stomata or controlling stomatal closure. Their role is to practice plants of hardening to stress, as a method of reducing the impact of drought due to salinity. Reducing the transpiration can play a useful role in this respect by preventing the luxurious loss of water to atmosphere via stomata.



or

Mode of action

Antitranspirants may reduce transpiration in three different ways:

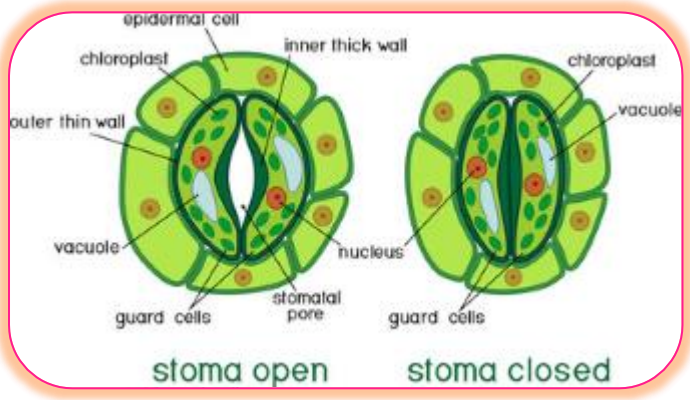
1. By reducing the absorption of solar energy and thereby reducing leaf temperatures and transpiration rates.
2. By forming thin transparent films which hinder the escape of water vapors from the leaves.
3. By promoting closure of stomata (by affecting the guard cells around the stomatal pore), thus decreasing the loss of water vapors from the leaf.

Types of Antitranspirants

On the basis of their mode of action these are categories into four types which are explained briefly:

1. Stomatal closing type:

They induce closure of stomata or decrease the size and number of stomata and reduce the rate of transpiration. Since the stomata are made to close, the rate of CO_2 diffusion into the leaf is also reduced leading to low photosynthetic rates.



CO_2 is an effective antitranspirants a little rise in CO_2 concentration from the natural 0.03% to 0.05% induces partial closure of stomata. PMA is widely used chemical for stomatal closer. It has the ability to close the stomata but it has a disadvantage that it is toxic to fruits and vegetables. This chemical also inhibits phosphorylation and hence damages the foliage by blocking photosynthesis Herbicides such as triazine, atrazine, simazine which are the inhibitors of ETC at QA and QB sites but at the lower concentration they can also be used as antitranspirants. **e.g**. Phenyl Mercuric Acetate (PMA), Abscisic Acid (ABA) and high CO_2 concentration.

2. Film forming type:

Plastic and waxy material which form a thin colorless film over the leaf surface and result in a physical barrier. These glossy films then reduce water loss on plants while at the same time allow them to breathe normally. Colorless plastics, silicone oils & low viscosity waxes are some examples of film forming types.

It has also some disadvantages that it is only effective at low temperature but not at high temperature also comes in the way of gas exchange and act as mechanical barrier in stomatal movement. e.g. Waxes, Plastic films, Silicone oils

3. Reflectance type:

These are white material which form coating on leaves and increase leaf reflectance (albedo). Reflects radiation falling on the leaf and reduces heat load on leaf. When heat load is reduced amount of water to maintain temperature is also reduced. Therefore water conservation occurs. Kaolin doesn't come in the way of any metabolic activity.

e.g. Kaolinite (Kaolin), calcium carbonate, magnesium carbonate, zinc sulphate etc.

4. Growth retardant type:

These chemicals reduce shoot growth and increase root growth and thus enable the plants to resist drought. They may also induce stomatal closure. Cycocel is useful for improving water status of the plant. e.g. Cycocel

Promising features of antitranspirants:

1. Non toxicity in nature.
2. Non-permanent damage to stomata mechanism.
3. Specific effects on guard cells and not to other cells.
4. Effect on stomata should persist at least for one week
5. Chemical or material should be cheap and readily available.
6. Antitranspirants are also useful for reducing transplantation shock of nursery plants.

Role of antitranspirants in field crops:

An increase in yield of an annual crop was observed after the application of antitranspirants. In general field crops are highly dependent or current photosynthesis for growth and final yield. Therefore it is unlikely that currently available antitranspirants would increase yield of an annual crop unless crop suffers stressed from inadequate water and or a very high evaporative demand, particularly during a moisture sensitive stage of development.

Fuahrin sprayed stomata inhibiting or film forming antitranspirants on field grown sorghum under limited irrigation conditions, he found that grain yield increases 5 to 17% and application of antitranspirants just before the boot stage was more effective than later sprays.

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Crop Modeling:
An overview

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"The crop modelling approach remains the best methods for surveying the impacts of future worldwide environmental change, hence helping in the definition of national strategies for moderation purposes."

Introduction

Higher the populace means higher the food request which has been an overpowered worry in the field of agriculture and allied sectors. The creation of food is as of now being tested by characteristic dangers and their intently family members. Proficient crop production innovation depends on the correct choice an opportune time in a correct manner. Customarily a cropping system works that are utilized in farming dynamic were gotten from traditionally experienced base agronomic practices, in which crop yield was identified with some characterized variable dependent on relationship analysis. Crop yield was communicated as mathematical functions of the scientific capacity of the characterized factors, with regression coefficient. The quantitative data acquired from this kind of experiment is very site explicit. The data got must be dependably applied to other sites where weather, soil parameters and yield are like those utilized in building up the first function. Accordingly, the quantitative utilization of crop-based model for decision making is seriously restricted. This paper audits some crop simulation models which are utilized by the researchers and analysts over the timeframe.

Cropping Systems Simulation Model (CROPSYST)

CropSyst (Cropping Systems Simulation Model) is a multi-year, multi-crop, every day time step crop growth model, created with an accentuation on an inviting UI, and with a connect to GIS programming and a climate generator (Stockle, 1996). The model's goal is to fill in as a logical apparatus to examine the impact of cropping management on crop efficiency and the earth. For this reason, CropSyst reproduces the soil water budget, soil-plant nitrogen budget, crop phenology, crop canopy and root growth, residue production, biomass production, crop yield and decomposition, soil erosion by water, and pesticide. These are influenced by weather, soil attributes, crop qualities, and crop managements including crop rotation, cultivar choice, irrigation, nitrogen application, pesticide applications, soil and irrigation water salinity, tillage operation and residual management. A propelled easy to use interface permits clients to effortlessly control input records, confirm input parameters for extending mistakes and cross similarity, develop simulation, execute single and clump run simulations, tweak yields, produce text and graphical reports, connection to spreadsheet programs, and even select a favored language for the interface text.

The model is expected for crop growth simulation over a unit field region (m^2). Development is depicted at the degree of the entire plant and organs. Reconciliation is performed with day by day time steps utilizing the Euler's technique. The nitrogen and water sub models in CropSyst, and an overall depiction of growth simulation have been introduced somewhere else (Stockle *et al.* 1994).

The water budget in the model incorporates rainfall, irrigation, surface runoff, water infiltration, water redistribution in the soil profile and evapotranspiration. Crop Evapotranspiration is resolved from a crop coefficient at full canopy and ground inclusion controlled by the canopy leaf area index.

The nitrogen budget in CropSyst incorporates N changes, ammonium sorption, and crop nitrogen demand, nitrogen fixation and uptake of nitrogen. Nitrogen changes of net mineralization, nitrification and denitrification are simulated. The water and nitrogen budget interface to create a simulate of nitrogen passage inside the soil.

Crop development is simulated dependent on the thermal time required to arrive at explicit development stages. The collection of thermal time might be quickened by water stress. Thermal time might be additionally regulated by photoperiod and vernalization. Day by day crop development is communicated as biomass increment per unit ground area. The model records for four restricting variables to trim development: water, light, nitrogen uptake and temperature.

Model Inputs

Four input data files are required for CropSyst: Weather file, Soil file, Crop file and Management files. Separate records take into consideration a simpler connection of CropSyst simulation with GIS software.

The weather file includes latitude, parameters of rainfall intensity for erosion forecasting, freezing climate parameters for locations where soil might freeze, and local parameters to generate daily sunshine hours and vapor pressure deficit (Patra *et al.* 2017).

The Soil file incorporates surface soil Cation Exchange Capacity and pH, parameters for runoff measurement, soil texture for erosion calculation and other parameters differentiated by soil layer which are Layer thickness, Field Capacity, Permanent Wilting Point, Bulk Density and Bypass Coefficient.

The Management file includes two types of events one is automatic and another is scheduled. Programmed events including irrigation and nitrogen supplements are commonly determined to give perfect conditions for optimum growth, in spite of the fact that irrigation can be likewise set for shortage of irrigation. The management events can be planned to utilize genuine date, relative date (comparative with year of planting), or utilizing synchronization with phenological events (e.g., number of days in the wake of flowering). Scheduled events incorporate irrigation application date and amount, nitrogen application includes date of application, amount, source-natural or inorganic and application mode, tillage, and residue management.

The Crop file have sections including: Phenology (thermal time prerequisites to arrive specific growth stages, photoperiod and vernalization if required), Morphology (root depth, maximum leaf area index, specific leaf area and other parameters describing characteristics of root and canopy), Growth (vapour pressure deficit controlled transpiration, light-use efficiency, stress response parameters, etc.), Residue (decomposition of crop residues), Nitrogen Parameters (nitrogen demand and crop uptake) and Harvest Index.

Validation of the Cropsyst model

Validation is performed by equating field observed data with simulated results and it is a critical measure in model assessment (Power, 1993; Addiscott *et al.* 1995). ETa, biomass, and grain yield etc. are considered as the verification parameters for the CropSyst model. Obtained crop parameters from the calibration process are further can be used in the validation.

DSSAT

The Decision Support System for Agro-technology Transfer (DSSAT) is software that involves crop simulation models for more than 40 crops just as devices to encourage compelling utilization of the models. The devices incorporate database that executes programs for soil, climate, crop management and experimental data and utilities. The simulation models recreate development, growth and yield as a component of the soil plant-climate dynamics. DSSAT furthermore, its simulation models have been utilized for a wide scope of uses at various scales ranges from geographical to different time series. This remembers for on field management, assessment of climate change and variability, water use, greenhouse gases, and soil carbon and nitrogen balance (Hoogenboom *et al.* 2010).

Model Inputs

The crop model requires day by day weather data, soil surface and profile data, and point by point crop management. Genetic data is characterized in a crop file that is given by DSSAT and cultivar or variety data that ought to be given by the user. The simulation process is started either at planting or before planting through the simulation of a fallow period. These simulations are led at an everyday step or now and again, at an hourly time step contingent upon the procedure and the crop model. Toward the finish of every day, the plant and soil water, nitrogen, phosphorus, and carbon balance are refreshed, just as the crops vegetative and reproductive improvement stage. DSSAT combines crop, soil, and climate information bases with crop models and application projects to mimic multi-year results of crop management techniques. Model incorporates the impacts of soil, crop phenotype, climate and the management strategies (Hoogenboom *et al*. 2019).

Calibration and Validation

The calibration of the model used climate information for the baseline period of nth years, crop information of the crop from past seasons and soil data on significant parameters. So as to evaluate the calibrated model, very much characterized criteria and data's are required. Accordingly, the exhibition of the model is to be approving utilizing an independent crop data from years that are not utilized for calibration. A definitive trial of a simulation model is the accuracy which is the end result after the comparisons between simulated data and observed data (Willmott *et al.* 1985). Various measurable techniques for analyze of the model are accessible. These are RMSE or percent of normalized root mean square error (RMSEn), index of agreement (d) (Willmott et al., 1985), and coefficient of determination (R2) which is utilized for assessing the integrity of fit between the observed and simulated values. Low estimations of RMSE and RMSEn, just as d-values and R2 near to unity is wanted to characterize a good match (Abera, 2019).

Conclusion

The best utilization of crop models so far has been largely only for experimentation, but it is a need of the hour to implement the modelling outputs to the farmers from every corner of the world to support them to rectify any errors they will make in future or implementation of some useful techniques to get higher yield in near future. Crop models have wide ranges of applications ranging from a research tool for researchers and scientists to become an application to recognize holes in our insight. Models based on physiological data are fit for supporting extrapolation to cropping phenology. Over a moderately brief timeframe range and at nearly low costs, the modeler can research an enormous number of the board procedures that would not be conceivable utilizing conventional techniques. Regardless of certain constraints, the modelling approach remains the best methods for surveying the impacts of future worldwide environmental change, hence helping in the definition of national strategies for moderation purposes. Other strategy issues, similar to yield forecast, agricultural operation management, issues in nature are all can be well acknowledged by the crop models.

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SUSTAINABLE IRRIGATIONAL TECHNIQUES IN AGRICULTURE FOR BUNDELKHAND REGIONS

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"In agriculture, irrigation is one of the main important activities among agricultural activities, for which water resources must be used efficiently and sufficiently and therefore, nowadays modern irrigation techniques are used by farmers, which are efficient and sustainable."

Introduction

Agriculture has been the pillar of India's economy and will continue so for a long time. Indian agriculture is characterized by agro-ecological diversities in soils, rainfall, temperature and cropping system. The majority of the livelihood of the Indian population depends on agriculture. Both men and women are actively engaged in agricultural activities. Over 75 percent of the population hinge on agriculture for their main livelihood, with 96 percent of income collectively generated through agriculture and herding. In agriculture, irrigation is one of the main important activities among agricultural activities, for which water resources must be used efficiently and sufficiently. Traditional irrigation techniques have been used, but nowadays modern irrigation techniques are used by farmers, which are efficient and sustainable. This article explains various modern irrigation techniques in the Bundelkhand region for farmers.

Bundelkhand region: an overview

Bundelkhand region is drought prone area, always faces shortage of rain. The farmers of Bundelkhand region mostly depends on rain; other resources are also there such as pond, river, well, tube well, etc., but then these resources are not reachable to many small farmers. Somewhere, there is lack of good irrigation facilities due to their land being shallow. Farmers' of Bundelkhand region receives water from different river sources namely Yamuna, Ken, Betwa, Sindh, and Pahuch. Historically, Bundelkhand had faced many droughts which had affected the growth of the farmers' economy. The area, which was once known as the Legume Bowl of India, is now facing the fourth consecutive drought in the past 5 years. The undesirable effects of these droughts weigh heavily on the spines of people living in this marginalized and economically deprived region. Although billions of dollars have been pumped into the Bundelkhand over the past decade, the water situation there has improved little or no enhancement. Certainly, the average annual rainfall in Bundelkhand has fallen 40 percent over the past 13 years, with a 60 percent drop in rainfall in the past 5 years alone. The subsequent acute water scarcity has triggered mass migration, without water many families in this largely agricultural region can no longer cultivate enough to maintain their incomes.

Irrigation

Water is a vital natural resource for the existence of life, a crucial contribution for plant growth and for the maintenance of the environment. While, water is a renewable source, it is pretty dynamic and rare. The major way of getting water is rainfall and it is affected by a number of factors. As a result, precipitation in the Bundelkhand is extremely variable, irregular and unreliable with wide variations between the several meteorological sub-divisions in terms of distribution and quantity. The highest and lowest annual average precipitation in Bundelkhand is 909 mm and 250 mm, respectively. It therefore requires that every droplet of rain be well-preserved and this can be done by in situ and ex situ harvesting of precipitation.

Traditional methods of irrigation

- **Tube wells-** tube well is a good source of irrigation. A tube well is a type of **water well** in which a long, 100–200 millimeters (3.9–7.9 in)-wide, stainless steel tube or pipe is bored into an underground aquifer. The lower end is fitted with a strainer, and a pump lifts water for irrigation. Tube well capacity bases in two types in tube well like 1.5 cusec and 1.0 cusec. Though, fresh water through tube well get wasted too

much, which can be saved through various conservation methods. Through various studies, it was found that Jhansi district of Bundelkhand region has highest number of tube wells (706). Whereas, in Mahoba district there is shortage of sufficient number of tube wells.

- **Pond-** A pond is a natural/ artificial source of irrigation, an area filled with water, either natural or artificial, ponds are frequently man-made, or expanded beyond their original depth and bounds. Among their many uses, ponds provide water for agriculture and livestock, aid in habitat restoration serve as fish hatcheries, are components of landscape hatcheries, may store thermal energy as solar ponds, and treat waste water as treatment ponds. Ponds may be freshwater, saltwater, or brackish. About 4,020 ponds have disappeared in water-starved Bundelkhand region in the past decade.

- **Well-** Traditionally wells are an important source of water supply and even today it is true in many communities. Technically wells are of two kinds shallow and deep.

Shallow well- Shallow wells tap subsoil water i.e. the water from above the first impervious layer-in the ground.

Deep well- A deep well system consists of an array of bored wells pumped by submersible pumps. Pumping from each well lowers the groundwater level and creates a cone of depression or drawdown around itself. Several wells acting in combination can lower groundwater level over a wide area beneath an excavation.

- **River-** A river is a natural source of irrigation, an area filled with water in natural. River is frequently made by nature. Rivers are main source of irrigation, energy production, fish production, drinking water for both animals and human.

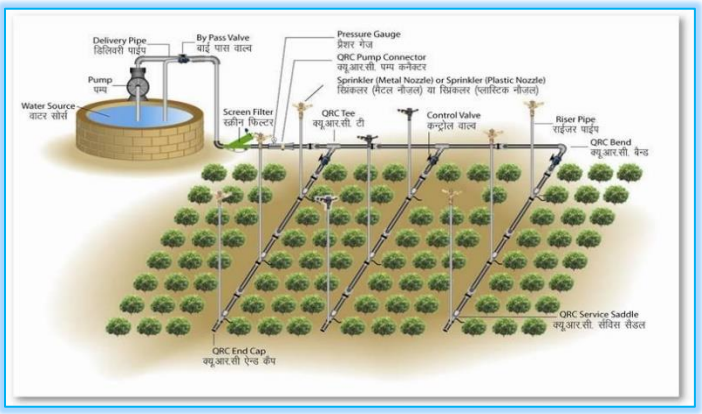
Modern methods of irrigation

Drip irrigation- Drip irrigation is the most efficient water and nutrient delivery system for growing crops. It distributes water and nutrients straight to the plant's root area, in correct quantity, at precise timing, so that each plant gets exactly what it needs and when it needs it, to grow optimally. Water and nutrients are directed through the field in pipes called "dripper lines with smaller units called "drippers". Each dripper emits drops containing water and fertilizer, allowing even application of water and nutrients directly to each root zone of the plant, over an entire field. Drip irrigation offers farmers an efficient and relaxed mode to operate their farms.

Characteristics of drip irrigation:

- Consistent higher quality yields
- Huge water saving: no evaporation, no runoff, no waste
- 100% land use - drip irrigation evenly in all topographies and soil types
- Energy-saving drip irrigation works at low pressure
- Resourceful usage of fertilizer and crop protection without leaching
- Less dependence on weather conditions, more stability and less risk.

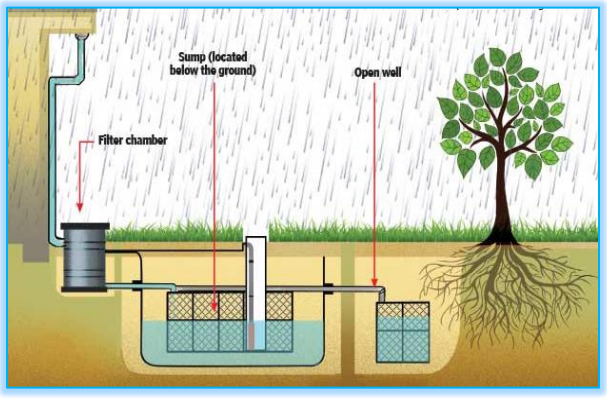
- **Sprinkler irrigation-** The sprinkler irrigation system allows the application of high-pressure water using a pump. It releases rain-like water through a small diameter nozzle fitted in the pipes. The water is disseminated through a system of pipes, sprayed into the air and irrigated into most types of soil due to the broad range of discharge capacity.



Water savings of up to 30-50% in the sprinkler irrigation method and an average yield increase of 36% on all crops. Appropriate for irrigation where the plant population per unit area is very high.

Rainwater harvesting method- Rainwater harvesting is the process of collecting rainwater from surfaces on which rain falls, filtering it and storing it for multiple uses. Rainwater harvesting puts the supply of water back to normal levels. It is the collection and storage of water from surfaces that rain has fallen upon. Rainwater harvest can be

used for irrigating crops, garden watering, livestock, laundry and flushing toilet. In a normal scenario, the rainwater is collected from roof buildings and then stored inside of a special tank. Rainwater harvesting systems are designed after assessing site conditions that include rainfall pattern, incident rainfall, subsurface strata, and their storage characteristics.



Conclusion

Modern methods like drip irrigation, sprinkler irrigation, etc. are conservative methods for efficiently using water. Today, climate change and natural resource management are burning issues around the world. Therefore, this farmer will have to convert his traditional irrigation techniques into modern, effective and sustainable irrigation techniques. Significant progress has been made in the development of water collection, conservation and use technologies. More efficient use of water needs to adapt to technically viable, economically viable and socially acceptable efficient irrigation methods. Drip and other micro irrigation systems should be adopted and popularized for line crops, horticulture and especially high-value crops, which are widely at distance on mountainous terrain, shallow and unsafe soils and areas where water is scarce. Local R&D and extension agencies, manufacturers and end users/users have not been asked to use the same. There is a need to adopt an integrated approach involving farmers. Optimum development and efficient use of water resources are of great importance.

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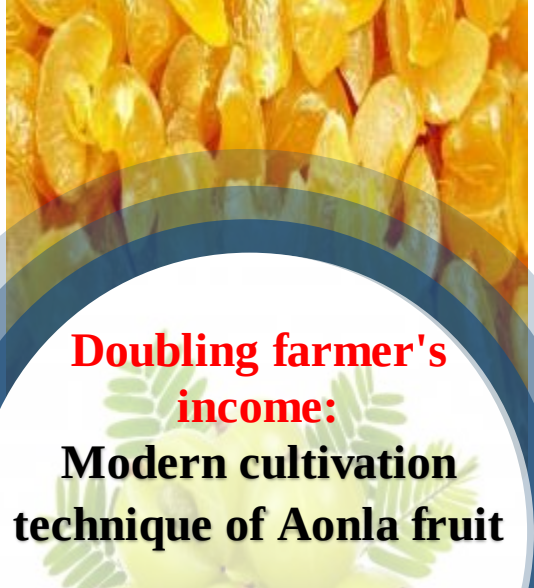

Doubling farmer's income: Modern cultivation technique of Aonla fruit

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> "Aonla is valued as an anti-ascorbutic, diuretic, laxative, antibiotic and acidic, cooling and refrigerant. Dried fruit is useful in hemorrhage, diarrhoea, chronic dysentery, diabetes, jaundice, dyspepsia and cough. Its fruit have excellent therapeutic value which is utilized for treatment of several diseases from ancient times like tuberculosis of lungs, asthma, bronchitis, scurvy, diabetes, anemia, weakness of memory, cancer, tension, influenza, cold, loss and grayness of hair etc."

Introduction

Aonla cultivation is common in India particularly in Uttar Pradesh comprising the districts of Pratapgarh, Raibareilly, Varanasi, Sultanpur, Kanpur, Agra and Mathura etc. It has been recognized as "Amritphal" in an ancient literature. The aonla fruit is valued high among indigenous medicines in India. It is valued as an anti-ascorbutic, diuretic, laxative, antibiotic and acidic, cooling and refrigerant. Dried fruit is useful in hemorrhage, diarrhea, chronic dysentery, diabetes, jaundice, dyspepsia and cough. Its fruit have excellent therapeutic value which is utilized for treatment of several diseases from ancient times like tuberculosis of lungs, asthma, bronchitis, scurvy, diabetes, anemia, weakness of memory, cancer, tension, influenza, cold, loss and grayness of hair etc. Aonla may be an important fruits of future due to its high medicinal and nutritional value, high productivity per unit area and suitability even in the waste lands particularly in salt affected soils. It has immense scope for processed and value added products like jam, jelly, RTS, squash, nectar, juice, canned fruit, ice cream, toffees, preserve, candies, laddu, barfi, Chayvanprash and Triphala. Aonla candy is now gaining much populerity in the market due to its natural appeal of an

original fruit, nutritional quality, easy to handling and transport, better self-life, low preparation cost and good return. Total area under fruit crop **6.53 Mha.**, total production **97.35 MT** and Productivity **14.96 Mt/ha**. Total area under Aonla fruit crop **0.093** Mha and Production of Aonla fruit **1075 MT** (Source NHB 2018).

Climate

Aonla is a subtropical fruit but its cultivation in tropical climate is quite successful. In India, it is being grown near sea coast upto 1800 m altitude. The tree is not much influenced either by hot wind or frost.

Soil

The production shall be highly benefited in deep and fertile soils. Aonla can be grown in light as well as heavy soils except in very sandy ones. The plants have capacity for adaption to dry regions and can also grow in moderately alkaline soils. It has great tolerance to salinity and sodicity and cultivated in pH range of 6.0 to 8.0 very successfully.

Varieties of Aonla

1. Banarasi: It is shy bearer which gives only 10-15 kg fruits per tree at 10 years of age and 100 to 200 kg per tree at the age of 20-30 years. Erect, spreading, medium to tall tree, shy and slightly alternate bearer and generally used for making murabba (preserve), candy etc.

2. Francis: Fruit weight is around 63g oval roundish, light green, slightly fibrous, moderately juicy, seed to pulp ratio is 1: 21 and give 300-400 kg fruits per tree.

3. Chakaiya: Tree has spreading habit, medium height, prolific and regular bearing tree. Fruits are green in colour having approximate weight of 30-35 g per fruit. The large fruits are suitable for preserve and candy purposes, but the smaller fruits are used for making pickles etc. Fruiting starts from 3rd year and 10 year old tree may yield about 100 kg fruits while 15 year, 20 year, 30 year old trees yield 200, 300, and 400 kg fruits per tree per year, respectively.

4. NA- 4 (Krishna): Bears moderately, fruit medium to large in size, flattened, conical, angular, basin papillate in shape, skin very smooth, yellowish in colour with red blush, flesh fibreless, hard and semitransparent. Average weight of fruit 40 gram, it is highly suitable for murabba making (Preserve).

5. NA-5 (Kanchan): Fruits are of medium size with average weight 30-35g. Its pulp is highly fibrous, therefore, suitable for pickles.

There are some other varieties of Aonla such as Bansi Red, Anand-1, Anand-2, NA-7, etc. Which are gradually getting popular with farmers.

Propagation

Aonla is propagated by seed as well as by vegetative methods. They are described below.

Propagation by seed: Aonla plants have been raised by seeds but the plants do not come true to type and there is a high variability. Besides, plants raised through seed are late in bearing. But for raising rootstocks, seedlings are required to be raised through seeds. Seeds attain full maturity by February when they are extracted from the fruits and sown in the last week of February for getting high percentage of germination. Since there is no seed dormancy in Aonla, fresh seeds give almost 100 % germination. Process of germination can be quickened by soaking dried seeds in 500 ppm GA solution for 24 hours. Seedlings can be raised in seed beds or in polythene bags which takes about four months to attain buddable size.

Vegetative propagation: In order to overcome the disadvantages of seed propagation multiplication of superior types of Aonla has been suggested by adopting vegetative methods of the various methods of propagation budding has been found to be the most practical and shield budding is the commercial method of Aonla propagation under north Indian conditions.

One year old Aonla seedlings with a girth of about one cm should be shield budded in early June with healthy and plump buds from new growth. Forker and patch budding are also very successful. They can be done at any time from June to September. The most important factor of budding of Aonla is the proper selection of mother plant which is highly fruitful and the bud is taken from such a branch which has good number of female flowers, otherwise, the plants will be unfruitful due to the presence of large number of male flowers.

Planting: Grafts or buddings of Aonla are best planted in the beginning of monsoon i.e. in the months of June to July. Since the trees grow to a huge size a distance of 8 to 10m both ways is recommended. In areas with irrigation facilities, planting can be done in spring (February-March).

Application of fertilizer: The young plants should be given 15-20 kg of well rotten FYM and the mature tree requires 30-40 kg in each year during September-October. In addition, application of 30 g nitrogen for each year age of the plant upto 10 years and afterwards 680-700 g of nitrogen per year per tree should be provided. Every mature tree should also be fertilized with 1 kg superphosphate and 1-1.5 kg murate of potash. The above fertilizers should be given in two equal split doses to mature bearing trees, once during September-

October and again during April-May after setting of fruits. The plants need to be irrigated after application of fertilizers.

Foliar spray of 0.6% borax thrice in the months of September and October at about 10-15 days interval has also been recommended to control fruit necrosis which develops due to deficiency of boron.

Irrigation: Aonla trees are hardy and stand very well against drought. Therefore, hardly any irrigation is practiced. However the crop shall be benefited by giving 2-3 irrigations at the time of full bloom and fruit set. During summer, when the fruit is dormant, there may not be any benefit to irrigate trees. However, the young plants require watering during summer months at fortnightly interval, particularly till they have fully established.

Training and pruning: Aonla tree does not require regular pruning. However, pruning in early years for giving proper shape and development of strong frame may be necessary for which tree should be trained to single stem upto the height of about 1 m and then primary branches can be allowed to regular space all around the trunk.

The pruning of bearing plants can be done after the termination of the crop each year. While pruning, dead, diseased, broken, weak, crossing branches and suckers appearing from root-stock should be removed.

Flowering and fruiting: In Aonla, flowering takes place on determinate shoots appearing in spring season. The flowers commence opening from the last week of March and the blooming period lasts for three weeks. Male flowers appear in clusters in the axil of the leaf all over the branchlet while female flowers on the upper end of the few branchlets only.

Pests and diseases of Aonla

A- Insect pests:

1- Mealy bug (*Nipaecoccus vastator*): Both nymphs and adults are feed on Aonla tree from April to November.

Control: Organophosphate provide excellent control of this pest. Malathion 0.08% or Methyl Parathion 0.03% are effective as sprays.

2- Bark Eating Caterpillar (*Inderbela tetraonis*): It damages stem and branches of grown up tree by eating bark and making tunnel into them. This insect is the problem of neglected orchards.

Control: The pest can be controlled by spraying 0.03% eldrin or injecting kerosene oil, petrol in the holes and plugging them with cotton or wet soil during Sept.- Oct. and Feb.- March.

3- Shoot Gall Caterpillar (*Betonsa stytophora*): The young caterpillars bore into the apical portion of the shoot during rainy season and make tunnel. Due to this, damaged region bulges out abruptly into a gall which provides space for movement of the caterpillar.

Control: This can be controlled by pruning the affected parts and spraying with 2% Parathion. Prophylactic spray of systemic insecticide like Rogar 0.03% is also suggested.

Diseases:

1- Aonla Rust or Ring Rust (*Ravenelia emblicae*): Ring rust appears as circular or semi-circular, reddish solitary or gregarious spots on leaves from the beginning of August infection on fruits follow. Generally one or two pustules measuring 10 to 20 mm in diameter appear on infected fruit.

Control: Spraying with Dithane Z-78 at 0. 2% at the interval of 7 to 28 days during the months of July to September proves effective.

2- Fruit Rot (*Penicillium oxalicum; P. islandicum*): The major loss takes place during transit to the market. The earliest symptom of infection is seen as water soaked lesion on the fruit surface, which enlarges in size followed by development of small pin head size colonies of golden yellow colour.

Control: Fruits showing such symptoms are discarded for marketing. Bruising and injury at the time of harvesting should be avoided. Treatment of fruits with borax and NaCl to control diseases.

Physiological disorder:

1- Internal fruit necrosis: In this disorder necrosis symptoms starts with the browning of inner most part of the mesocarpic tissues, at the time of endocarp hardening in the second and third week of September. Depending upon the severity of the disorder, mesocarp of affected fruit turns back and become corky and gummy pockets develop.

Control: This disorder is due to the deficiency of boron for which spray of 0.6% borax thrice in the month of September and October at about 10 to 15 days interval are recommended to control the disorder.

Harvesting and yield: Generally, vegetatively propagated tree starts bearing commercial crop after 6-8 years of planting, while, seedling trees may take 10-12 years to begin commercial bearing. Productive life of trees is estimated to be 50-60 years under good management conditions.

Generally Aonla fruit are ready for harvest in November-December. The fruits are light green at first, but when they mature, the colour becomes dull greenish yellow, or rarely brick red. It has been observed that the best time of harvesting Aonla fruits is February when the fruits have maximum vitamin C content.

As for as yield is concerned, the production varies from cultivar to cultivar. On an average, a grown up tree should yield 150 to 200 kg fruits per annum.

Insect-pests complex associated with Black gram and Green gram

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> "Blackgram and greengram is damaged by an array of insect pests from sowing to harvest in the field as well as in the harvested produce under storage conditions."

Introduction

Blackgram (*Vigna mungo* L.) and Greengram (*Vigna radiata* L.) is an important pulse crop and belongs to family Leguminaceae. The native of greengram and Blackgram is believed to be central Asia and India. Blackgram and greengram is damaged by an array of insect pests from sowing to harvest in the field as well as in the harvested produce in storage.

Insect-pests of blackgram and greengram

A. Stem damaging pest

Stem fly, *Ophiomyia phaseoli*

The maggot of stem fly, *Ophiomyia phaseoli* (Tryon) was found to attack on stem from seedling stage and continued up to the end of vegetative stage. The damage was more observed on seedlings as contrast to mature plants. The infestation of this pest was not serious in crop

B. Sucking pests

1. Whitefly, *Bemisia tabaci*

The white fly, *Bemisia tabaci* (Gennadius)) is the most serious pest causing substantial damage by sucking cell sap from leaves/ tender parts, and secretes honeydew on which sooty mould develops that hinders photosynthesis. It was also observed a vector of yellow mosaic virus, which is a serious threat to pulse production in India.

2. Leaf hopper, *Empoasca kerri*

The leaf hopper, *Empoasca kerri* (Pruthi) population appeared in the vegetative phase of the crop stage. Both nymph and adults sucked the sap from ventral surface of the leaves and the affected leaves curled downwards and became inverted cup shaped.

3. Pod bug: *Riptortus pedestris*

The pod bug, *Ripotortus pedestris*, nymph and adults sucked from developing seeds through the pod wall of the crop. Pods show yellow patches on feeding sites.

4. Thrips, *Thrips tabaci*

The thrips cause considerable damage to tender shoots, leaves, buds and flowers resulting in curling of leaves dropping of flower buds and flowers. Severe infestation may reduce the pod set and alter the pods

5. Black aphid, *Aphis craccivora*

Black aphid, *Aphis craccivora* (Koch) nymph and adults were attacked on the inflorescence, tender pods and also the terminal twigs resulted in twisting of pods and stunted plant growth. Aphid appeared during the vegetative stage and continues up to young podding stage of the crop.

C. Defoliators and Flower feeders

1. Surface Grasshopper, *Chrotogonous trachypterous*

Grasshopper nymph and adult were found mostly in the vegetative stage of the crop; feed on leaves in sporadic form, irregular cutting on the margins of leaves were observed in the field.

2. Bihar hairy caterpillar, *Spilosoma obliqua*

The early infestation by bihar hairy caterpillar, *Spilosoma obliqua* (Walker) was seen on isolated plants and appeared in large numbers, which feed gregariously on the under surface of the leaves by scraping green tissues, which caused skeletonization of plants, while grown up caterpillars consumed the leaves, and make an appearance of net or web.

3. Tobacco caterpillar, *Spodoptera litura*

The cutworm, *Spodoptera litura* (Fabricus) was found on all the stages of crop. The early instars gregariously scrapped undersurface of the leaves and caused skeletonization. The later instars disperse and fed on the entire leaves.

D. Pod borer complex

1. Spotted pod borer, *Maruca vitrata*

The spotted pod borer, *Maruca vitrata* (Geyer) appeared on the crop at reproductive stage with webbing of the leaves, later holes into the half matured pods. The early stages of larvae entered into the seeds and fed on the pods whereas, the grown up caterpillar caused damage by hollow out the seeds. The infested pods when opened observed the presence of caterpillars and excretory pellets and few silken threads.

Damage by *M. vitrata* Damage pods by *H. armigera*

2. Gram pod borer, *Helicoverpa armigera*

The caterpillar of gram pod borer, *H. armigera* (Hubner) in the early stage fed on the foliage, flower buds and and seeds of the plant while, later instars entered into developing pods with circular holes on individual seeds of the pod. In additional, the posterior part of the larvae remained outside of the pods.

3. Blue butterfly, *Lampides boeticus*

The larvae of blue butterfly, *Lampides boeticus* (Linn.) was found to boring into the flower buds and pods. Blue butterfly appeared during the flowering and podding stage and continued till the maturity of the crop.

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Seed Certification:

Importance, steps involved and type of seeds

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"Seeds is indeed a crucial step in seed production and marketing which is generally done to maintain high-quality seeds standards and making them available to farmers for maintaining good and quality yield. In this system varieties of crops are generally grown aiming checking the purity, viability and physical identity and characteristics of seeds."

Seed certification

Certification of seeds is indeed a crucial step in seed production and marketing which is generally done to maintain high-quality seeds standards and making them available to farmers for maintaining good and quality yield. In this system varieties of crops are generally grown aiming checking the purity, viability and physical identity and characteristics of seeds. It is a legally controlled system for checking quality status of seed production and its multiplication techniques.

Objectives of seed certification

Seed Certification process has many objectives but the main aim is ensuring the seed standards like seed purity, vigour, genetic makeup and seed health and quality index. A good seed certification system should be able to accomplish three objectives which are:

1. A systematically increased production and marketing of superior varieties or cultivars.
2. Identification and generalization of new released elite varieties and their fast increase under generally accepted and suitable names.
3. Through cautious maintenance, providing regular and continuous supply of seed material.

Certification agencies

Certification of seeds should be done by the Seed Certification Agency which has got registration under year 1966 Section 8 of the Seeds Act.

Eligibility requirement for seed certification

Seeds of only suitable varieties which are already got certification from Seeds Act in year 1966 under Section 8 shall be acceptable for certification process. The variety in question for becoming acceptable for certification should strictly follow certain requirement which are listed below:

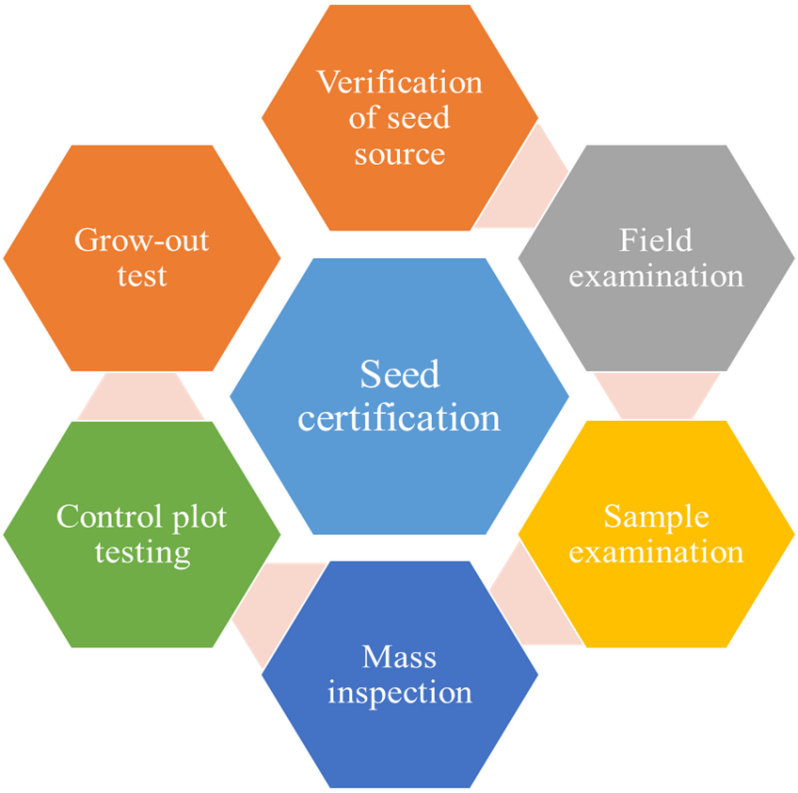
1. **Basic requirements:** Variety should be registered variety under Section-5 of the Indian Seed Act in year 1966 strictly. It should come under the chain of production. Pedigree record of the variety should be properly traceable.
2. **Field Standards**: Field standards include good site selection, isolation distance is maintained, spacing should be maintained, planting ratio should be check, rows of border should be maintained etc.
3. **Certain requirements**: Presence of different types in any seed crop like pollen-shedders in Sorghum crop, Bajra, Sunflower etc. Shedding tassels in maize crosses, dead and disease affected plants, objectionable weed plants etc., should be within the maximum allowable levels for seed certification.

4. **Quality Seed standards**: Minimum certification of seed standards have been developed crop-wise.

Process followed in seed certification in India

Following are the process and steps in seed certification methods:

- **A Managerial check on the genesis of the propagating material:** Seed confirmation is the basic and crucial step in Certification Programme of seeds. For the acceptance of seed by approved source and of legal class certification agency seed should be procured from reliable sources. Hence, true to type and high-quality standard seed for sowing of seed crops should be used.
- **Field Examination:** The assessment of the crop which is growing in the field conditions for checking the genuineness of variety, maintenance of isolation distance, physical admixtures, disease circulation and surety should be made on crop condition as respect to the spread of prevalent diseases and the existence of weed plants etc.



- **Sample Examination:** Through various laboratory tests, evaluation, and examination of planting value of the seeds which includes various germination and other purity tests for affirmation of varietal purity and seed viability.
- **Mass Inspection**: In the certification process the supply is generally made for bulk mass examination. Due to this the estimation of the seed lot for checking the seed viability index and homogeneity of the bulk mass should be carried out for seed produced as compared with the quality sample to check the viability of seed.

- **Control plot testing:** This step is one of the crucial steps in which various specimens are collected from the place of origination and a side by side check is created along with the standard quality samples of the seeds of the variety. It is ascertained that the purity of seed, varietal purity, and health of the produced seed are equal to the results based on field examination.
- **Grown-out test:** This test is conducted for examining the seeds for their species or varietal authenticity or seed infected diseases or any infection. The listed samples/varieties are taken from the seed lots and grown in the field conditions with the standard check varieties. The observations are made for growing plants for the varietal purity and seed purity index. This type of test helps in the removal of the sub-standard seed lots.

Phases of seed certification

Seed Certification process is carried out in 6 steps that are listed as under:

1. Receiving careful examination he field conditions to prove for conformity to the advised for various field grades.
2. Administration after harvesting stages that adds packing and processing in it.
3. Collecting of specimen and setting it for analysis to meet out the seed quality standards and quality status of seeds.
4. After all the steps certificate, certification labels, labelling, tagging and its close up etc. should be given.

Validity of seed certification (Time period)

The validity time period of seed certification is around 9 months from the day of testing when certification is done in initial time. The valid time period of any certification can be further increase for around 6 months giving on re-testing seed conforms to the purity standards that are counsel in concerning of physical purity, inborn purity, sprouting of seed and damage and the loss done by insects and pests for all the seeds for which huge shall be again re-identified for the seed purity and grade standards, grade standards that are characterized for selecting crop. Resulting seed lot will be qualified for the validity period if it conforms to the specify terms and conditions.

Quality of seed

Seed is seen as a starting unit in crop cultivation and agriculture system. It is a developed embryo, and a living organism containing food depository tissue. In case of a seed, prime importance is particularly given to the biological presence and activeness

however, in case of grain the importance is usually given to the supporting tissue and nutrient content for having a profitable produce.

Seed Act (1966) defines a seed as:

- Food crop seeds that usually includes edible oil seeds and fruits & vegetables seeds.
- Seeds of cotton.
- Cattle fodder seeds.
- Seeds of jute.
- Tubers, rhizomes, bulbs, seedlings, roots, cuttings, grafts and other vegetatively propagated material for cattle fodder or food crops.

Importance of a good quality seed

- There should be genetic and physical authenticity of the crops under focus.
- Seed should supply the needed plant population.
- Seedlings acquired are more strongly in nature, immediate growing and can tolerate and resist pests and disease attack to certain level.
- Power to stand the unfavourable climatic conditions.
- Make confident about the constant growth of seeds and maturity of seeds.
- Expanding root system will be better that absorb nutrients in good amount and outcome in excessive good yield and good production.
- It will respond well by adding more fertilizer and other inputs.
- Pure quality standards and grades of seeds of improved seed varieties make confident the higher yield up to 10 – 12 %.

Major seed quality parameters to follow

Major seed quality is the command of seed with necessary genetic and physical clearness of seed that is to go together with physical qualities and fitness status of the seed. The major important seed quality dispositions are mentioned below, they are:

Physical Quality

Physical quality is a kind of purity status of seed taking context there should be no mixing from others, impurity status, inside matter, diseased seed and damaged seed done by insect. A good seed should have physical qualities like equal size, weight, and colour and free from other stems, twigs, flowers, debris, stones, leaf, fruit wall, dust, and without any other inert material and crop seeds. It also should not be diseased, moulded, shrivelled, fully empty seeds, without coloured, rotten and injured. The seed should be effortlessly recognized as a species of specific class and category of specific species. Lacking this important quality generally affects the field for depositing and planting value of the seed. These quality traits and seed standards are generally attained with the seed lots by having proper hygiene, proper cleaning, and grading of seed (processing) continuously after collection and before sowing /storage of the respective seeds.

1. Genetic purity

It is a true to type identity of the seed germplasm which can be inferred as the seedling per plant per tree needs to be an exact copy of mother in all quality characters aspects. These quality characters are necessary for getting the desired seed quality characters of raising the crops either yield or for resistance or for required quality factors.

2. Physiological Quality

This is the real look of seed in further generation and multiplication. Standards based on physical quality characters of seed should be composed of the seed germination, seed quality and seed vigour like performances. The performance-based action of a seed is known as viability of the seed. Seed's stretch of liveliness for production of good seedling with normal root and shoot under suitable conditions are commonly known as germinability of a seed. Vigour of a seed is the energy or possibility in producing best and good quality seedling. It is the total of all seed credit and qualities that enables its regeneration of under any given conditions. Hence, we can say that all viable seeds need not be germinable that is can't germinate but all germinable seed will be viable. Adding to this, all vigorous seeds will be or be germinable but all germinable seed need not be vigorous in nature. Seed with good vigour and good health is preferred for raising a good plantation as the fruits, the economic come out are to be realized after several years. So, the selection of seed based on seed vigour is important for raising perfect plantation.

Various classes of seeds

The basis of seed multiplication of all notified varieties/hybrids is the Nucleus seed. Generally, 4-5 classes of seeds are seen which are mentioned below:

Nuclear seed

Nucleus seeds are cent percent pure seed on genetic basis with no physical impurity as well as full genetic purity which are generally originated or developed by the eminent indigenous breeders/Agricultural Institute/State Agriculture University (SAU) from raising primary nucleus seed stock. In this a pedigree record certificate is taken by the producing breeder.

1. Breeder seed

Breeder seed is also a hundred percent physically and genetically pure seed for foundation seed production. For breeder seed, golden yellow coloured certificate is provided for this class of seed by the producing breeder or workers.

2. Foundation seed

Foundation seeds are the offspring of breeder seeds which are build and admitted by seed producing agencies in public and private sector, under management of seed certification agencies in such a way that its quality standards is continued according to prescribed field ad seed standards. A white coloured certificate is provided for foundation seed by the concerned seed certification agencies.

3. Registered seed

This seed is the offspring of the foundation seed that is so made as to continue its genetic recognition of seed and purity according to specified standard for the specific crop being certified. A purple colour certificate is given for this stage of seed.

4. Certified seed

It is the offspring of foundation seed which is made by certified seed growers under seed certification agencies management system to constant the seed quality as per minimum seed certification standards. A blue colour certificate is given by seed certification agency for the certified seed category.

Fig. 1- Various types of tags used in certification of all the types of seeds

Source: Seed classes Retrieved from https://agristudent.com/seed-classes/ and amazon.in 20/08/2020

The certified seeds and foundation seeds can be increased at stage 1 and II, but the reproduction cannot be increased to 3 generations after breeder seed.

Certified and truthful labelled seed's differences

Certified seed	Truthful labelled seed
Seed certification is an optional step.	Truthful labelling for all notified kind of varieties is a compulsory step.
Quality of certified seed is generally approved by the concerned certification agency.	Quality of truthful labelled seeds is guaranteed by seed producing agency.
Applicable to notified kinds only	Relevant to both released varieties and notified ones.
Certified seed should convince both minimum field and seed standards.	These seeds are tested for physical clarity, fitness, and germination.
Seed certification officer, seed inspectors can take samples for inspection	Seed inspectors alone can take samples for checking the seed quality.

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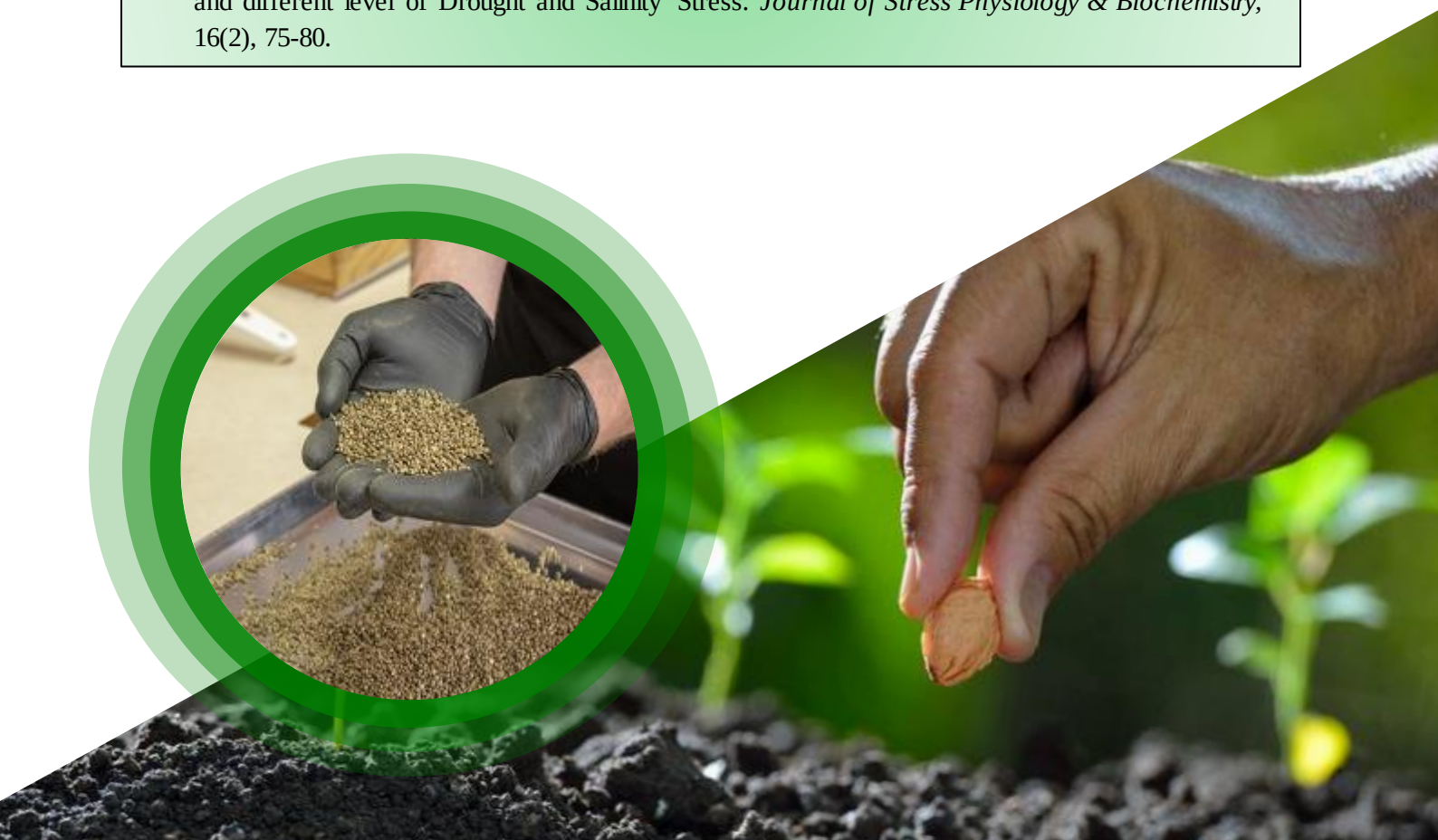

Use and Advantages of LCC for effective Nitrogen management in Maize

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> "Nitrogen availability with crop needs is the best management practice that would result in better N-use efficiency and yield. Nutrient-management approach leaf-colour chart (LCC) are the better options to increase fertilizer efficiency and productivity of maize."

Introduction

Maize is a crop of worldwide economic importance, provides approximately 30 per cent of the food calories to more than 4.5 billion people in 94 developing countries. The demand for maize is expected to be doubled worldwide by 2050. About 85 per cent of the maize produced is consumed as human food and animal feed including poultry. If the farmer do farming with a proper guidance and latest technology, then can earn good profit from the high yield of this crop.

Why it needed?

Nitrogen being the most yield-limiting factor in maize, its stress reduces growth and yield and considered as a most crucial nutrient. Poor nitrogen utilization in maize crop is due to inclusion of excessive nitrogenous fertilizers by farmers in the absence of nutrient recommendations as well as without assessing the crop-N demand and crop stage. Furthermore, problem associated with this nutrient is the high mobility in soil, causing loss by heavy rainfall. Therefore, N management poses a serious challenge in addition to loss of N in such area having high rainfall and temperature. Hence higher yield of maize on sustainable basis are of paramount importance in this region.

Fine-tuning rate and time by split application in order to coincide nitrogen availability with crop needs is the best management practice that would result in better N-use efficiency and yield. Nutrient-management approach leaf-colour chart (LCC) are the better options to increase fertilizer efficiency and productivity of maize.

What is LCC (Leaf color chart)?

Leaf color chart (LCC) is an innovative cost effective tool for real-time or crop need based N management in maize. LCC is a phenomenal and subjective indicator of plant nitrogen deficiency and is an economical, easy to use. It measures leaf color intensity that is related to leaf N status. LCC is an ideal tool to optimize N use in Maize at high yield levels, irrespective of the source of Nitrogen applied. It is an eco-friendly tool in the hands of farmer.

How to use LCC (Leaf color chart):

The color panels of the LCC are designed to indicate whether maize are hungry or over- fed by nitrogen fertilizer. By matching the color of the maize leaf to the color on the LCC farmer can judge proper time and amount of N Fertilizer for application.

- Randomly select at least 10 healthy maize plants in a field with uniform plant population.
- Choose the topmost fully expanded leaf from each plant. Place the mid part of the leaf on a chart and match the leaf color with the color panels of the LCC. Do not dispart or destroy the leaf.

- Measure the leaf color under the shadow of your body, because straight sunlight affects leaf color readings. If possible, the same person should take LCC readings at the same time of the day.
- Negotiate the average LCC reading for the selected leaves.

Advantages of LCC (Leaf color chart):

- Increase crop production per hectare.
- It saves 20-30 kg of nitrogen per hectare.
- Improve nitrogen use efficiency of plants.
- Easy to use.
- Do not require any type of power.
- Cheaper than S.P.A.D. meter
- Comparatively less incidence of disease and pest.

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