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RESEARCH & EVALUATION

SYSTEMS OF VARIETIES IN INDIA

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Agriculture Updates

7th Dr. M. S. Swaminathan Award

The prestigious **7th Dr. M. S. Swaminathan Award** for the period **2017-2019** was awarded to **Dr. V. Praveen Rao,** the Vice Chancellor of Professor Jayashankar Telangana State Agricultural University. This biennial national award jointly constituted by Retired ICAR Employees Association (RICAREA) and Nuziveedu Seeds Limited (NSL) carries a cash prize of **Rs. 2 Lakhs**, a **Gold Medal** and a citation.

Dr. Praveen Rao currently the **first Vice Chancellor** of Professor Jayashankar Telangana State Agricultural University has, to his credit, outstanding contribution in the area of micro irrigation.

Visakha Organic Mela-2021

The **2nd organic mela** – **Visakha Organic Mela-2021** - will be held at **A.S. Raja Ground** at MVP Colony on **December 3, 4 and 5**. NABARD chairman **Chinthala Govindaraju** inaugurated the three-day Visakha Organic Mela -2021 at AS Raja Grounds in MVP Colony in Visakhapatnam.

Organic farmers and traders from across the state participated in the **three-day mela**. They displayed their organic products at the exhibition that has more than **100 stalls**. On the final day, awards will be given to organic farmers, NGOs, journalists, and scientists who were promoting organic farming.

First 'poultry waste-free district'

Kannur district is leading by example in **poultry waste management** and is in its pursuit of an ambitious accolade- **Kerala's first 'poultry waste-free district',** by end of January. This has been spearheaded by the combined efforts of **Suchitwa Mission** and **Haritha Keralam Mission.**

The objective is to put an end to the issue faced by the people from the illegal dumping of slaughter waste.

The vendors have welcomed the move and are in favour of the scientific processing of poultry waste.

(MoRD) and Flipkart signed a MoU for (DAY-NRLM)

Ministry of Rural Development of Government of India (MoRD) and Flipkart has signed a Memorandum of Understanding (MoU) for the **Deendayal Antyodaya Yojana** – National Rural Livelihood Mission (DAY-NRLM).

MoU between **ministry & Flipkart** will help in empowering **local businesses** and **self-help groups** (SHGs) by bringing them into the e-commerce fold.

Partnership is in line with the **DAY-NRLM's** objective of strengthening the capabilities of rural communities for **self-employment** and **entrepreneurship**.

Thus, it provides further momentum to the Prime Minister Narendra Modi's vision of an **Atma Nirbhar Bharat.**

IFFCO ranked 'number one in cooperative society'

The **Indian Farmers Fertiliser Cooperative Limited** (IFFCO) has been ranked **'number one Cooperative'** among the **top 300 cooperatives** in the world. The ranking is based on the **ratio of turnover** over the gross domestic product (GDP) per capita. It signifies that IFFCO is contributing significantly to the GDP and economic growth of the nation. The 2021 edition of the **10th Annual World Cooperative Monitor** (WCM) report, withholding its position from the 2020 edition.

- IFFCO **Founded**: **1967**
- IFFCO **Headquarters**: **New Delhi**, **India**
- IFFCO **MD & CEO**: **Dr. U. S. Awasthi.**

Union Cabinet approved PMKSY for 2021-26

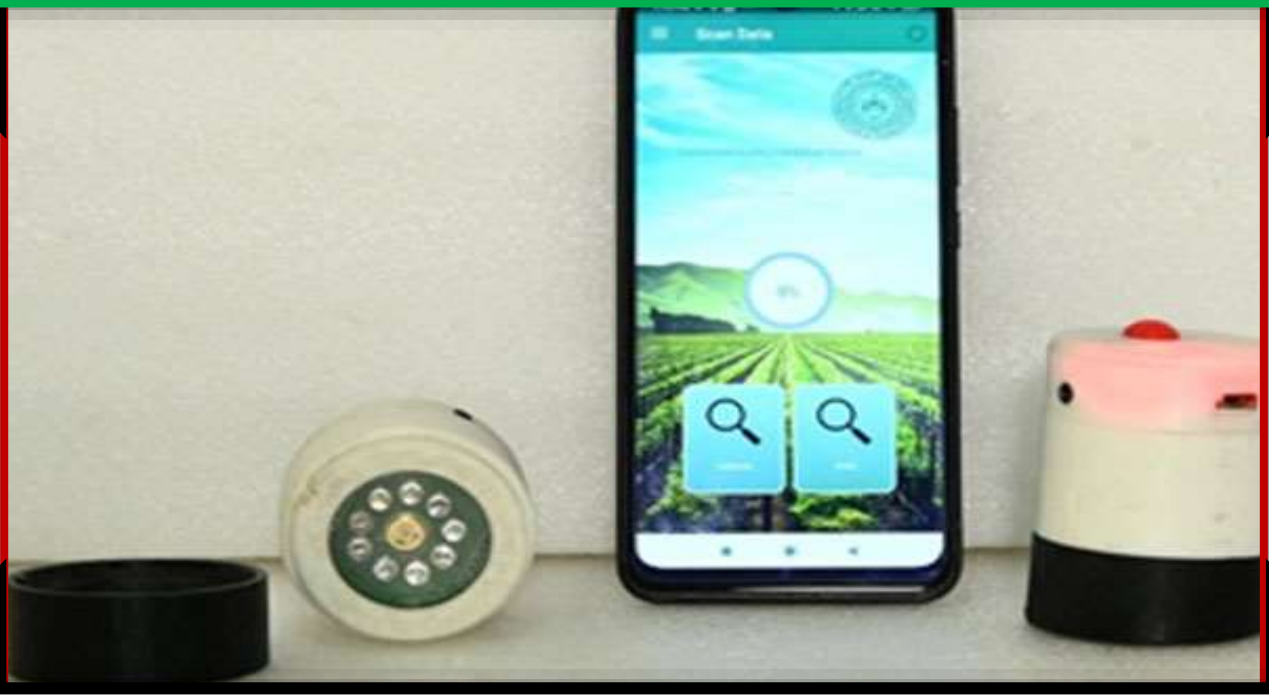
The Union Cabinet approved the implementation of **Pradhan Mantri Krishi Sinchayee Yojana** (PMKSY) for **2021-26** with an outlay of **Rs.93,068 crore** that aims to benefit about **22 lakh farmers** including 2.5 lakh SC and 2 lakh ST farmers in the country. Addressing the media, Union Minister Gajendra Singh Shekhawat said, "Pradhan Mantri Krishi Sinchayee Yojana was implemented in the country in 2015-16 under Prime Minister Narendra Modi. In **2015-16**, a total of **99 projects** were identified which were completed more than 50 per cent but had been pending for years. Of the 99 projects that were identified, 46 have been completed. The rest of the projects will be **completed by 2024-25**."

2nd edition of 'Animal Husbandry Startup Grand Challenge'

The **Department of Animal Husbandry and Dairying**, in partnership with Startup India, launched the **2nd edition** of **'Animal Husbandry Startup Grand Challenge'** at an event celebrating **'National Milk Day'** in Anand, Gujarat to commemorate the birth centenary of **Dr. Varghese Kurien**.

The **1st edition** of the startup grand challenge was launched by Prime Minister, Shri Narendra Modi, on **12th September, 2019**. Shri Parshottam Rupala, to scout for innovative and commercially viable solutions to address six problems faced by the animal husbandry and dairy sector. The challenge is open for application on the Startup India portal – **www.startupindia.gov.in**

Bhu Parikshak



A team of researchers at the Indian Institute of Technology, **Kanpur (IIT-K)** has created **Bhu Parikshak- a portable, app-linked soil testing device** that will help in analysing soil and using fertilisers accordingly. The device has a **5cm cylinder**, where **5 grams of dry soil needs** to be put for the device to analyse the soil composition. Once the sample is added to the device, it can **analyse the presence of six elements** in the soil - **nitrogen, phosphorus, potassium, organic carbon, clay and the soil's cation exchange capacity**. A memorandum of understanding (MoU) has already been signed between IIT-K and AgroNxt Services -- which has licensed the technology and will mass produce it to bring it to the market.

CCEA approved MSP of copra for 2022 season

The Cabinet Committee on Economic Affairs (CCEA) chaired by Prime Minister Narendra Modi has given its approval for the **Minimum Support Prices (MSPs)** for **copra for 2022 season**. The MSP for fair average quality of **milling copra** has been increased to **Rs. 10,590 per quintal for 2022 season** from **₹10,335 in 2021** and the minimum price for **ball copra** has been increased to **Rs.11,000 per quintal for 2022** season from **₹10,600 in 2021,** the CCEA said. The cabinet said the move is to ensure a return of **51.85% for milling copra** and **57.73% for ball copra** over the all India weighted average cost of production. "The increase in MSP for copra for 2022 season is in line with the principle of fixing the MSP at a level of at least 1.5 times the all India weighted average cost of production.

Cover Story

IMPROVED CROP VARIETIES TO THE HANDS OF A GROWER THROUGH ROBUST RESEARCH & EVALUATION SYSTEMS IN INDIA

From the dawn of civilization, agriculture is the mainstay of India and improved agricultural practices principally depend on the use of newly evolved improved crop varieties. In Indian scenario, a robust and statutory varietal release system is working where notification and denotification process are playing a crucial role in quality regulation of seed. Crop research institutes of **ICAR** (Indian Council of Agricultural Research), **SAUs** (State Agricultural Universities) and private seed companies are the main pillars to discover and develop improved varieties in India. The thumb rule is, improved variety must have a superior yield compared to the existing one (national and state check varieties) and this is ensured via several multilocational evaluations at stage wise levels.

India is a fast-growing economy and agrarian country. Almost **70 per cent** of the Indian population depends on agriculture and its allied sectors to obtain employment and sustain livelihood. Seed is considered as a basic and key input in agriculture. In order to reduce the dependence of food on foreign countries, doubling the farm income and to meet the nutritional demand of expanding population and to become self-reliant in food grain production, Indian Government established **All India Coordinated Crop Research Projects** (AICCRPs) and other institutes in a systemic manner to produce a large number of improved varieties with assured availability of quality seed for all major crops. The ultimate intention was to introduce the newly evolved high yielding cultivars to the hands of resource-poor farmers for region wide cultivation in the area of their adoption.

THE GOVERNING BODIES

The Government of India acknowledged seed an essential commodity under the Essential Commodities Act, 1955. On October 1964, Varietal Release System (VRS) came into existence with the formation of the Central Variety Release Committee (CVRC) at the national level, and State Variety Release Committees (SVRCs) at each state level. A Central Seed Committee (CSC) was established under the Ministry of Agriculture, Cooperation and Farmers Welfare provided in the Seeds Act, 1966. The functions of the CVRC were taken over by the CSC in 1969 to ensure the quality of seeds on sale and notification of the varieties. To perform the function at central level for release/notification, provisional notification and de-notification of varieties, CSC constituted a Central Sub-Committee on Crop Standards, Notification & Release of Varieties for Agricultural Crops and Horticultural Crops. To perform similar functions at state level, State Seed Sub-Committee (SSSC) was constituted.

Let us now understand the Indian system of variety release, evaluation process at a different level, and the importance of notification and denotification.

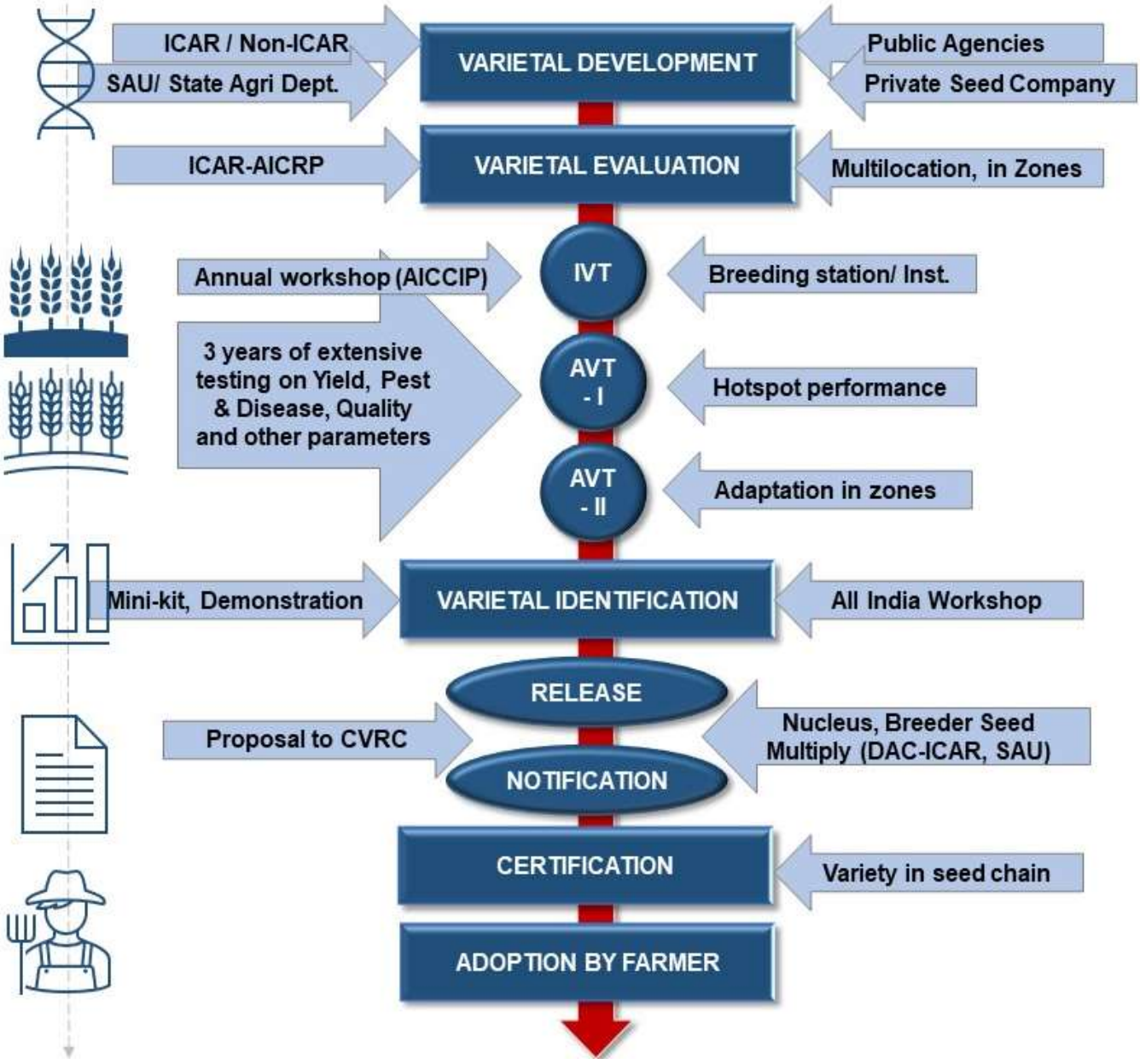


Fig: Event flow for crop varietal release and notification system in India.

1. DISCOVERY

Improved genetic materials are discovered and developed by the concerned plant breeders/ agencies through scientific pathways with extensive breeding programs for the benefit (food and nutritional security) of humankind. Different conventional and advanced plant breeding methods are being used by ICAR or non-ICAR National Institutes, SAUs, private national or multinational companies etc. to generate elite materials of high yield potential, better nutritional quality and other value added traits. Developed elite materials are being tested by the concerned plant breeder/s at their research stations for three to four years in replications for stability and selected superior cultivars enter into the All India coordinated crop improvement projects (AICCIPs) trials for further testing in multi-environments across the country.

2. DEVELOPMENT AND TESTING

First AICCIP was started way back in 1957 by ICAR on maize crop. In general, the three-tier system of multi-location evaluation is used for three years except perennial fodder crops (which requires four years-one for crop establishment and three for evaluation) in India. Multilocational trials are conducted by the Project Coordinator (PC)/ Project Director (PD) of AICCIP with the help of concerned Principle Investigators (PI). The AICCIPs have been developed for all the major crops including forage crops. All AICCIP trials are well organized, systematic and conducted through a uniform testing procedure across the centers as per crop standard.

A. THREE TIER SYSTEM OF EVALUATION

The AICCIP centers for various crops are located at ICAR institutes or State Agricultural Universities (SAUs) or other volunteer centers recommended by AICCIP workshop based on covered crop area, adaptability, and agro-climatic condition etc. It involves following steps trialing steps.

A.1 Initial Varietal Trial (IVT)

All the entries, which found superior in respective station trials under breeding institutes, would be introduced into the IVT which to be done for 1 year. These entries would be used for multi-location trials along with three checks (national, zonal and local) for efficient evaluation across the centers. The IVT trials are conducted in such a manner that minimum difference of yield (5–10%) and other ancillary traits can be measured. An IVT includes the maximum number of locations across the country to evaluate varietal adaptation and performance. The number of testing locations varies with crop across the zones. A team of scientists (plant breeder, agronomist, pathologist, entomologists etc.) monitor all the IVT trials as per the recommendation of the project coordinator who constitutes this monitoring teams. Entries which are superior to the best checks in terms of yield and other related traits will be promoted into the advanced varietal trial-I.

A.2 Advanced Varietal Trial-I (AVT-I)

Based on superiority (5–10%) over the best performing check, entries enter into the AVT-I from IVT. The number of tested entries in the AVT-I are less than IVT. The number of testing locations should be more as compared to IVT in a given zone for more realistic data on yield and other economically important traits, varietal adaptation, biotic and abiotic stress tolerance, quality parameters, etc. National, zonal and local checks (which were used in IVT) are used for critical analysis along with the entries. Same as IVT, monitoring team are deputed by the PC/ PD at different growth stages of the crop and observed data are submitted to the concerned PC/ PD. Based on the performance of entry over the best performing check-in the respective zone, the superior entries would enter into the AVT-II.

A.3 Advanced Varietal Trial-II (AVT-II)

In AVT-II, all the requirements shall be fulfilled as like AVT-I. The seed technology center develops descriptors of the varieties which help in the seed certification process. All the processed and analyzed data on yield and other related traits, across the locations/ centers (cooperatives and volunteer) are submitted to the PC. On the basis of these data, annual reports are being made in each crop. All the data of superior entries are comprehensively discussed in the annual workshop/ national group meetings by the PC/ project director. After completion of the AVT-II, the concerned breeders are informed to submit varietal proposal to CVRC/ CSC based on the performance of their entries during three years of evaluation.

3. VARIETAL IDENTIFICATION

Based on three years performance, best performing test entries are identified in the annual crop workshop or national group meet. The Zonal Coordinators and Principal Investigators attend the national group meet to provide wider aspects of information on the selected varieties. After the approval from Deputy Director General (Crop Science) of ICAR, a "Varietal Identification Committee (VIC)" constituted in advance of annual workshop or national group meet. Principal investigators (PIs) of different disciplines can assist in the process of discussion but they do not have the right to vote. Only committee members have the right to cast vote. The VIC provides detailed information on recommended entries to the Central Sub-Committee on Crop Standards, Notification, and Release. This committee has sole right to release and notify the best-performing entry into national wise or zonal wise based on the varietal eligibility criteria and by recommendations of the VIC.

4. RELEASE AND NOTIFICATION

Central Sub-Committee releases varieties as per the benefit of the stakeholders/ farmers and need of regional, zonal or national importance, and the State Seed Sub-Committee releases varieties beneficial for a particular state. Notification of variety is compulsory on regulating the seed quality under the provision of **Seed Act, 1966**. Notification usually authorizes certified seed production throughout the country, by private or public seed multiplication organizations. Once the CSC accepts the notification proposal, the varieties/ hybrids are released for the concerned agro-climatic zone(s) (which may cover one or more number of states or nationally). Simultaneously, a variety must be notified for seed certification purpose in the country.

Being agriculture as a state subject in India, centrally released varieties are not directly accepted by all the states for which they have been released. Each state has its own regulatory system which they have to follow for varietal release in the state. They have to pass through all the steps of the concerned state release procedure before they approve for cultivation in the state *viz*., state wise multi-location trials for three years and adaptive trials based on the requirement. The notification requires that the variety must have been tested at least for one year in the AICCIP trials and recommended for release in the state by the AICCIP Varietal Identification Committee.

IMPORTANCE OF NOTIFICATION

The purpose of release of cultivars is to introduce the newly evolved varieties to the public for general cultivation in the region in which it is suitable. It enables the farmers to choose cultivars for cultivation in a region. In other words, release of a cultivar is in the nature of a recommendation to the farmers for its adoption. However, since only notified varieties will be under the purview of Seed Law Enforcement, hence it is necessary to bring the seed of a particular crop variety under notification system. The seed inspector can only draw a sample from notified variety for analysis and ensure the seed quality. A released variety cannot come under seed chain without notification by the Gazette of India. Therefore, these issues will make the notification as necessary requirement for other things to act on it. Notification is also prerequisite for production of certified seed which ensures high quality of seeds to the hands of a farmer. After notification, variety becomes asset of government of India. Notification also helps in the genesis of original variety based on its pedigree and regulates any kind of infringement in the later stages of varietal promotion.

DE-NOTIFICATION OF VARIETIES

Released varieties can be de-notified if they are not performing well in the area of their adoption or have been in cultivation for more than 15 years or are not much in demand from the grower. De-notification can be done based on the recommendation of CSC by the government of India.

Conclusion

There are several ways and means to increase the crop production and productivity, however using genetically pure and high-quality seed is first and prime objective in agriculture. Therefore, the variety which will be used by farmers must have undergone several evaluations in order to ensure its stable yield potential, tolerance to biotic and abiotic stresses and these criteria are being fulfilled by a legal varietal release system. The main objective of the varietal release system in India is to introduce newly developed, high yielding varieties to the farmers for wide cultivation in the area of their adoption and only those varieties will be notified which are superior to the existing ones. It provides choice to the farmers to cultivate a specific variety, based on their need for crop diversification. This augments the varietal replacement rate in the country and maintain a vibrant seed system in India. The systemic varietal evaluation and release framework has helped farmers to get high quality of seed of superior features from market / Seed Corporations for which the production has increased many folds since the inception of AICCP. With this robust system it is not far to realize the doubling of farm income by Indian farmers driven by quality research, development and stable seed system.

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A CRITICAL NOTE ON SOLAR ENERGY FOR FUTURE AGRICULTURAL APPLICATIONS

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The world's energy demand is rapidly increasing because of population growth and advancements in technologies. There are two types of energy sources such as renewable source and non-renewable source. Any natural resources that can be replaced rapidly are considered as renewable energy sources. These energy sources are abundant, renewable, naturally replenished and environmentally friendly. It includes solar energy from the sun, wind energy, geothermal energy from the heat inside the earth, hydropower from running water, ocean energy in the form of waves and biomass from plants. A non-renewable resource is a resource that cannot be replaced once it has been consumed. It includes petroleum, hydrocarbon gas and liquids, natural gas, coal and nuclear energy. Both energy sources have advantages and disadvantages based on different technologies that are used in our current energy system. There is a growing trend in using renewable energy sources and creating technology to improve their efficiency because of the limited amount of fossil fuels available and their environmental effects. Solar energy is one among renewable energy sources with a high potential to effective agricultural applications in a sustainable manner. However, the fundamental aspects of such concept is still not displayed properly among agricultural communities all over the world. This critical note therefore tends to display a cutting edge view of potential solar energy applications among readers of this magazine.

SOLAR ENERGY

Solar power is an unlimited source of energy on the earth. Moreover, every day the sun produces significantly more energy than human requirements to power everything on the entire globe. However, most of the useful fraction of the solar energy is still wasted without productive outcomes. Therefore, it is important to promote the applications of solar energy in agriculture for the better environmental sustainability. The following sections have therefore been filtered from the vast array of literature in order to provide innovative views to the readers so as to increase the use of solar energy for various agricultural applications.

Important facts regarding solar energy to be emphasized for a better expansion in future.

- **Renewable:** Solar panels generate electricity by converting the sun's constant flow of energy into electricity. It can be used for various agricultural applications including automated dryers and greenhouses.
- **Free of CO_2 emissions:** When solar panels generate power, no hazardous emissions are emitted into the atmosphere. It is widely accepted that the emission potential of solar systems is negligible, and it is badly needed to help minimize the emission of greenhouse gases by the burning of fossil fuel resources.
- **Low operating cost:** The photovoltaic process does not contain fuel and other variable costs. However, users of the solar energy do not understand it clearly. It is important to make it clear among the various users of solar energy.

SOLAR ENERGY TECHNOLOGIES

In one hour, the sun produces energy to the earth higher than the entire global energy need per year. Sunlight is converted into usable energy sources using variety of technologies. There are two ways to obtain solar energy from sunlight such as energy from heating systems and electricity from photovoltaic technology (PV). Solar thermal and photovoltaic technologies are two types of solar energy technologies. Solar thermal technology converts the energy of solar radiation into heat using flat-plate and concentrating solar collectors. It can then be stored and used in a variety of household, residential and industrial applications. PV systems are able to convert sunlight directly into electricity because they use semiconductors. In agriculture, both thermal and PV applications try to enhance profitability by improving yields, minimizing losses and speeding up production. There are various ways of applications of solar energy in the agriculture sector. The following said windows of solar energy applications in agriculture can be upgraded using innovative technologies.

- Solar dryers
- Solar greenhouses
- Irrigation for agricultural crop

SOLAR DRYERS

The presence of moisture in agricultural commodities causes microbial deterioration of such products. Therefore, it is essential to remove free water present in such products in order to avoid spoilage of organisms' activity. Food preservation through drying is one of the earliest and most widely utilized strategies for enhancing the nutritional value of food. Food is

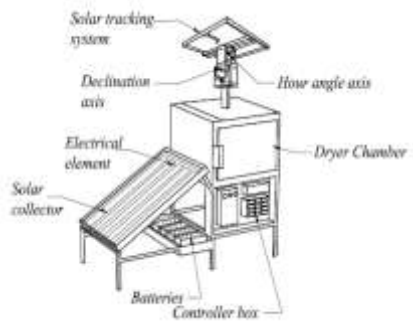

Figure 1: Hybrid solar dryer with solar tracking system (dual axis solar tracker)

dried to remove moisture so that it can be stored for a long period and be protected against contamination. Furthermore, reducing the weight and volume of materials helps to make easy transportation and storage of agricultural commodities. However, the efficiency of solar drying systems can be improved further by the incorporation of hybrid systems as clearly explained in the Figure 1. A new concept has been proposed with tracking system for the improvements in solar drying of agricultural produces as shown in the Figure 1. Therefore, the efficiency of solar absorption would be higher than normal hybrid solar dryer, if the proposed concept is validated scientifically. It then leads to effective utilization of solar energy for drying of agricultural produces. This cutting-edge concept can be utilized by researchers of various sectors for the development highly effective solar drying systems with reasonable level of energy.

AUTOMATED SOLAR GREEN-HOUSES

The greenhouse is a structure that is now commonly used in agriculture to cultivate high quality plants. Solar energy has recently been used to heat greenhouses called as solar greenhouses. Solar greenhouses are intended to collect solar energy not only during sunny days but also to store heat for use at night or during cloudy periods. Solar panel can be a wall mounted or attached to houses or barns. Solar energy can also be used to provide light to the greenhouse. Solar powered agricultural greenhouses are categorized into two types such as passive and active solar greenhouses. Active solar greenhouses (ASGs) are combined with solar systems such as photovoltaic (PV), photovoltaic thermal (PVT) or solar thermal collectors to accelerate the collection of solar energy, whereas passive solar

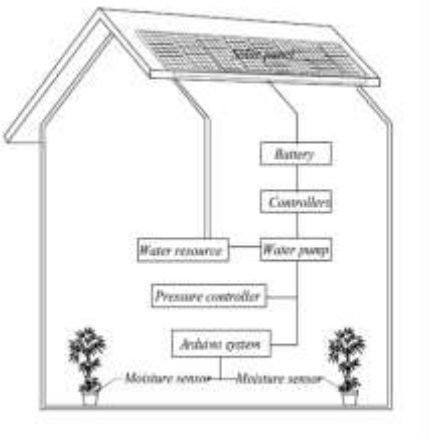

Figure 2: Active solar greenhouse with automated irrigation system

greenhouses (PSGs) are designed to obtain as much of solar energy as possible. A new concept has been proposed to design automated greenhouses for various plants. The below Figure 2 is the conceptualized framework for helping researchers and others to develop effective automated greenhouses. Solar energy is used in several regions of the world to irrigate agricultural crops in areas where there is no access to an electrical grid.

The Figure 2 shows the automated solar irrigation system. An electrical motor can be operated by a controlled solar energy system with stored energy to operate irrigation systems. Automated irrigation is controlled with the help of Arduino system and moisture sensors in the greenhouse. Moreover, solar electric (photovoltaic) systems for greenhouses are not cost effective unless you are growing high value crops. Furthermore, studies on automated greenhouses are very limited. Hence, there is need to perform comprehensive scientific evaluations into the automated greenhouses for the better utilization of these structures at the commercial level.

CONCLUSION

Agricultural technology is rapidly growing. Farm machinery, farm structures and production facilities are all being updated on a regular basis. This critical note is a summary of the newly conceptualized windows of solar energy applications for the better agricultural outcomes in future. Moreover, this piece of the discussion is considered important for various researchers all over the world to significantly expand effective use of solar energy in agricultural applications. It will help improve environmental sustainability for future generations.

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STINGLESS BEES: AN EMERGING AND POTENTIAL POLLINATOR

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Stingless bees belong to the family Apidae and tribe Meliponinae. At the moment, both wild and domesticated bee colonies are quickly dwindling, posing a global threat to pollination services. As pollinators of many wild species, stingless bees perform an important ecological function and appear to be promising candidate for future commercial pollination alternatives. These are native pollinators in tropical and subtropical areas of world. Like honey bees these bees also possess colony life and division of labour is also there. These also exhibits foraging activities and carry pollen, nectar and other plant-based materials. The honey produced by stingless bees is known as pot honey and it contains different minerals, sugars (Fructose, Glucose, Sucrose and Trehalulose), flavonoids, phenolic compounds etc. This honey has excellent antioxidant and antibiotic properties and also used in wound healing and fighting both internal and external infections. This article shows the efficiency of stingless bees as crop pollinators and also as an economically important insect.

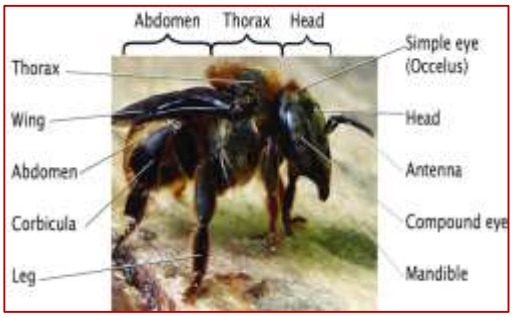
INTRODUCTION

Pollination is a vital ecosystem service that increases food security and improves livelihoods. Many species, including bees, are the primary pollinators that perform this function. Bees plays a crucial role in pollination of flowering plants, resulting in quantity and quality of fruits and seeds. They are known to pollinate approximately 70-80% of flowering plants. Until far, the majority of controlled pollination services have been through the utilization of *Apis melifera*, the honeybee. But now a days population of honey bees is declining day by day. As a result, it has become necessary to look for a credible alternative for regulated pollination in both agricultural and natural areas. This search appears to have led to Stingless bees, which have existed in tropical and subtropical habitats since the beginning of time. Stingless bees play a vital part in basic health care by producing therapeutic hive products such as honey, propolis, and Beebread. Stingless bees comprise many species and can be found in tropical regions of the world including Central and Southern America, Australia and Africa.

HIERARCHICAL CLASSIFICATION OF STINGLESS BEES

Order– Hymenoptera
Family– Apidae
Sub-family- Apinae
Tribe- Meliponini
Two genera- Melipona and Trigona

MORPHOLOGY OF STINGLESS BEES



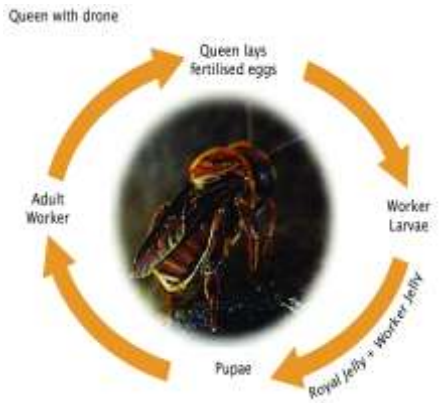
External morphology of a worker stingless bee (*Meliponula bocandei*) (fig.1)

LIFECYCLE OF STINGLESS BEES

The queen mates with a single drone from another colony and stores all the sperm she requires for egg fertilization during her life. This is done while in flight. She returns to her nest and starts laying two kinds of eggs, fertilized eggs and unfertilized eggs. The fertilized eggs develop into worker or queen larvae and unfertilized eggs develop into drone larvae.

The queen

The queen is mother of the colony and it controls all the activities of the nest. This is done by releasing chemical substances known as pheromones.



Life cycle of worker bees Fig. 2

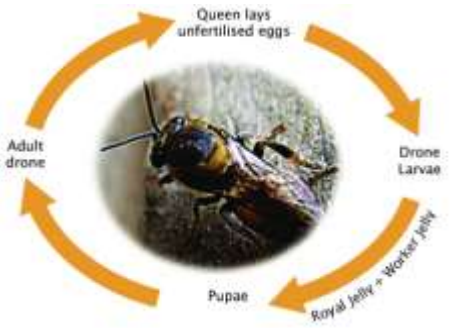
The workers

Workers develop from larvae produced from fertilized eggs, are the

female members of a colony apart from the queen. The larvae are fed royal jelly for a few days and then fed with worker jelly until the pupal stage when the cells are sealed. Adults emerge as workers and perform the majority of the nest's duties including as foraging, nest cleaning, defense, and larval feeding.

The Drone

Drones are male part of colony, and they play a key role in colony reproduction. These mate with virgin queens from different colonies. They are formed from unfertilized eggs. Drone larvae, like worker larvae, are fed larval food. Drones are observed as light-colored objects within the nest.



Life cycle of drones (fig.-3)

Swarming

When foraging resources are plentiful the number of their colonies increases. Colonies having a lot of resources split apart to develop new colonies. These young colonies disperse and establish new nests in new sites and this phenomenon is known as Swarming. This usually happens during the dry season.

COLONY BEHAVIOUR

1. Nesting biology

Stingless bees have adapted to a broad variety of nesting places, including ant and termite nests above and below ground, cavities in trees, branches, rocks, or human constructions, as well as largely self-constructed, exposed nests in trees. Stingless bee nests are mostly constructed of cerumen, which is bee-produced wax combined with resin and other sticky plant components. The entrance to stingless bee nests varies from small, inconspicuous openings the size of a bee head (e.g. in *Frieseomelitta* and some *Melipona*) to large elaborate and ornate tubes of more than 50 cm length. The brood portion is surrounded by many layers of cerumen membranes known as the involucrum, which is necessary for temperature control in the nest and layers are separated and suspended by connectives and pillars. Activities done in nest are 1. Storage pot construction 2. Honey and pollen processing and packing 3. House cleaning and maintenance 4. Larval feeding and provisioning 5. Queen grooming and feeding 6. Colony security.

2. Colony defence

In response to these external threats, stingless bees have evolved many fascinating defence traits, but they have also lost the most obvious defence trait, the sting. Other defensive features compensate for the loss of a functional sting. Defensive techniques differ widely among stingless bee species and are dependent on the enemy. Threats to stingless bees colony are-

Predators: lizards, birds, toads, spiders, and ants.

Intruders: robber bees, hive beetles, wax moths, flies, other animals and man.

Workers on guard retract into the nest at night and apply propolis to seal the nest entrances. This behaviour keeps ants, beetles, and other animals out of the nest. Every morning, the propolis seal at the entrance is removed and replaced with a new one. To enhance colony defence, certain stingless bee species build a long and convoluted tunnel to the outside of the nest. Species that attack large vertebrates frequently do so in great numbers, and typically attempt to penetrate noses, ears, hair, or eyes.

3. Foraging

Stingless bees require a variety of materials in order to rear brood, develop nest structures, and protect their colony. This has significant implications for tropical ecosystems because pollen, the primary protein source for larvae, and carbohydrates in the form of floral nectars lead to pollination. Thousands of plant species are projected to benefit from stingless bee pollination around the world. Stingless bees differ from honey bees in that they spend a large amount of time foraging for non-floral resources (such as resinous materials, fruit juice, and carrion). Workers begin foraging efforts as early as sunrise and finish by dusk, depending on weather and forage availability. Peak foraging seasons correlate with the dry season, when forage is plentiful. Generally stingless bees forage within 2km radius from their nest.

4. Inter-colony relationship

Worker bees can get confused and probably wind up in the nest of another colony. Members are quickly recognized if they enter a different colony because each nest is unique, especially in what is termed as 'colony odor.' They are either accepted if they bring food, or they are regarded as robbers and are refused. In certain cases, colony workers specialize as robbers and raid others' whole supplies.

ECONOMIC IMPORTANCE OF STINGLESS BEES

Stingless bees are important very important as they are required for pollination, production of medicinal honey and other hive products.

1. Pollination

Pollination is the transfer of male sex cells (pollen grains) from the anther to the female receptacle (stigma) of the same or different flower of the same plant species. Pollination results in fertilization and the formation of fruits and seeds. Stingless bees because of their small size known as efficient and potential pollinator for forest trees.

Stingless bees obtain nectar, pollen, wax, resins, oils, and other plant substances from flowers of plants such as crops and forest trees, as well as shrubs and herbs. They accomplish this by transferring pollen grains to stigmas, resulting in pollination of these plants, which leads to fertilization and finally, fruit and seed production. The frequency with which they visit flowers and their efficiency (ability to deposit pollen collected on the bees' bodies on stigmatic heads) in pollination result in high quality and quantity yields of fruits and seeds. These bees can also be employed as an efficient pollinator in greenhouse crops and plants in both temperate and tropical regions.

2. Hive products

Stingless bees produce honey, propolis, wax and pollen or beebread. All these products have unique medicinal qualities.

- **Honey**

Honey is produced by stingless bees from the nectar of flowering plants and stored in wax cerumen pots. Honey is mostly composed of glucose and fructose, but it also contains minerals, vitamins, and other elements. It is the primary source of energy for bees and can serve as an energy booster for people. Stingless bee honey can be utilized in the creation of bread, cookies, and biscuits, as well as alcoholic and non-alcoholic beverages. Fletcher et al. (2020) suggests that the disaccharide commonly identified as maltose is, in fact, Trehalulose, an isomer of sucrose. This is an intriguing finding because Trehalulose has potential health benefits for humans. Stingless bee honey is well-known for its antioxidant and antibacterial characteristics, which contribute to its effectiveness in wound healing and treating both internal and external infections.

- **Pollen**

Workers of stingless bees collect pollen grains from the flowers

and stored them as beebread in nest. Pollen can be harvested by beekeepers from workers by fitting pollen trap at the entrance of the nest. It is rich in vitamins, proteins and minerals and can be used as food supplement and also added to infant food. It is also used in cosmetic preparations.

- **Propolis**

Propolis is used to protect nest against all external intruders by sealing all openings and cracks. Bees produced this propolis by collecting resins, gums and other plant exudates. It can be harvested from hives by scrapping with the help of hive tool. Stingless bees generate propolis by collecting resins, gums, and other plant exudates. Propolis has been scientifically demonstrated to be useful against a wide range of health problems. It is a natural antibiotic that helps the body heal wounds and infection. Propolis has been used to treat wounds (both internal and exterior), skin infections, and rashes. Propolis is believed to help manage blood pressure and enhance the immune system when used on a regular basis.

- **Bees wax**

Abdominal glands of worker bees secrete wax which is used for pot formation in nest. These pots are used for storage of food and rearing of brood. This bee wax can be used in body and facial creams as well as in lip balms also. This can be used in industrial products such as textiles and polishes. Beeswax also used as to coat tablets and capsules in pharmaceuticals.

3. AESTHETIC VALUE

Aesthetic value involves the creation of stingless bee artefacts such as jewellery and souvenirs in order to bring happiness and relief to people. Stingless bee images can be moulded from many materials such as wood, metals, plastics, and wax and utilized in jewellery such as necklaces, earrings, bangles, rings,

key holders, and so on. Wood and other materials can be used to create a variety of art pieces representing stingless bee pictures. Paintings and colour photographs can be printed and marketed as souvenirs on cups, plates, mugs, and T-shirts. Stingless bees may be interesting to maintain at home and at work to provide people with enjoyment and relief.

4. RESEARCH AND TRAININGS

Stingless bee colonies interact with their surroundings in a variety of ways. Human activities that have a negative impact on environmental health, such as poor farming methods and air and soil pollution, will also have an impact on stingless bees. As a result, stingless bee colonies can be utilized as indicators of environmental change. Stingless bee colonies can be used to do research on plant pollination, animal society behaviour, and other ecological investigations.

5. TOURISM

The curiosities that surround bees that do not sting as well as the fact that hive products from stingless bees have outstanding medical capabilities, provide excellent tourist attraction. People who want to test out some of the bee goods will be drawn to a natural forest setting with nests and various designs of bee hives. Visitors might purchase souvenir such as little artifacts, T-shirts and other appealing products.

DIFFERENCES BETWEEN STINGLESS BEES AND HONEY BEES

Both honey bees and stingless bees share important features but they are also different in number of ways. These bees lack a functional stinging apparatus and have reduced venation in wings. Main differences between stingless bees and honey bees.

Traits	Stingless bees	Honey bees
Species diversity	Approx. 550 described species	Approx. 10 described species
Building material	Cerumen and batumen: wax mixed with varying amounts resin and other materials	Pure wax for cells, propolis to close openings.
Brood and food cells	Different in shape, size and location	No difference in brood and food cells.
Mating numbers	Queens are singly mated	Queens mate with many males
Queen determination	Queen destined larvae receive more larval food. Genetic factors are likely to be important in *Melipona*	Queen rearing requires qualitatively and quantitatively different food
Brood cell	Open upwards and built newly for each egg	Open sideways, reused to rear next generation
Defence	Mandibles are biting, resin to immobilise small enemies	Mostly by stinging
Collected resources	Variety of resources next to nectar and pollen	Mostly nectar and pollen
Recruitment Communication	From solitary to chemical trails	Waggle dance

EMERGING CHALLENGES TO STINGLESS BEES

Like other insects, stingless bees are facing many challenges like agrochemicals, climate change and newer pathogens. A key challenge is conversion of natural and semi-natural land into urban or intensely farmed land. Deforestation has also become a threat to stingless bees as tree cavities are home for them. Pesticides also contribute to bee population decline in temperate areas. Neonicotenoids (e.g. imidacloprid, thiamethoxam) and phenylpyrazols (e.g. fipronil), for example, are neurotoxins that impair the functioning of the central nervous system of bees. Pesticides acquired in low doses might not kill individuals and colonies immediately, but they can have so-called sub-lethal effects by impairing learning and memory, navigation and reproduction bees.

CONCLUSION

Stingless bees are important alternate for pollination services. This can be a compliment to the honey production and pollination services provided by honeybees. As these bees have remarkable medicinal values in their honey, propolis and pollen. Due to some human activities in addition with pest and diseases impact, there is upcoming threat to survival of stingless bees. As Meliponiculture is not so prevalent in under developed countries so it requires collaborative efforts to conserve stingless bees in order to sustainably provide the valuable ecosystem services. So, the general public is therefore encouraged to showing interest and learning about stingless bees, planting trees and flowering plants and encouraging pollinator-friendly agriculture.

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HEALTH BENEFITS OF PICKLES

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Pickles are made from fruits and vegetables. It is one of the oldest preservation methods of several foodstuffs such as vegetables, fruits. Pickling imparts unique and desirable changes in flavor, texture and color that take place over time in fermented pickles. It contains Antioxidants, vitamins and minerals. Pickles not only complete our taste buds but the nutrients present in it also fulfill the nutritional; needs of the body. The antioxidant properties present in pickles protect the body from the damage caused by free radicals, as well as keep you young, because usually turmeric is used in all pickles.

Nutritional value in Pickles-

Pickling involves preserving foodstuffs under high acid concentration, enabling their preservation for over two years without refrigeration. Pickles are rich in Vit.- K, Vit.- A, Vit.- C, Potassium and calcium.

Vitamin K helps and protects to keep healthier the bones and vitamin A works to protect the eyes, skin and diseases. Potassium works by delivering nutrients to the cells and release the waste products out of the cells and calcium is considered as essential part for strong bones.

Pickling Equipment:

- Utensils made of zinc, iron, copper, or galvanized metal should not be used.
- For fresh-pack pickling large container made of stainless steel, glassware.
- For fermenting and bringing, a crock or stone jar, an un chipped enamel-lined pan, a glass jar, a bowl, used for small quantities.

Spices and Herbs make it even more delicious and Beneficial-

When spices are mixed with herbs and added to the pickle, not only does it give flavors to the pickle, but along with increasing the shelf life of the pickle, it also works to provide a lot of health benefits.

What are the benefits of spices-

Garlic:

Due to the presence of Vitamin B and cancer-fighting antioxidants in it, it works to fight cancer flu as well as increase immunity. It also works to reduce cholesterol level.

Cardamom powder:

It controls blood pressure and prevents from blood clotting in body.

Dry Red Chili:

Along with improving digestion and metabolism, it also helps in fighting infection.

Coriander seeds:

Along with smoothing the kidney function of the digestive system, it also takes care of the health of the skin and hair.

Mustard seeds:

Along with being rich in vitamins and minerals, they work

to protect against cancer and keep the digestive system healthy.

Turmeric:

It improves blood circulation as well as maintain digestive balance in body. It also increases immunity level in human body.

Fennel seeds:

Due to the high amount of fiber in it or keeps the stomach fine.

Dry Ginger:

It has anti-oxidants, anti-inflammatory and anti-allergic properties that works to improve digestion and protect against painful infections.

Many types of ingredients are added to pickles, but there is one thing that is used in very small quantities but leaves its flavor with health.

Nigella seeds:

It increases brain power, improve hair quality and very helpful for person whose are suffering from asthma disease.

Other benefits:

Helpful in digestion:

Fermented pickles are full with good bacteria called probiotics which are known to be good for stomach health.

Restore Electrolytes balance:

Electrolytes are salts that are needed for the proper body function and when a person has the problems of dehydration, it means that the balance of electrolytes in his body has also been disturbed. As such, electrolytes are high in sodium as well as high in electrolytes. That is why, pickles prove to be very beneficial in the event of dehydration after heavy work out.

Control the blood sugar:

Eating vinegar best pickles helps in controlling the sugar level as well as controlling the feeling of hunger very fast.

Rich in Antioxidants:

Like fruits and vegetables, pickles are also rich in antioxidants which protect the body from free radicals.

Eating pickles daily depends on your health to a great extent. Example if you have problems related to blood pressure, diabetes then pickles will not be good for you because it contains more spices and oil. But if you eat Vinegar best pickle daily, then it will take care of your health along with keeping the taste of your tongue right.

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HEALTH BENEFITS AND NUTRITIONAL VALUES OF GRAPES (*Vitis vinifera*)

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The grape (*Vitis vinifera*) is one of the most economically important fruit crops in the world and has many uses. Fruit is eaten fresh or made into juice, fermented to wines and brandy and dried into raisins production and sultanas. Total area under grapes in India is about 40,000 ha, with a total production 1,234.9 thousand tons and productivity of 11.1 tons/ha distributed mainly in Maharashtra, Karnataka, Andhra Pradesh and Tamil Nadu. **Nashik**, called **"grape capital of India"**, is the leading grape producer in the country, with about 1.75 lakh hectare of land under grape cultivation. The ideal climate for grape growing is the Mediterranean climate. In its natural habitat, the vines grow and produce during the hot and dry period. Under South Indian conditions vines produce vegetative growth during the period from April to September and then fruiting period from October to March. Temperatures above 100C to 400C influence the yield and quality.

Facts about grapes and their color:

Grapes are popularly called as the Queen of Fruits and are categorized into three variants based on their colour:

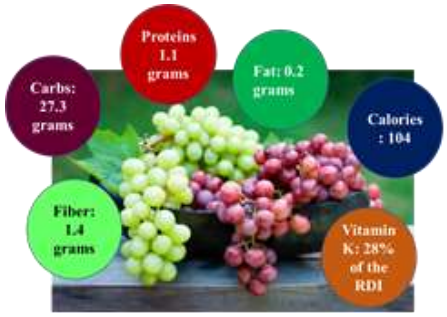
- Reds, Greens and Blacks/Blues.
- White or green grapes are the sweetest.
- Red grapes have the simplest flavour.
- Blue/black grapes taste the best if their colour is deep and rich.

Important TOP 10 Health benefits of grapes

1. Rich in Health-protecting Anti-oxidants

- Grapes are a powerhouse of antioxidants. They contain a wide range of phytonutrients right from carotenoids to polyphenols.
- Red grapes contain higher numbers of antioxidants the anthocyanins that give them their color. The antioxidant content is the highest in the seeds and the skin also found in plants.
- In fact, over 1,600 beneficial plant compounds have been identified in this fruit.
- One of the antioxidants in this fruit is resveratrol.
- It protects against chronic health conditions, such as diabetes, heart disease, lowers blood sugar and protects against the development of cancer including colon cancer and breast cancer.

2. Chock-a-block with Nutrients, Especially Vitamins C and K



- One cup of grapes (92g) provides 62 calories, 0.6g of protein, 16g of carbohydrates, and 0.3g of fat.
- Grapes are an excellent source of vitamins C and K necessary for connective tissue health.

3. Beneficial for heart health in various impressive ways

- Lower blood pressure. Eating one cup (151 grams) of grapes contains 288 mg of potassium, which is 6% of the RDI. May help reduce cholesterol.
- Eating three cups (500 grams) of red grapes a day for eight weeks was shown to lower total and "bad" LDL cholesterol. White grapes did not have the same effect.
- A low-sodium-high-potassium diet has proven beneficial may help reduce cholesterol.

4. May decrease blood sugar levels and protect against diabetes

- Grapes contain 23 grams of sugar per cup (151 grams), which may make you wonder if they're a good choice for people with

diabetes. Compounds found in grapes may even decrease blood sugar levels.

- Additionally, resveratrol has been shown to increase insulin sensitivity, which may improve your body's ability to use glucose and hence lower blood sugar levels and also increases the number of glucose receptors on cell membranes, which may have a beneficial effect on blood sugar

5. Good for the eyes

- Grapes promote eye health from signaling changes at the cellular level to directly countering oxidative stress.
- Grapes contain several compounds, such as resveratrol, lutein and zeaxanthin that may protect against common eye diseases, including age-related macular degeneration, cataracts and glaucoma.

6. Boost memory power, attention

- A certain compound found in grapes and nuts is believed to have some miraculous properties called as resveratrol.
- This compound is rich source of anti-oxidants and certain elements that are capable of

destroying the energy source of cancerous cells. It could help speed up mental responses and prove to be beneficial for those suffering from brain related ailments like Alzheimer's.

7. Good for the knees

- Grapes contain many nutrients important for bone health, including calcium, magnesium, phosphorus and vitamin K.

- Daily intake of grapes can help get relief from knee pain, especially the ones triggered due to symptomatic osteoarthritis. Most important and beneficial one being polyphenols, which help in improving the flexibility and mobility of joints.

8. Protect against certain bacteria, viruses and yeast infections

- Numerous compounds in grapes have been shown to protect against and fight bacterial and viral infections.
- Grape skin extract has been shown to protect against the flu virus.
- Compounds in grapes stopped the herpes virus, chicken pox and yeast infections from spreading.
- Resveratrol may also protect against foodborne illnesses. When added to different types of food, it was shown to prevent the growth of harmful bacteria, such as *E. Coli.*

9. Anti-inflammatory properties

- Grapes contain certain enzymes which bring about anti-inflammatory effect in our body.
- As such it brings about relief to the arteries, promotes heart health and helps in other repair functions of the body.

10. Cures Asthma

Due to their well-known therapeutic value, grapes can be used as a cure for asthma. Delicious, versatile and easily incorporated into a healthy diet. Grapes are easy to incorporate into a healthy diet. Here are a few ways you can enjoy them:

- Eat grapes plain as a snack.
- Freeze grapes for a cool treat.
- Add chopped grapes to a vegetable or chicken salad.
- Use grapes in a fruit salad.
- Add grapes or grape juice to a smoothie.
- Add grapes to a cheese board for an appetizer or dessert.
- Drink 100% grape juice.

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PRE-COOLING OF FRUITS AND VEGETABLES: AN OVERVIEW

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Fruits and vegetables harvested in the middle of the day under a hot sun absorb a lot of heat. Field heat is the heat gathered by the produce from the field. It reduces the shelf life of products by speeding up biological processes such as respiration and transpiration. The heat in the produce is primarily caused by the sun or by chemical reactions within the produced respiratory heat. Pre-cooling is critical for maximizing post-harvest life and minimizing the impact of product senescence on the market. It is also regarded as one of the most cost-effective methods of preserving the quality and extending the shelf life of commercial crops. The pre cooling process involves removing field heat immediately after harvest, as field heat hastens the deterioration and senescence processes. Pre-cooling rapidly reduces the temperature of freshly harvested produce and is performed immediately after harvest to minimize spoilage.

What is pre-cooling?

Pre-cooling is the rapid removal of field heat or respiratory heat from freshly harvested fruits and vegetables prior to shipment, storage, or processing in order to reduce metabolic activity. It is the first step in implementing good post-harvest management practices. Pre-cooling is an essential practice in any successful horticultural cool chain management.

WHAT IS OBJECTIVE OF PRE-COOLING?

Because there is such a large difference in temperature between harvested crops and cooling storage, the primary purpose of pre-cooling is to remove heat from the crops after they have been harvested. Pre-cooling reduces the rate of fruit respiration and thus increases crop storage life.

ADVANTAGES OF PRE-COOLING OF FRUITS AND VEGETABLES

- Reduces water loss from the produce.
- Slows respiration, transpiration, and ethylene production.
- Inhibits the growth of decay-causing organisms.
- Restriction of enzyme activities and aids in rapid wound healing.

PRE-COOLING LIMITATION

They can cause damage if the pre-cooling method is not used properly-

- The product's dehydration (if speed of cooling air is high).
- Tissue damage may occur as a result of improper packing.
- Produce decay as a result of the product's sensitivity to water exposure.
- Hasten decay due to water accumulation between the leaves and calyx.

METHOD OF PRE-COOLING

There are seven primary methods for pre-cooling fresh horticultural produce which are following.

1. Forced air cooling

Forced air heating is a method of distributing air throughout a home or structure by a cooling system. The air is forced through ducts and vents that are linked to a heating or cooling unit. This is in contrast to a central air conditioning system. The unit is almost always installed outside and still employs ducts and vents. It is suitable for Banana, Barbados cherry, Grape, Guava, Fig, Tomato, Cauliflower, Okra, Ginger, Bell pepper, and other fruits and vegetables.

2. Room cooling

Pre-cooling temperature for different Fruits and Vegetables

Commodity	Pre-cooling temperature (°C)
Mango	12-14
Banana	12-14
Strawberry	3-5
Grape	2-4
Kiwifruit	1-2
Orange	4-8
Pineapple	7-12
Asparagus	1-2
Potato	2-5
Tomato	10
Capsicum	7-10
Okra	7-10
Pumpkins	10-14
Cantaloupe	2-5

Room cooling is a slow method of cooling that occurs when a product cools passively inside a cool room. Depending on air circulation and container venting, temperatures can take hours or days to approach the room set point. Room cooling is simply placing a bin or carton of produce inside a cool room. It is appropriate for all fruits and vegetables (cabbage, garlic, onion, potato, sweet potato, lime, lemon, orange, pineapple, watermelon etc.).

3. Hydro-cooling

Hydro-cooling is the use of chilled or cold water to reduce the temperature of a product in bulk or smaller containers prior to further packing. The product is chilled by flooding, spraying, or immersing it in chilled water. There are several commercially available hydro-cooler designs. The cooling rates and overall process efficiencies of hydro-cooling methods vary. The method of cooling and the manner in which produce is moved or placed in the cooler distinguish the various techniques. For example, vegetables with stems and leaves, as well as fruits (broccoli, celery, cucumber, artichoke, cauliflower, pomegranate, kiwifruits, knoll-khol etc.).

4. Ice cooling

Crushed or fine granular ice is used to cool the produce in ice cooling. The ice is either packed in cartons or sacks around the produce, or it is made into slurry with water and injected into waxed cartons containing the produce. The ice then fills the gaps left by the produce. Contact or package icing was widely used for pre cooling produce and maintaining temperature during transit prior to the advent of comparatively modern pre cooling techniques. Unlike other cooling methods, however, ice not only quickly removes heat when applied, but it also continues to absorb heat as it melts. There are numerous methods for applying ice to produce in order to achieve the desired cooling effect. This method is appropriate for vegetables with roots, stems, and flowers (Brussels sprouts, spring onions, Chinese cabbage, leek, carrot, sweet corn etc.).

5. Cryogenic cooling

Using the latent heat of evaporation of liquid nitrogen or solid CO_2 (dry ice), you can generate 'boiling' temperatures of -196 and -78°C, respectively. This is the fundamental principle of cryogenic pre cooling. The produce is cooled using cryogenic cooling by passing it through a tunnel where liquid nitrogen or solid CO_2 evaporates. However, at the temperatures listed above, the produce will freeze, rendering it useless as a fresh market product. This issue is avoided by carefully controlling the evaporation rate and conveyor speed. Cryogenic cooling is relatively inexpensive to install but costly to operate. Its primary application is in cooling crops with a seasonal production period, such as soft fruits. As a result, by employing cryogenic cooling, the grower avoids the high capital costs associated with alternative cooling techniques over such a long period of use. Due to the high cost of liquid nitrogen, dry ice, and other non-toxic refrigerants, this process is best suited for relatively expensive products.

6. Vacuum cooling

Based on the principle of latent water vaporization, it is a very energy efficient rapid cooling method for horticultural produce. Water boils at 100°Cat normal atmospheric pressure of 760 mm mercury. However, as air pressure decreases, the boiling point of water decreases, and at 4.6 mm mercury, water boils at 0°C. As a result, low-pressure boiling of some of the water cools the produce. The produce is placed in a sealed container with a pressure of about 5 mm mercury. Water boils at 1°C at this pressure, and the product is cooled by evaporation of water from the tissue surface. Approximately 2% of the produce weight is boiled off as water for every 5°C drop in temperature.

7. Evaporative Cooling

Evaporative cooling is a low-cost and efficient method of reducing produce temperature. It is most effective in areas with low humidity. Dry air is drawn through moist padding or a fine mist of water, and then through vented produce containers. Water absorbs heat from the air as it changes from liquid to vapour, lowering the produce temperature. For effective evaporative cooling, the incoming air should have a relative humidity of less than 65 percent. It will only lower the temperature by 10-15°F. This method is appropriate for warm-season crops that require warmer storage temperatures (7-13°C), such as tomatoes, peppers, cucumbers, or eggplant.

FACTOR AFFECTING PRE-COOLING OF FRUITS AND VEGETABLES

Time and temperature are the two most important factors on which pre-cooling are dependent.

- Produce accessibility to cooling medium.
- Temperature difference between produce and cooling medium.
- Cooling medium velocity.

DRAGON FRUIT: AN EMERGING EXOTIC SUPER FRUIT

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Dragon fruit is a food that grows on a climbing cactus called hylocereus, which you'll find in tropical regions around the world. The plant's name comes from the Greek word "hyle," which means "woody," and the Latin word "cereus," which means "waxen." Dragon fruit a recently introduced super fruit in Indian market. It is getting tremendous popularity among growers because of its attractive fruit colour and mouthwatering pulp with edible black seed imbedded inside the pulp, nutraceutical value, excellent export potential and highly remunerative in nature as produces yield from 14- 16 months after planting of stem cutting and yield up to 20 years with long crop cycle from May – December in different flushes in each and every year. It is also a part of urban horticulture because of its beautiful nocturnal showy white flowers which can be used in moon garden. It's rich in antioxidants like flavonoids, phenolic acid, and betacyanin. These natural substances protect your cells from damage by free radicals molecules that can lead to diseases like cancer and premature aging.

PROPAGATION AND PLANTING DENSITY

H. undatus and H. costaricensis can be multiplied naturally and very easily by cutting off the stem as soon as it touches the ground. It takes 14 months to come to bearing under west Bengal condition; however duration may vary in different locality for different climatic conditions. Seeds can also be used as propagation material but it will take 3 years to come to bearing. The hardiness of the crop enables it to survive under field condition. Provided cuttings are at least (50 to 70) cm in length and are regularly watered in order to ensure satisfactory rooting. If all these conditions are provided around 90% of the cuttings ensure rooting. The distance between plants depends on the type of support used. With a vertical support a 2–3 m distance between planting lines is required which could accommodate 2000 and 3750 cuttings/ ha, at the rate of three cuttings per support is planted

SCENARIO OF DRAGON FRUIT CULTIVATION IN INDIA

Dragon fruit is a semi epiphytic vine plant which can climb naturally to any natural or artificial support they meet (trees, wood or cement posts, stone walls, etc.), due to presence of aerial roots. Many different types of support are used, but mainly vertical supports made of wood or cement and iron posts and on horizontal and inclined supports. Plant growth is rapid and continuous, though possibly with a vegetative rest period when the climatic conditions are unfavorable (drought and very low temperatures).

MINERAL NUTRITION AND IRRIGATION REQUIREMENT

For better yield performance of the crop proper nutrient requirement is needed. The pitahaya's root system is superficial and can rapidly assimilate even the smallest quantity of nutrients. Mineral and organic nutrition is particularly advantageous and, when they are combined, their experiment conducted in Bidhan Chandra Krishi Viswavidyalaya for different combination of N, P, K fertilizer doses revealed the dose of N 450 P_2O_5 350 K_2O 300 perform best result for yield and quality.

CONCLUSION

From the above article it is concluded that commercially, dragon fruit appear to have numerous selling points; they are attractive in shape and colour, and very good nutraceutical property which attract growers from all over the India. The red flesh species i.e H. costaricensis are additionally rich in betalains, meeting the increasing trade interest for antioxidant products and natural food colourant. Fruits are easy to keep fresh under room condition. Several processed products can also be made from the pulp of the fruit. The crop is hardy and can survive in any type of climatic condition favourable for flowering and fruiting and soil condition provided with good drainage. In general, they produce fruits quickly and few diseases and pests are encountered at the present time. This fruit crop needs research in different aspects.

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PRODUCTION OF VEGETABLES ON ROOFTOP

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Rooftop vegetable gardening is a production system on the roofs of industrial, commercial, & residential structures. The practice of producing vegetables on roofs is gaining importance in recent years as a method to increase agricultural sustainability in urban areas. Rooftop gardens are now an important part of the rejuvenation of urban agriculture as they offer alternative spaces to grow vegetable products for markets situated in urban areas. Green roofs not only create spaces for the production of vegetable crops but also generate opportunities for integrating agriculture among urban communities. Vegetable production activities on rooftops are currently in few cities only due to multiple challenges. Rooftop vegetable gardening is becoming more common in many cities as consumers seek healthy, locally produced vegetables.

Local food production may reduce carbon dioxide emissions by having reduced, short-distance-transportation from where the food is produced and where it is consumed. Vegetable crops grown on rooftops provides several ecological and economic benefits in addition to being a source of locally produced fresh food for urban inhabitants.

NEED OF ROOFTOP VEGETABLE PRODUCTION SYSTEM

The population of our planet is increasing at an alarming rate. As we are heading further and further into the 21st century, the way in which we grow our food is going to have greatly change for meeting the growing demands of the planet. One reason for this is the growing population across the world. Today there are roughly 7.7 billion people living on earth. However, this is expected to grow more than 9 billion people by the year 2050. This population growth will require almost double food supply within the next 30 years alone. The issue here is that we are sort of running out of space available for crop production. Increasing the food supply through expanding available farmland is simply not going to be an option in the future. This is due to the fact that arable or land that is capable of growing crops is quickly disappearing. This can primarily attribute the effects of climate change over farming and soil erosion. These contributing factors over the past 40 years have led to the loss of approximately one third of all arable land across the world.

BENEFITS OF ROOFTOP VEGETABLE PRODUCTION

Planting a vegetable rooftop garden offers so many advantages. If you do not have a backyard garden, your roof will provide an excellent platform to grow your favourite vegetables. Having your own garden comes with satisfaction if you have some free time.

- Green roofs provide tremendous opportunities to grow vegetables for urban residents.
- It helps in generating income and can provide some local employment for the poor.
- It assures supply of healthy and fresh vegetables. Growing vegetables for yourself allows you to control what ends up in your table.
- We can dictate the types of chemicals and fertilizers to use.
- We can save our money and time for going to buy vegetables in the grocery.
- Fresh vegetables have good levels of vitamins.
- We can pick them simply and cook immediately. Vegetables in the grocery stores are usually picked earlier, and then stored for long time. They end up losing their freshness.

- Gardening offers good physical and mental activity, with the reward of getting fresh vegetables at long last. It is a good form of exercise
- A garden adds to the beauty of your building.

SUITABLE VEGETABLES

Shallow-rooted vegetables that include some salad greens crops are thought to be the most suited for this system as they are high in productivity with minimum inputs. Crops like lettuce, celery, coriander, spinach, kale, beet leaf and radish can be easily produced in an extensive green roof medium with sufficient nutrient and moisture inputs. Other deep-rooted vegetable crops like tomato can be produced but they will require constant monitoring of fertility and moisture levels in soil.

GROWING SUBSTRATE

Green roof mediums may not contain good fertility levels which is necessary to maximize vegetable plant growth and productivity. The success of rooftop vegetable production directly depends on fertility management systems to create optimal growing conditions for vegetables. Due to weight limits often associated with extensive green roofs, soil and organic materials sometimes become too heavy to install as a growing medium. Soil-less alternative growing mixes that are composed predominately of a light-weight material are commonly used. The light-weight material is coarse, inert, and does not provide proper nutrients for plant growth. Moreover, the adding organic materials provides some nutrients for plant growth, as well as increases nutrient and moisture retention, but will become depleted after a few growing seasons, unless replenished in proper manner. Although soil-less, light-weight growing mixes are most commonly used for extensive rooftop production, soil-based systems that are most commonly used for intensive green roof cultivation are more eco-friendly and socially beneficial for urban areas than are soil-less based systems.

WATER MANAGEMENT

Water management plays an important role in the production of vegetables grown on rooftop environments. Moisture retention in the rooftop mediums is very important factor to be considered when trying to optimize water holding capacity throughout the growing period. Regardless of the green roof type, a good substrate must be included for plants to grow by maximizing water holding capacity, providing nutrients and structure, and minimizing bulk weight without exceeding the overall weight limits. Extensive green roof mediums have an average planting depth of 8 to 15 cm, and consist of a 75% to 90% light-weight aggregate, shale, or other materials.

NUTRIENT MANAGEMENT

Nutrient management plays an important role in the successful rooftop vegetable production systems. Good fertility practices are an important part of maximizing vegetable productivity in both intensive and extensive rooftop vegetable production systems. Although initial rooftop mediums often have sufficient fertility for the first few growing seasons, supplemental fertilization is required in following years, with slow-release fertilizers should be commonly used to reduce the amount of nitrate and phosphate runoff from it. Due to the composition of extensive green roof substrate mixes, providing supplemental nutrients is essential to maximize vegetable crop plant growth and productivity.

PEST CONTROL

We may expect that there are not typically serious vegetable crop pest concerns on high elevated green rooftops. Pest control is an important part of vegetable production on rooftops. We can observe many types of pests, including numerous diseases, insects, and weeds can become major problems in a rooftop planting. Pests could come to the rooftop in many different ways, such as with plugs or plants, soils or composts, on the bottom of shoes, or by wind. Animals, such as raccoons or squirrels, can also be problematic pests in these situations. Both of these pests have been devastating to our green roof vegetable research plots during the summer months as they have especially eaten or destroyed fruits resulting from tomato and melon research. Nettings and other barriers have had little effect on preventing damage. Management of pests must be done carefully, especially if chemicals are being used, due to potential environmental contamination from runoff. Monitoring frequently as well as prevention are the best methods to maintain healthy plants, and it is the best practices to use for pest control.

CONCLUSION

Vegetable production and consumption in urban areas has become a global concern due to increasing population living in and moving towards urbanized living spaces, which threatens food security. Currently, many cities across the globe are encouraging the widespread adaptation of rooftop gardening through

policies. These policies are supposed to change the present situation in positive direction. Giving the needed demand for local foods and available opportunities in urban areas, there is a great demand for developing food production programs for commercial production. Vegetable production by using green roof technology is gaining an increasingly important part of urban crop production system. Rooftops create spaces for the production of organic vegetable crops, which create opportunities for integrating agriculture into urban societies.

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EFFECTS OF VERTICAL MULCHING ON SOIL AND WATER CONSERVATION

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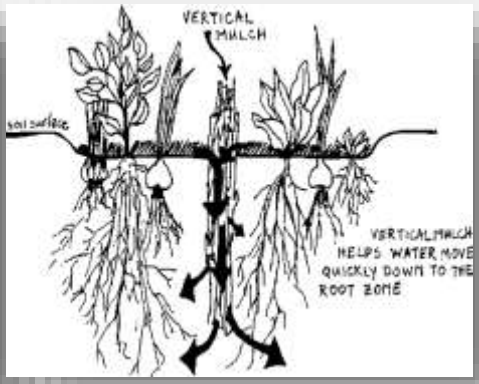
Vertical mulching is premised on the idea that surface runoff descending the slope falls into ditches, where it then infiltrates into the surrounding soil. While vertical mulching does not prevent surface runoff from forming in the regions between the ditches, it significantly decreases the quantity of runoff that exits a field, sometimes to nil, by collecting most or all of it in the ditches. At the same time, soil erosion is reduced. Much or all of the eroded material is trapped in the ditches as long as there is still any erosion, preventing it from becoming a problem downstream. Infiltration from the ditches also boosts the water supply for plants and recharges the groundwater.

Introduction

Spain and McCune (1956) developed a new form of mulching technique called "vertical mulching" to minimize runoff by boosting infiltration for a longer period of time. It involves vertically inserting stuffed plant residues into sub-soiler markings to maintain the slots open and functional for a longer period of time. Surface water travels downward into the subsoil, as well as from the ground surface, following the things introduced into the tillage mark. Depending on the amount of crop wastes applied, a network of open slots develops on the ground surface throughout this procedure. It's also important to keep in mind that the slots should not be covered by the soil during ploughing. It is a soil treatment that is performed near a tree's root system to enhance the root function and health of the tree by venting the compacted soil, improving the soil's water retention power, advancing the soil's infiltration capacity, and providing nutrients to the soil. It is done by digging 30 cm deep and 15 cm broad trenches over the hill at 2 to 4 m intervals and filling them with organic materials such as grasses, straws, and stubbles.



SIGNIFICANCE OF VERTICAL MULCHING

Soil structure deterioration, soil compaction below the arable layer, and reduced micro porosity have all resulted from intensive soil mobilization in the traditional tillage regime. Reduced soil water infiltration resulted in increased runoff, soil erosion, and sedimentation in rivers and reservoirs as a result of these changes. Water erosion from the soil surface is virtually managed under the no-tillage method, and farmers have eliminated terraces. Despite this, the surface flow is greater than in a traditional tillage system. One of the major issues in hydrology is the limited infiltration of water into the soil in regions where intensive agriculture is practiced. It reduces the amount of water in the soil profile and increases surface runoff, both of which are linked to soil erosion. To promote water infiltration, vertical mulching can be used in conjunction with a no-tillage system. When done on contour, vertical mulching has a significant impact on runoff management, according to field experience. This approach has also been used as a drainage tool for removing surface water from low-lying regions, and it has shown to have a superior reaction.

CONCLUSION

Surface runoff from agricultural land is a serious problem in worldwide, because it leads to soil erosion. Many researchers from their experiments showed that vertical mulching can be very effective in reducing surface runoff from a field.

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STRATEGIES FOR SUSTAINABLE FOOD PRODUCTION: AN AGRICULTURAL PERSPECTIVE

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Global food security is under pressure by several factors, such as the world population explosion, the amount of arable lands, availability of water resources, climate conditions and accessibility of food and its losses etc. Over time, the world has taken a steadily more comprehensive view of food and nutrition. To ensure food security with regard to its managerial, environmental and developmental aspects, new agriculture methods/ technologies are needed. However, long term food security requires a balance between increasing crop production, maintaining soil health and environmental sustainability.

Indian farming community is facing the second generation problems like decreasing factor productivity, low soil fertility, saline and alkali soils, scarcity of irrigation water, nutrient removal and addition gap widen etc.

Here we specify various agricultural and its related strategies that ensure the adequate food production to the growth of ever increasing global population in the future.

1. Integrated Systems

Integrated Plant Nutrient system (IPNS) is the management and conservation of natural resource base and orientation of technological and institutional agencies in such a manner as to ensure the attainment and continuing satisfaction of human needs for present and future generations. It maintains soil fertility and plant nutrient supply by optimizing the benefits from all possible sources of plant nutrients. Integrated Weed Management (IWM) is promoted by improving the timing, dosing and application method of nutrients, thus minimizing the potential impact on weed growth. Integrated plant nutrient management contributes to pest management. Crops grown in well-developed structured soils with sufficient nutrients are less susceptible to pests.

2. Efficient Use of Renewable and Non-Renewable Resources

There is significant potential for agricultural involvement in the production and consumption of renewable resources like solar, wind, geothermal, bio-refineries and biomass energy. Use of this a growing source of energy and income in farming systems can be used in agriculture in a number of ways, saving money, increasing self-reliance and reducing pollution. Water used for agriculture (rainwater and lakes and rivers) must be used in a sustainable way. Forest cover, crop residues and litter biomass after briquetting can be used as organic manure.

Fig. 1 shows solar panels providing green energy for crop growth: Rice grains dried using solar Dryer

3. Crop Diversification

Agriculture diversification involves the shift of resources from the regional dominance of one crop or livestock to a large mix of crops or livestock. Diversification of agriculture in favour of non-cereals and high-value commodities such as fruits, vegetables, milk, meat, eggs, fish etc. are emerging as a promising source of income augmentation, employment generation, poverty alleviation and export promotion. Maintaining crop species and genetic diversity through intercropping can lead to greater productivity in plant communities, less nutrient leaching, volatilization and greater ecosystem stability.

4. Soil resource management

Sustainable management of the world's agricultural soils have become imperative for ensuring global food security. Being a finite

resource, the natural area of productive soils is limited i.e., under increasing pressure of intensification and competing uses for cropping, forestry, pasture / rangeland and urbanization. Soil is increasingly threatened by a number of anthropogenic activities such as erosion, humus and nutrient depletion, surface crusting, salinization as well as chemical pollution. Intergovernmental Technical Panel on Soils of the Global Soil Partnership recommends actions: soil protection and reclamation as well as sustainable land management projects; increase area under sustainable soil management practices, enhance the restoration of degraded soils and promote 'sustainable production intensification' through adapted biological resources, increasing soil fertility, water-use efficiency, ensuring sustainable use of inputs and recycling of agricultural by-products.

5. Nutrient management

Improving nutrient management is a central element in meeting the challenge to increase food production, increase farm incomes, improve soil quality, reduce nutrient losses to environment and protect natural ecosystems. Science based principles for integrated, site-specific use of fertilizers, organic materials and other nutrient sources have been developed through research. Nutrient management involves matching a specific field soil, climate and crop management conditions to rate, source, timing and place (commonly known as 4R nutrient stewardship) of commercial fertilizers, manure, soil amendments and organic by-products to agricultural landscapes to match plant needs. Efficient use of nutrients can be achieved by the adoption of best nutrient management practices (BMPs).

6. Conservation agriculture

CA involves a set of agricultural practices with three interrelated core principles: minimum mechanical soil disturbance, permanent organic soil cover and diversified crop species in rotation or associations including legumes. Among the sustainable cropping systems available to smallholder farmers limited to rain-fed practices, CA can reverse soil degradation, improve crop production and enhance the socio-economic condition of smallholder farmers.

7. Use of precision farming

This concept is sometimes called Precision Agriculture **or** Prescription Farming or Site-specific Management**.** The idea is to know the soil and crop characteristics unique to each part of the field and to optimize the production inputs within small portions of the field. Precision agriculture not only brings new technologies, but the use of these technologies provides a better and more accurate farm management system.

8. Organic Farming

Organic agriculture contributes to food security through a combination of many ways:

- ❖ Increasing yields in low-input areas.
- ❖ Conserving bio-diversity and natural resources on the farm.
- ❖ Producing safe and varied food.
- ❖ Being sustainable in the long term

9. Good quality seed/planting materials

Seed is the most critical input on which the efficiency of all other inputs depends. Increasing agricultural production can be effective and sustainable if subsistence farmers have access to affordable quality planting material. The lack of good-quality planting material is repeatedly identified as a major constraint to greater adoption of agroforestry innovations.

10. Biotechnology in crop productivity

Biotechnology, nonetheless, must be viewed as just one element in a comprehensive sustainable agriculture and food security strategy focused on broad-based agricultural growth. Plant biotechnology has emerged as a supplemental tool to increase the efficiency of crop production by way of developing transgenic plants with improved traits viz. as disease resistance, insect / pest resistance, herbicide tolerance, abiotic stress tolerance, nutritional quality improvement, delayed fruit-ripening. Quality augmentation to improve standards of produce by developing bio-fortified products, facilitating enhanced ripening and addressing abiotic stresses by adapting to adverse local agro-climatic. Nanotechnologies are being applied to agriculture in such areas as water treatment, energy storage, food processing and storage, vector and pest detection and control, agricultural productivity enhancement and improved environmental management.

11. Adaptation and mitigation climate change

In general, climate change is likely to reduce food safety due to higher rates of microbial growth at increased temperatures. To meet future food goals while minimizing further impacts on the climate, low emissions development (LED)

options for producing food are needed. The immediate challenge is to identify incentive systems that secure food using low emissions pathways. The most promising outcomes compatible with future food security will arise from sequestering carbon through increased agro-forestry and from avoided future emissions, through increased productivity, improved efficiency of inputs, reduced food loss or waste, diets based on lower emissions foods and avoiding conversion of high carbon trees and forests.

11. Information systems in agriculture

The information systems of computer based are capable of providing information on some specific fields / areas of application such as crops, diseases, insects and cultural practices etc. Information and communication technologies (ICTs) are used by many international organizations for mapping and monitoring world food supplies, early warning systems and to respond when disasters strike. The mobile phone revolution offers new opportunities to benefit farmers and agricultural production. In developed countries, standards of better design with ubiquitous sensor networks and radio-frequency identification applications are leaving the university and research labs to be deployed in the fields and food supply chains.

Epilogue

Agricultural research, when appropriately focused creates an impetus for solving farmers' problems and generating outputs that will bring about increased productivity. Researchers should use a participatory, bottom-to-top approach in addressing farmers' problems and conduct holistic research of national priorities using a multi-disciplinary approach to address agricultural value-chain issues. Promotion of appropriate technologies through extension services and training should be emphasized. Development of low-cost, adoptable technologies that encourage small scale enterprises, increased food processing through the establishment of small-scale agro-industries can contribute to the year-round availability. Many agricultural practices such as conservation tilling, terracing, contouring and planting vegetation as windbreaks and practices should be encouraged. Current decision-making processes include land-use planning, crop and animal production factors, economic factors and integrity of local surface water and groundwater as well as the fate of far-away environmental systems. Today, different approaches, such as plant breeding, genetically modified foods, in-vitro planting and spread of closed ecological systems are applied as a solution to increase food accessibility.

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JUTE AND OTHER NOVELTY BAST FIBRES

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Today, the time has arrived where the world is in urgent need of paying attention towards nature and rely on natural resources. This also applies to the field of fibres and textiles. Thus, the radar is shifted towards bast fibres from cellulosic fibres. There are researches going on some novelty bast fibres so that they could be mainstreamed instead of being underutilized. Some novelty bast fibres have been given space in this article.

INTRODUCTION

Natural fibre may be defined as any hair like raw material directly obtainable from an animal, vegetable, or mineral source and convertible into nonwoven fabrics such as felt or paper or, after spinning into yarns, into woven cloth. Apart from economic considerations, the usefulness of a fibre for commercial purposes is determined by such properties as length, strength, pliability, elasticity, abrasion resistance, absorbency, and various surface properties. Most textile fibres are slender, flexible, and relatively strong. Natural fibers are a renewable resource and have several advantages associated with them, such as that they impart the composite high specific stiffness and strength, have a desirable fiber aspect ratio, are biodegradable, are readily available from natural sources.

Natural fibres are of several types including plant or cellulosic fibres, animal or protein fibres, natural rubber and mineral fibres. The plant or cellulosic fibres are further classified according to the part of the plant that produces the fibre. Thus, there exist the categories of seed hair fibres, bast or stem fibres, leaf fibres and the miscellaneous category.

BAST FIBRES

Bast fiber, also called phloem fiber, is a type of plant fiber that can be collected from the phloem or bast surrounding the stem of certain dicotyledonous plants. Bast fibers can be obtained either from cultivated herbs, such as flax, hemp, and ramie, or wild plants, such as linden, wisteria, and mulberry. The strands of bast fibers are usually released from the cellular and woody tissue of the stem by mechanical, biological, or chemical methods. Bast fibers have higher tensile strength than other natural fibers, thereby are usually used in the production of high-quality textiles. Bast fibers are processed and utilized in many industries, such as textiles, ropes and nets, carpets and mats, brushes, and mattresses industries, in addition to paper and board materials industries.

SOME NOVELTY BAST FIBRES

Jute: Jute fabric is a type of textile fiber made from the jute plant. While there are a few different botanical varieties of jute, one of the main species used to make jute fabric is *Corchorus olitorius* (white jute). However, another species of jute, called *Corchorus capsularis* (tossa jute) is considered to be superior even though it is harder to cultivate.

PROPERTIES OF JUTE

- ✓ 100% bio-degradable recyclable and thus environment friendly.
- ✓ Natural fibre with golden & silky shine.
- ✓ The second most important and widely cultivated vegetable fibre after cotton.
- ✓ High tensile strength with low extensibility.
- ✓ Very versatile natural fibres that has been used in raw materials for packaging, textiles, non-textile, and agricultural sectors.

Hemp: Hemp (*Cannabis sativa*) is called a fiber of hundred uses. The significance of Hemp to the economic and day to day lives of our ancestors is increasingly being recognized. It was important for textile, paper, rope and oil production. Indeed, Hemp was so important in England in the

sixteenth century that King Henry VIII passed an act on parliament which fined farmers who failed to grow the crop. Besides fabrics, Hemp is also used in the production of paper.

PROPERTIES OF HEMP

- ✓ Natural organic Hemp fiber "breathes" and is biodegradable.
- ✓ Hemp fiber is longer, stronger, more absorbent, more mildew resistant and more insulative than Cotton fiber.
- ✓ Hemp is harsh and stiff and cannot be bleached without harm to the fiber.
- ✓ The nature of Hemp fibers make them more absorbent to reactive dyes, vat dyes and sulfur dyes.

Roselle: Roselle plant is classified in hibiscus group and the scientific name is *Hibiscus sabdariffa* L. Over the last few decades, roselle fibres have been used for heavy-duty cables and composite materials due to their sustainability and lack of decay for a long duration. Roselle fibres are safe, biodegradable and recyclable. Roselle is highly adorned for its luster, strength, excellent microbial resistance and valuable hygienic properties.

Kenaf: Kenaf fiber is one of the famous natural fibers used as reinforcement in polymer matrix composites. Kenaf comes from the plant *Hibiscus cannabinus*, which has been used as a source of fiber for making cordage and coarse fabrics. It is used mainly as a jute substitute. The fibers in kenaf are found in the bast and core. Kenaf fiber is gaining attention as an alternative reinforcement for composite products due to low cost, reduced environmental impact and attractive mechanical properties.

Lotus: The lotus plant provides fibres which are used for making a rare kind of cloth matching with the flawless virtues of the silk. Fibres extracted from the lotus flowers of are spun by hand and woven within 24 hours making a fabric similar to silk. The fabric looks like a blend of linen and silk, and possess wrinkle resistant and breathable qualities given by the molecular makeup of the lotus plant. It has a milky yellow hue.

Ramie: Ramie fibre, also known as China grass, and ramie fabric, variously known as grass linen, grass cloth, or China linen, have been exported from East Asia to the Western Hemisphere since early in the 18th century, but commercial production of ramie products did not achieve importance in the West until the 1930s. Because of its desirable properties, including strength and durability, ramie has frequently been promoted as a textile fibre of great potential. Ramie is used to make such products as industrial sewing thread, packing materials, fishing nets, and filter cloths. It is also made into fabrics for household furnishings and clothing, frequently in blends with other textile fibres. Shorter fibres and waste are used in paper manufacture.

Urena: The bast fibre as a substitute for jute (*Corchorus* spp.), for instance to make sacks, carpets, cordage and upholstery. It is often used mixed with jute. In tropical Africa and elsewhere *Urena lobata* serves for making string, twines, ropes, fishing lines and nets, and nets for hunting, while the unprocessed bark is often used as tying material. Fresh stems of *Urena lobata* yield (3–)5–6(–7) % retted bast fibre. The fibre is fine, soft, flexible and lustrous, with a creamy white or pale-yellow colour. It resembles jute more than other jute substitutes, such as kenaf (*Hibiscus cannabinus* L.) and roselle (*Hibiscus sabdariffa* L.). It can be spun on jute machinery without any change to the machines and without the operators needing experience with *Urena lobata*. The bast fibre cells are (0.8–) 1.4–4.5(–5.9) mm long, with a diameter of (9–)12–19(–34) µm.

Conclusion: The novelty bast fibres are reliable fibres which will thrive to excel in recent future and become integral part of human life and wardrobe. The upcoming times will witness their mainstream usage as current researches have come up with credible results on their properties.

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TOBACCO FARMING IN INDIAN ECONOMY

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Tobacco is a profitable and one of the world's most economically important agric-ultural crops. According to a recent study, the tobacco industry is one of the most important contributors to the Indian economy, generating Rs 11,79,498 crore in total economic value.

According to the survey, the tobacco sector employs around 4.57 crore people in India, including 60 lakh growers, two crore ranch labourers, 40 lakh splint pluckers, 85 lakh individualities working in processing, manufacturing and exports and 72 lakh working in merchandising and trading, said the report.

HISTORY

Tobacco originated in the western hemisphere, and types of tobacco presently being cultivated evolved in Mexico and Central America. It was cultivated by Red Indians at the time of the discovery of America by Columbus in 1492. Tobacco was first brought to India by the Portuguese in the early 17th century.

TOBACCO CULTIVATION IN INDIA

- 2nd largest producer after China.
- 5th major exporter after Brazil, USA, Malawi and Turkey.
- Principal cultivated varieties are Flue cured, Burley, Rustica, Natu, Kasturi, Malawi Western Sun Cured (MWSC), Dark fire cured, Oriental, Talmari
- Stovepipe Cured Virginia tobacco (*Nicotiana tabacum* L.) is an import acquainted tobacco type grown substantially in the countries of Andhra Pradesh, Telangana and Karnataka.

CLIMATIC REQUIREMENTS

- In India tobacco grown from 8^{0}N latitude to 34^{0}N latitude.
- Tobacco seeds require about 21^0 C temperature for germination.
- Tobacco plant grows and mature rapidly when average temperature are about 25^0 C.
- Tobacco require 100-115 centimeter of annual precipitation for successful production.

AGRONOMIC PRACTICE

- Land should be well prepared first by deep ploughing with mould board plough followed by three or four cross harrowings.
- Care should be taken to see that weeds, stubbles, etc., are well removed from the field.
- Tobacco is adapted to acidic soils, with pH ranging from 5.5 to 6.5.
- Impeded drainage.

NURSERY RAISING

- Raised seedbeds of size of Length 15m, Width 1 m, Height 15 cm with space between two raised beds ½ cadence are prepared during 1st week of November.
- Seed rate followed is 2.5 Kg/ ha.
- Seeds are sown by hand through Uniform broadcasting by mixing with ordure or beach.
- Seedbeds are mulched with leaves/ paddy straw for humidity retention.
- Gentle irrigation is given 2-3 times a day by using rose can over to 10-15 days prior to transplantation and let seedlings harden.

TRANSPLANTING

- The first 20 days after transplantation are critical for weed competition in the planted crop.
- During Third of November end, Individual Seedlings are scattered when about 8-10 cm high with pencil consistence.
- Low position of irrigation is after transplantation. Grounded on the soil humidity conditions, irrigation is done after each inter-civilization operation and after harvesting of every stalk position.

GROWING

- Tobacco seeds are strewn on the soil's surface because light promotes germination. Branches were placed over seedbeds to protect the young plants from frost, and the plants were left alone until November.
- Immediately after broadcasting, tobacco should be rinsed with about 0.5 inch of water. This helps to settle the soil around the roots and provides humidity to stimulate fast root development.
- Basal application of 50gram of Ammonium sulphate, 100g of potassium sulphate, 300g of superphosphate and 100g dolomite per 10m^2 bed.

HARVESTING

- 120 days after broadcasting.
- Only mature, grow leaves should be gathered.
- First 2-3 leaves to grow shouldn't be gathered, because it has a low position of solids happy undesirable for manufacturing.
- Mature leaves parade a slight yellowing and break off the stalk easier.

CURING OF TOBACCO

- It is essentially a drying process where by most of the moisture of leaf is removed to impart required colour, texture and aroma to the final product.
- There are four methods:

a. **Flue curing-** Tobacco leaves kept in an enclosed heated area for 1 week, because flue curing turns its leaves gold, orange, or yellow.

b. **Air curing-** Sheltered from wind and sun in a well-ventilated chamber for about 6-8 weeks.

c. **Fire curing-** Smoke from a low buring fire on the bern floor infuses the leaves for 3-10 weeks. Leaves contain distinctive smoky aroma and flavor.

d. **Sun curing-** Dries uncovered in the sun.

- Time for curing leaves from the various harvestings varies from 15-35 days., with lower stalk positions generally requiring less time.

Bulking

- The bulks have to be covered with polythene wastes to compact the bulk without damage to help gain or loss of humidity.
- Period: 20 - 30 days.

TOBACCO ROLE IN INDIAN ECONOMY

Tobacco is one of the world's most economically important agricultural crops. On the one hand, it employs a big number of people, and on the other, it contributes significantly to the National Exchequer through excise income and foreign exchange revenues. For the fiscal year 2019-20, tobacco and tobacco products generate roughly Rs.22737 crore in excise income and Rs.5870 crore in foreign exchange revenue for the national exchequer. Despite the fact that tobacco cultivation is limited to 0.24 percent of total cultivated land Tobacco supports the livelihoods of 36 million people in India, including 6 million farmers and 20 million agricultural labourers, as well as 10 million people employed in processing, manufacturing, and exports. 4.4 million people are employed in bidi rolling alone, and 2.2 million tribals are employed in tendu leaf harvesting. Small and marginal farmers, rural women, tribal youth, and the poorer sections of society are the main beneficiaries. Tobacco earns 4,400/- crores in foreign exchange, accounting for 4% of total agri-exports, and 14,000 crores in excise income, accounting for more than 10% of total excise money collected from all sources.

MEDICINAL USES OF TOBACCO

Sore throats, wounds, fevers, insect repellents, discomfort, and headaches are just a few of the uses for the tobacco plant. Tobacco leaves were used to reduce pain, tobacco powder was used to treat catarrhal problems, and it was used to treat wounds and burns locally. To create huge amounts of a human protein known as Interleukin 37, or IL 37, transgenic tobacco plants are being used. It may be used to treat a variety of inflammatory and autoimmune diseases, including type 2 diabetes, stroke, dementia, and arthritis. In 1525, Mexico said that tobacco relieved the agony of a cold. Tobacco leaves and juice were commonly used to treat skin problems, including basal cell carcinoma. Excess dosage of any beneficial drug is harmful, thus we should check leaves for therapeutic compounds in a systematic manner.

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STRATEGY FOR REDUCING RURAL OUT-MIGRATION

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Migration of people from one region to another has influenced economic status of communities throughout the world. People's social, cultural, economic, and political variables all have an impact on migration. Migration and human development are inextricably linked, both within and across state borders. In India, migration is mostly impacted by societal structures and development patterns. Since independence, every government's development policies have accelerated the migration process. Migration from Uttarakhand is nearly entirely made up of men, and this is deeply ingrained in the lives and choices of the people. In Uttarakhand, rural people's livelihood strategies are in change. Migration is not just a livelihood strategy but a way of life in the state. Male out-migration in search of work is well-known in Uttarakhand's mountain areas. Migration, on the other hand, can exacerbate vulnerability, particularly when households grow reliant on remittances as a result of insecure or inconsistent employment. Meanwhile, those who remain in the villages suffer a variety of issues, and when men migrate, the vulnerability of women and children increases dramatically. This article attempts to attract attention to Strategy for Reducing Out-Migration from Uttarakhand's rural areas.

Suggest Suitable Strategy for Reducing Out-Migration:-

Strategy for Reducing Out-Migration: Steps

1. Diagnosis

(A) Identify the push and pull factors of migration

(a) Push factors

- Lack of employment opportunities in villages is forcing the rural people to migrate.
- Inability to meet basic needs with existing income cause rural urban migration.
- If there is increase in household expenses, then rural people tend to take decision to migrate.
- Lack of government's employment guarantee schemes, like MNREGA play an important role in taking the decision to whether to migrate or not.
- Inability to meet educational expenses of children causes migration.
- Migration occurs due to inability of people's to meet medical expenses of their family.
- Peer group of rural people influence them to migrate to cities.

(b) Pull factors

- High demands of labors in urban areas attract rural youths to migrate and work in urban areas.
  - In urban areas there are better earning opportunities than rural areas
  - Higher wages.
  - Experience of already migrated persons motivate other people to migrate
- Work is available throughout the year in urban areas.
- Ease of life people in urban areas is attracting people towards cities.

(B) Pattern of migration

- The most probable reason was that most of the migrants were not wholly dependent on agriculture for their living before migration as it is not remunerative. They were doing some other non-agricultural works in the villages for their livelihood but later when these employment opportunities also gradually declined, they migrated to other places. Very few of the migrants who migrated for agricultural work in the destination areas are mostly seasonal migrants. Most of the

youths were engaged in non-agricultural occupations as the income from them was comparatively higher and regular as compared to the agricultural work.

- The families having up to two migrants had the main motive of getting remittances by doing job in the destination area. The families having three and four migrants had sent their family members for both education and income purposes, one or two members were doing job in destination area and other migrants were studying. It was also observed that if one migrant of family is getting good income after migration, the other family members were also thinking of migrating to the same place.
- Most of the rural youths were migrated from the village to nearby town.

2. Planning-

- We identified different factors and pattern of migration. Thus, to overcome the problems there is a need of proper planning.
- Planning of any developmental project and programme is more successful when it is done with the involvement of target people, for whom work is to be done.
- To create proper awareness among the rural youth, different livelihood options are available in their area like vegetable production, mushroom production, floriculture crop production, bee keeping, fruit crop production, vermin-culture, livestock farming, poultry farming, sericulture, fisheries, medicinal crop production, organic farming, spices crop production, cereals, millets and pulse production, and integrated farming.
- Apart from these enterprises rural youth may also develop small scale agro based industries with the help of government and local opinion leaders in the rural areas.
- They may construct polyhouses in the rural areas and may indulge in off season cultivation of crops. It was also observed during the study that few people in the villages, especially ex-servicemen were keen to stop migration and wanted youths to generate employment activities in the village itself. So using such people to motivate and influence the youth about different locally available enterprises and also training them with government help.

3. Implementation-

- Implementing programmes at the village level by government and non-government agencies with the help of ex-servicemen and opinion leaders.
- Creation of farmers groups in the villages to make them aware and train them for new farm technologies by KVK and NGO personnel.
- Extensively working for implementing government schemes for the rural youths.
- Providing loans and micro-credit to the rural youths for establishment of new enterprises through government funding agencies.
- Constructing polyhouses in the village areas by village development officers.
- SAUs should provide required extension services to the rural areas by means of extension agents and ICTs.
- Introduction of low volume, high value crops among farmers through demonstrations or exposure visits.
- KVKs should focus on development of entrepreneurial competence of rural youth based on the demography and agro-climatic conditions and providing them vocational training.
- Organization of training programs, demonstration on use and importance of improved agriculture practices and technology to encourage the involvement of youth in agriculture.

4. Monitoring and Evaluation (M&E) –

- Continuous assessment of the performance of projects and programmes set up by government and NGOs to improve the current scenario and future management of outcomes and impact. Monitoring is a continuous assessment of programme based on early detailed information of the progress or delay of the ongoing activities. An evaluation is an examination concerning the relevance, effectiveness, efficiency and impact of activities in the light of specified objectives.
- Monitoring and evaluation processes can be done by the financing agency, an independent branch of the implementing organization, project managers or implementing team themselves,

village level leaders and/or by a private company. The credibility and objectivity of monitoring and evaluation reports depend very much on the independence of the evaluators. Their expertise and independence is of major importance for the process to be successful.

5. Reconsideration-

- Reconsideration of loopholes or problem faced during implementation of any activity has got its own importance in order to improve the loopholes in the activity for future use.

To take up for reconsideration, as a matter previously acted on by go vernment or non-government agencies.

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PULSES: THE SECONDARY CEREALS

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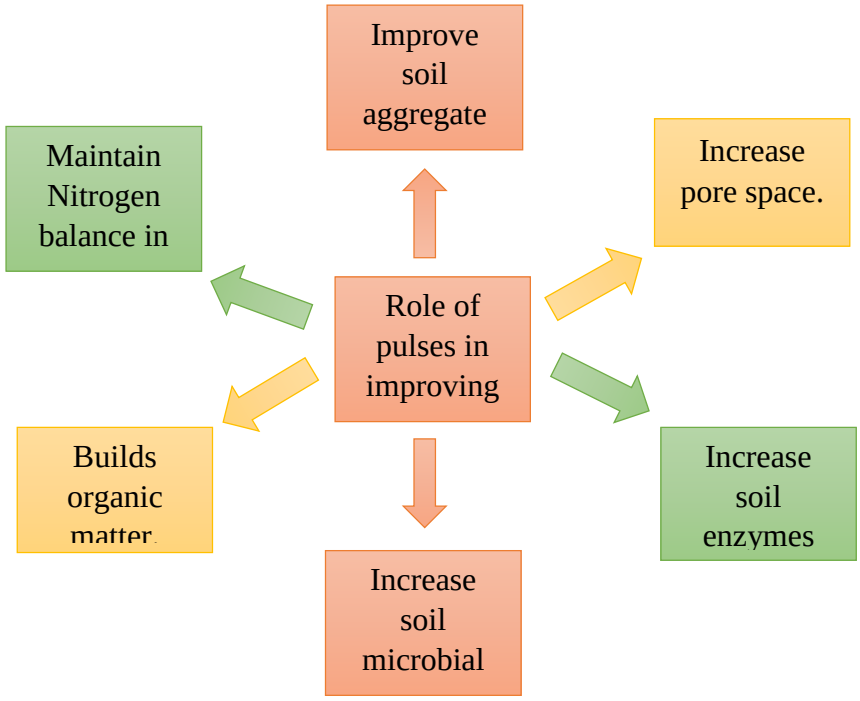
Better economic stability, better environment sustainability along better Health and nutrition are the basis needs of a nation. Crop diversification can improve impact of green revolution in sustainable and ecological manner. For agriculture, cereals play a central role in survival but for nutritional values pulses empower the goal of nutritional health challenges. Pulses are next to cereals in nutritional as well as economic status of human diet. These edible seeds packed in pods, enriched with protein-fibres belongs to family Fabaceae or Leguminosae. Among cereal based vegetarian diets, pulses have its prominent place due its important chemical constituents that will contribute to healthy and balanced diet. Pulses are cultivated globally, whereas India is largest producer and consumer in the world. Major pulses which are cultivated in India are Chickpea (*Cicer arietinum*), Pigeonpea (*Cajanus cajan*), Greengram (*Vigna radiate*), Blackgram (*Vigna mungo*), Lentil (*Lens culinaris*) and Field pea (*Pisum sativum*). But, due to climate changing patterns, nutritional quality decreases and arising the problem of malnutrition. Malnutrition is a big challenge for developing countries. Due to enriched with nutrients, pulses can be used as an effective tool in alleviating malnutrition problem.

AS NUTRITIONAL SOURCE

In Agriculture, pulses are always underrated. Also, during period of Green revolution, cereal production was almost tripled than pulses production. Most national dietary guidelines recommend pulses as part of a healthy diet. Pulses are vital source of plant based proteins and amino acids for people around the globe and amino acids for people around the globe and should be eaten as part of a healthy diet to address obesity, as well as to prevent and help manage chronic diseases such as diabetes, coronary conditions and cancer . As pulses like pea and fabacean contain higher protein content than cereals, it can be replaced on non-vegetarian diet. If pea plant is included in diet, then it can increase all the essential amino acids content which further help in improving health status. Having almost negligible fat content, pulses contain essential micronutrients like iron, manganese, zinc, selenium etc. In addition, the phytochemicals, saponins, and tannins found in pulses possess antioxidant and anti-carcinogenic effects, indicating that pulses may have significant anti-cancer effects. Pulse consumption also improves serum lipid profiles and positively affects several other cardiovascular disease risk factors, such as blood pressure, platelet activity, and inflammation. Pulses seeds contain ample amount of starch content and act as potential source of energy. That's why, pulses are consumed as staple food in countries like Africa, South America and India. Pulses consumption also reduce the carbon footprints which reduce risks of heart problems and maintain body weight. It should be consumed by both adults and children.

IMPROVING SOIL PRODUCTIVITY

For meeting the food demands of rising population, the crop production system, shifting more towards cereal based cropping system. But, in this there is higher input of fertilizers as well as highly nutrient exhaustive. This over exploitation of nutrients leads to poor soil health, decline in water level and other environmental issues. Introduction of pulses in cropping systems can play considerable role in



enhancing soil quality. Pulses introduction exploits symbiotic bacteria for nitrogen fixation that is utilized by subsequent crop, increasing its yield. The major benefits provided by pulses are shown in Figure 1. As with pulses the soil aggregation stability increases, the main reason is production of protein named 'glomalin' by the roots. As it is insoluble and sticky in nature and serves as 'glue' which bind soil particles. Due to aggregation, pore space increase which further reduce soil erosion and crusting. Another advantage of soil aggregation is that microbial activities increase, which effectively decompose organic matter and mineralized nutrients present in the soil. These soil aggregates act as fertilizer pellets which slowly provide nutrition to growing crop. Leaf litter of pulses also contributes in organic matter composition of soil.

Mostly pulses have deep root system which penetrate deeply into soil. Due to nitrogen rich roots, it promotes activities of earthworm and helps in improving soil quality. It also reduces the concentration of N_2O gas by fixing atmospheric nitrogen. This crop also increases soil enzymatic activity like activity of amylase, cellulase, β-glucosidase etc. and also concluded that organic acid which is released from roots of pulses help in mobilizing the unavailable nutrients in soil.

In Mitigating Climate Change As food quality, food production and climate change are intrinsically linked with each other. Changing climatic conditions, effects not only average yield but also reduce the nutritional quality that ultimately affect the health and economic status of country. Inclusion of pulses into cropping systems can increase adaptive potential of plants during adverse climatic conditions. Three major approaches by which climate change mitigation can be done by:

1. Decreasing the use of fertilizers in agricultural lands.
2. Sequestration of carbon in the soil.
3. Decreasing the fossil energy inputs in the system.

Forage plants also contribute in climate changes either directly or indirectly by emitting greenhouse gases. Methane and Nitrous oxide are major gases which play role in warming effect. Cultivation of pulses as forage crops help in reducing greenhouse gas emission which may be attributed to presence of tannins, lower fiber content, higher dry matter intake and very fast passage rate.

CONCLUSION AND FUTURE PERSPECTIVES

Pulses reduce price volatility, high output return to farmers and sustain their economy. These maintain promising protein source via controlling health benefits such as blood sugar level, lower cholesterol level and reduce risks of heart arrest. Pulses have great potential in reducing malnutrition level, improving soil health and mitigating the climate change effect. Pulses are climate smart as it simultaneously adapts to climate change as well as play key role in mitigating the adverse effects of climate change. Pulses have broad genetic diversity, from which elite varieties can be selected. By this method, crop resilience varieties can be developed. Due to multiple benefits, introduction of pulses in cropping system enhance resource use efficiency as well as livelihood security. Hence, more emphasis should be given on policy initiatives for bringing more area under pulse production. To rethink the equation of crop water availability, pulses are imperative for food security with less input cost (water and fertilizer) and high market price. For the countries, where every drop of water is hope pulses provide better opportunity for health of human being as well as for health of our planet.

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INDIA'S EXPORTER POTENTIAL OF HORTICULTURE PRODUCE- OPPORTUNITIES AND INTERVENTIONS

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India is the second largest producer of the fruits and first largest producer of vegetables and shown significant production growth in flowers and medicinal crops in past few years. India stands in second place after China in many major horticulture crop productions which has created great potential and opportunities to be one of the largest global exporters in future. The Horticulture sector has shown continuous growth in the past few years. Horticulture came out as a salient component of Indian Agriculture. This has increased the export of fruit and vegetables in major countries like Bangladesh, Nepal, Sri Lanka and many Middle East countries. Before two decades nobody knew about the horticulture but now things are changing with time. Now across the world, India is leading in the production of many fruit crops like banana, mango, papaya etc. Farmers are increasing their interest in horticulture and are exporting their produce with the help of the government. Not in the fruit and vegetable only but export is increasing in the plantation and medicinal and aromatic crops also. Many Perfumery industries are demanding flowers for making their products. APEDA is making efforts to increase export market of horticulture crops in India. It's making efforts to boost the export of fruits, vegetable and plantation crops. It is helping in providing infrastructure, ensures supply and quality input material and developing the market linkages between the countries for increasing the export market. Government of India and the state government had developed the standard operating procedures for producing pest free horticulture produce in their region. Horticulture crops has high export potential as India ranks in first and second position in the production of majority of horticulture crops after China. APEDA is providing refrigerated vehicles to support the supply chains in horticulture for better export. This has helped the farmers of horticulture crops who are exporting their crops like mangoes, grapes, pomegranate and fresh vegetables.

OPPORTUNITIES

- Indian government is working on various policies for export of horticulture and agriculture products so that it can motivate farmers for export their crops.
- APEDA is helping and promoting Agriculture exports under its various plan schemes.
- Government is focusing on the Research and Development sectors to increase export
- APEDA had helped exporters for establishment of packhouses having facilities as per demand of the Importing countries.

INTERVENTIONS

- Quality of some crops are not as good as to meet the export standards.
- Post-harvest (loss after harvesting) losses is a major problem in the export of horticulture crops especially in fruits and vegetables.
- Lack of the infrastructure and proper storage facilities in Airports and Seaports.
- Due to the short life span of the horticulture crops such as mango, banana, grapes and many vegetable high risk of decaying.

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WOMEN AND SMALL BUSINESS IDEAS (MICROENTERPRISE) – INNOVATIVE INCOMES FOR ENTERPRISING WOMEN

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Women entrepreneurs are participating highly in the workforce and contributing to Indian economy as they are spending more than 8 hours per a day and increasing the work productivity. India could be the world's fastest-growing economy, if it treats its women workforce in improved manner. Small scale women entrepreneurship is on the rise as the women show enthusiasm in startup their own enterprises or businesses for enhancing their standard of living in terms of food, shelter, clothing and education. Some of the research suggested that 97% of all women workers in India are mainly concentrating actively in informal sector and micro-size, engaged in low productivity, low-return activities and domestic work. Women entrepreneurs are struggling in different ways to improve or develop their family status even though they are still unrecognized and their potentiality is untapped.

INDIAN SCENARIO OF WOMEN ENTREPRENEUR:

In India, women constitute only 13.76 per cent of the total entrepreneurs i.e., 8.05 million out of the 58.5 million entrepreneurs. In totally, these establishments provided employment to 13.45 million people owned by majority of the females. At present, women entrepreneurs may be less but overall women comprise about 30% of corporate senior management positions, which is notably higher than the global average (24 percent).

> "Improving the worth of work, compensation and enhancing the well-being of such women entrepreneurs are an urgent priority"

WHY TO BECOME WOMEN ENTREPRENEURS?

For many rural women, generating income is part of a broader livelihood strategy, often undertaken on a part-time basis to support their family in the form of additional revenue. Unless the women's potential is properly developed, no improvement in economic development of rural society is possible. Government is providing several opportunities by launching various schemes. Those schemes help women not only to get self-employment but also to market their products without any middlemen to urban consumers. As family is the first preference for the most of the Indian women, they can spend only few hours out of home for their livelihood. In spite of underutilization of their potentiality, they can be made more productive if they are turned to entrepreneurs. Indian women can actively involve in multiple tasks if their talent can be identified and put them in a right path.

WHY ONLY WOMEN?

Women are the innovators, designers and developers of a new life as mothers who can take care of everything, not only formulation can also design the future. They have different qualities like:

- She is smarter and shows curiosity in creating a new thing.
- She is honest and hard worker.
- She has a positive outlook, confidence and courage.
- She compromises and remains calm in fights and calms you down too.
- She is a well organizer, supporter and commitment to excellence.
- She has the ability to listen, learn and adapt.

HOW TO START?

In India approximately 45 million rural women are mobilized and bought into the fold of self-help groups which a financial intermediary committee is run by members itself. SHGs are boon to the women entrepreneurs for approaching banks rather than as individuals, SHG members can easily approach the

banks and get linkages. These groups were provided with access to finance, markets, and business development services for the development of women as micro enterprises.

- Banks
- Private and corporate institutions
- Internal linkage of SHGs
- NGOs

WHAT ARE THE BUSINESS IDEAS?

A business idea is a concept which can be used for economic growth by selling the product or service that can be offered for money. These are the few business ideas to the Indian women to get benefit from better quality of work to become best entrepreneur.

1. **Agarbatti Making:** Agarbatti is also one type of Incense Sticks. These have potential markets in different countries which can be initiated easily on small-scale basis. Agarbatti making business can be started with simple machinery and moderate capital investment.

2. **Bindi Making:** Bindi is a day to day required product for all the women with a small start-up capital and is a home-based business. Bindi making is a simple process with good marketing opportunities, possibilities and cost-effectiveness.

3. **Biscuit Making:** Biscuit making is one of the most profitable small scale business ideas for women entrepreneurs. Biscuit making is a conservative activity and a newcomer can start this business with low capital. This makes biscuit making a very lucrative business idea for rural women.

4. **Candle Making:** Candle making

is one of the most profitable small scale business ideas for rural women entrepreneurs. This business can be initiated or start up as a small-scale and part-time basis. Candle not only used for religious purpose but also as a decorative purpose. It also has a very potential market for scented and decorative candles.

5. **Cooking, Catering and Restaurant Management:** Women are known for being homemakers and cooking food in their home kitchens for their entire family and relatives. It can be an enjoyable field for customer service oriented individuals who love doing something different every day. Women foodpreneurs have become passion able career for one reason or another in these days.

6. **Ecofriendly Handbags and Paper bags:** Handbags is a upcoming business enterprise to start right from the comforts of home which can be taken up part-time basis. A competitive advantage in making of handbags is unique designs and utilizing uncommon materials can be sale in wholesale to retail shops. Additionally, the handbags can also be sold directly to consumers by displaying the products at fashion or craft, mela's and exhibitions shows or selling them online.

7. **Papad Making:** Papad making is one of the most moneymaking home based manufacturing business ideas for women

entrepreneurs. A thin wafer-like

product often served as an appetizer in south Indian meals, demand is good and the production process is not that complex.

8. **Spice processing:** Spice grinding and packaging is one of the most profitable food processing businesses and it is an essential item in cooking and food processing. Apart from individual spice powder like chilly, cumin, turmeric; special quality mixed spice powder processing is more profitable. Some of the most popular items are meat masala, curry powder, chat masala etc.

HOW TO SELECT A PRODUCT?

There are many steps required to bring a product to market, but ultimately, it all starts with the product idea itself. If you have the wrong product idea, then all the other steps, no matter how well you perform them, won't really matter.

- Affordable to develop.
- Potential for a high profit margin.
- Easy to reach market.
- Recurring revenue.
- Skills of the entrepreneur.
- Differentiated product.
- Right price.

WHERE TO MARKET?

Marketing is about finding perfect customer and sharing message or product. Marketing attracts prospects, prospects become buyers, and buyers provide profit. But marketing is more than just putting the business name out into the world.

- Advertise on the radio.
- Advertise in a targeted publication.
- Advertise on a billboard.
- Take out an ad in your local newspaper.
- Advertise on a local cable TV station.
- Use a sidewalk sign to promote your specials.
- Participate in exhibitions and Mela's.

CONCLUSION

The real value may be in the implementation, but it all starts with the new idea. Women entrepreneur need to make sure in putting their time, money and effort in bringing out a new product that has the best chances of making good profits. Household goods or an idea having a great potential market and also in demand all-round the year.

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INFORMATION AND COMMUNICATION TECHNOLOGY IN AGRICULTURE

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Agriculture occupies a key position in the Indian economy because of its contribution to overall economic growth through supplies of food, raw materials and exports. It is a source of livelihood for a majority of the population and provides a large market for non-agricultural goods and services. Agriculture in India is a prime occupation for a major segment of population and a vast majority of population depends on this prime occupation. The sector faces major challenges of enhancing production in a situation of dwindling natural resources necessary for production. The growing demand for agricultural products, however, also offers opportunities for producers to sustain and improve their livelihoods. Information and communication technologies play an important role in addressing these challenges and uplifting the livelihoods of the rural poor.

ICT otherwise known as e-agriculture is one of the action lines identified in the declaration and plan of action of the World Summit on the Information Society (WSIS). The "Tunis Agenda for the Information Society, emphasizes the leading facilitating roles that UN agencies need to play in the implementation of the Geneva Plan of Action, published on 18 November 2005. The Food and Agriculture Organization of the United Nations (FAO) has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-Agriculture. More specifically, e-Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture. The main phases of the agriculture industry include crop cultivation, water management, fertilizer application pest management, harvesting, transfer of foods, safety, quality management and marketing management, Any system applied for getting information and knowledge for making decisions in any industry should deliver accurate, complete, concise information in time or on time. The information provided by the system must be in user-friendly form, easy to access, cost-effective and well protected from unauthorized accesses.

ICTs are indeed revolutionary in nature. By definition ICTs are a diverse set of technological tools and resources to create, disseminate, store, bring value addition and manage information knowledge thereby becomes the fundamental resource for all economic and developmental activities in the knowledge society. ICT have become part and parcel of the process of socialization. At the global level, the spread and appropriation of ICTs has been a key dimension of liberalization, globalization and privatization. ICT revolution will bring prosperity in our country. There is a need for developing capacity to generate, absorb, disseminate and protect knowledge. It can help to meet the farmer's information needs.

Many ICT interventions have been developed to help agriculturists improve their livelihoods through increased agricultural productivity and incomes, and reduction in risks. Producers can realize the comparative advantages of their production system and marketing management system.

ICT is a bridge between traditional knowledge and modern knowledge. ICT (Information and Communication Technologies) refers to technologies that provide access to information through telecommunications medium such as

the radio, television, cell phone, computers, satellite technology; internet including email, instant messaging, video conferencing and social networking websites which have made it possible for users across the world to communicate with each other to give users quick access to ideas and experiences from a wide range of people, communities and cultures. The importance of ICT in development process was long recognized and access to ICT was even made one of the targets of the Millennium Development Goal No. 8 (MDG 8) that emphasizes on the benefits of new technologies, especially ICT in the fight against poverty.

DEFINITION OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT)

Information and Communication Technology (ICT) is defined by the World Bank as "any device, tool, or application that permits the exchange or collection of data through interaction or transmission." It "includes anything ranging from radio to satellite imagery to mobile phones or electronic money transfers."

Information and Communication Technology (ICT) which can be seen as the study or business of developing and using technology to process information and aid communication has become within a very short time, one of the basic building blocks of modern society. Each of the concept are explained below with the meaning of ICT as seen by various authors also enumerated.

INFORMATION

Is a term with many meanings depending on the context? It is seen as organized data which is understood to have significance and meaning or data that have been processed and presented in a form suitable for human interpretation, often with the purpose of revealing trends or patterns or an organized data that has been arranged for better comprehension and understanding. Information as an integral part of ICT in whatever form is not useful or of value until it is accessed, relayed, transmitted, diffused and used or adopted.

COMMUNICATION

Takes place when information is shared interchangeably between two or more individuals, the first individual referred to as the sender e.g. Extension agent, while the second individual(s) is/are referred to as receiver(s) e.g. farmers through a medium for the purpose of translating or transmitting relevant information. It is an interaction processes used to change and influence the learner's behaviour towards intended outcomes.

TECHNOLOGY

Simply implies the application of knowledge to meet the goals, goods and services desired by people. It is the innovation, change or modification of the natural environment to satisfy perceived human needs and wants.

OBJECTIVES OF ICT

Global communication is accelerating at breakneck speed as a result of proliferating Information Communications and Technology (ICT) - the hardware and software used to send and receive information. Social networking sites such as Facebook, Twitter and MySpace, computers, phones and tablets make up the term ICT. Over the past few years, the ICT sector has grown substantially with a lot of new companies releasing new gadgets and creative technologies to enhance communication.

Information and Communication Technology (ICT) in agriculture, popularly knownas e-Agriculture is a promising field. It focuses on the enhancement of agricultural and rural development through improved information and communication processes. In particular, e- Agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use information and communication technologies (IT) in the rural domain, with a primary focus on agriculture. The term e-Agriculture is a relatively new and its scope is likely to grow as the understanding of the area grows. Indian Agriculture contributes to 13.7 per cent of India's GDP, and approximately 60 per cent Indians derive their livelihood from the agricultural sector. Commercialization of Indian agriculture through private initiatives like contract farming has further broadened its coverage.

E-Agriculture is one of the action lines identified in the declaration and plan of action of the World Summit on the Information Society (WSIS). The Food and Agriculture Organization of the United Nations (FAO) has been assigned the responsibility of organizing activities related to the action line under C.7 ICT Applications on E-Agriculture. The main phases of the agriculture industry include crop cultivation, water management, fertilizer application, fertigation, pest management, harvesting, post-

harvest handling, transport of food products, packaging, food preservation, food processing/value addition, quality management, food safety, food storage, and food marketing. All stakeholders of agriculture industry need information and knowledge about these phases to manage them efficiently.

ICT in agriculture sector meets several objectives and thereby achieving agricultural growth, rural employment, enhanced productivity and happy livelihood. Following are some of the main objectives of ICT enabled agriculture:

- To ensure ownership and develop entrepreneurship in farmers of Indian villages.
- To develop local content and create awareness.
- To spread knowledge of technologies, crop cycle, suitable use of fertilizers etc.
- To ensure language and cultural pertinence and active participation of farmers.
- To help the villagers augment the growth of agriculture and contribute in GDP growth.
- To implement a framework for agricultural development strategies, investments and programs.
- To provide concrete guidance on agriculture through several motivational real time examples; telling them the success stories of farmers who have been successful using ICT.
- To increase public investment in agriculture.
- To provide local as well as global markets.
- To improve access to financial and banking services.
- To improve performance of producer organizations.
- To use innovative practices through science and technology.

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EFFECT OF ACUPUNCTURE ON PLANTS AND PLANT MERIDIAN SYSTEM

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Acupuncture is being practiced and used for thousands of years to prevent, diagnose and treat many human disorders by activating and maintaining the vital force "Qi". Researchers have worked on establishing acupuncture and meridian system in plants as it is successful in humans, mammals and animals. Enhanced plant growth parameters and plant tolerance to pests were recorded through acupuncture experiments on plants.

INTRODUCTION

For around 5000 years acupuncture is being practiced and used, curing more than 1/4th of the world's population by preventing, diagnosing and treating many disorders. The art of inserting fine needles to predetermined specific points on the body, which leads to specific physiological effects on the body is called acupuncture. Historically people skilled in acupuncture believed that in the human body there is a "Vital Force" or "Life Energy" called "Qi" through which life processes in the human body are activated and maintained. This Vital force flows from the primary body organ to the outer tissues of the person through the channels called meridians. Meridians are intangible and invisible in organisms' anatomy. Physical (in some cases emotional) disorders occur when this flow is blocked. Acupuncture aims at restoring proper energy flow and balance to the afflicted areas, as a result, a homeostasis state is achieved and the body is healed itself.

As acupuncture origin-ated sharp stones were used to prick or pierce the specific body sections. Time and development in science replaced sharp stone with needles made of stone, bone, bamboo, copper, iron or gold. In present times fine needles of stainless steel are used coupled with laser, magnetic field or ultrasonic sound. Traditionally, more than 365 major acupuncture points are on the human body. The recent rebirth of interest in acupuncture and by interventions of new technologies around 800-1000 acupoints have been reported on the human body. Veterinary acupuncture is used for therapeutic, diagnostic and hypoalgesic property in since it is used for humans. For pig, fowl, camel, goat, cow, horse Traditional Chinese acupuncture charts are available.

Researchers have worked on establishing acupuncture and

meridian system in plants as it is successful in humans, mammals and animals. Plant Meridian system was established through studies of different plants on their biophysical characteristics of electricity, sound and temperature. The effect of acupuncture on plant growth, metabolism and development was also investigated.

EXPERIMENTS DONE TO ESTABLISH MERIDIAN SYSTEM IN PLANTS

1. Bioelectricity and acupuncture

Plant used for the experiment:
Soybean (*Glycine max*)

Acupuncture

Stainless steel needles (approximately 3cm length 0.33 mm diameter) were inserted into leaf cushion and remained there for the entire experiment.

Findings

High Electrical Potential and Low Electrical Resistance was associated with small vein, main vein and leaf cushion areas as compared to other plant parts. After 5 hours of acupuncture with two needles at low resistant point, i.e., leaf cushion area, Electrical Resistance decreased 4.5 % on mesophyll and 26.0 % on the main vein of the soybean leaf.

Conclusion

The bioelectrical characteristics of soybean coincides with the transmission lines in humans and other animals, suggesting meridian system might also exist in plants.

1. Temperature and acupuncture

Plant used for the experiment:
Soybean (*Glycine max*)

Acupuncture

Two stainless steel needles (approximately 3cm length 0.33 mm diameter) were inserted on the opposite side of the stem at a point located between the two unifoliate buds (budding acupoint) and remained there for the entire experiment.

Findings

On the first day after acupuncture mean temperature of the main vein increased 0.59 ℃ and on the second day it increased 0.48 ℃. While on the first day after acupuncture mean temperature of mesophyll increased 0.50 ℃ and on the second day it increased 0.47 ℃.

Conclusion

The mean temperature changes of soybean coincides with the humans and meridian system, suggesting meridian system might also exist in plants as is known to exist in mammals.

2. Sound and acupuncture

Plant used for the experiment:
Phylodendron (*Alocasia*)

Reason for choosing Phylodendron (*Alocasia*):

Perennial with large and clear veins and broad leaves. Usual plant in extrasensory perception studies.

Acupuncture:

Two stainless steel needles were inserted into the underside of the petiole of philodendron and retained there for the entire experiment.

Findings:

After acupuncture, spontaneous sound production in the main vein increased about 40 dB and in the mesophyll sound production increased about 6 dB.

Conclusion:

Acupuncture affects the acceptance of external sound waves and the production of spontaneous sound waves, suggesting meridian system might also exist in plants as in humans and other animals.

1. Circumnutation movements of shoots and acupuncture

Plant used for the experiment:
Pole bean (*Phaseolus vulgaris*)

Acupuncture:

Two experiments were conducted one using stainless steel needle and the other with a needle carved from bamboo (both needles approximately 3cm length 0.33 mm diameter). Two needles were inserted in each experiment one on each side of the stem between two unifoliate buds (bud acupoints).

Findings:

The period lengths of the ultraradian rythyms of circumnutation movement of pole bean shoots are markedly shortened by acupuncture reported very first time by Hou *et al.*, (1997).

Uses of acupuncture in plants

Meridian system in plants is established by the experiments by Hou *et al.*, (1994). Acupuncture has opened up various operating fields in plant physiology. Hou *et al.*, (1994) have suggested some areas for the application of acupuncture in plants:

i. Exploring meridian systems from humans and animals to plants.
ii. Acupuncture a new alternative treatment for diseased plants.
iii. A new way to increase plant yield without negative effects (i.e., pollution and poison)

Hou and Li, (1997b) recorded strengthened growth and development of the plants pole bean (*Phaseolus vulgaris* cv. Kentucky wonder) and bush bean (cv. Slenderette) when subjected to acupuncture:

i. 20.5 % increase in mean net photosynthesis rate.
ii. 27.2 % increase in mean transpiration.
iii. 22.5 % increase in growth and total length of internodes.
iv. 22.9 % increase in total dry weight of the shoot from the cotyledon to the apex.
v. Acupunctured plants flowered 3 days earlier.
vi. 14.4 % increase in the number of fruits per plant.

Hsiao Gui-wen, (2007) a researcher from Taiwan applied acupuncture to fruit-bearing plants like peach and apple trees. The needles used were made from steel spokes from bicycles 3-4 times larger than used for human acupuncture. He reported:

i. Advance in harvest time by a month and a half.
ii. Decreased damage by blight disease.

Conclusion

Acupuncture is a viable technique of increasing yield in agricultural plants which requires low input and thorough skills for a healthy plant (pest tolerant, etc.) and to procure good crop yield. This area of research needs to be explored for specific results in local areas of the country.

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RAMSAR SITES: THE ACTION FOR NATURE

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The Convention on Wetlands of International Importance is special in that it is the first contemporary treaty between states targeted at natural resource conservation. In 1971, the Ramsar Convention on Wetlands was signed in the small **Iranian town of Ramsar**. The Convention on Wetlands has been known as the Ramsar Convention. **UNESCO *(United Nations Educational, Scientific and Cultural Organization)*** established an intergovernmental environmental treaty in 1971, which comes into effect in **1975**. The Ramsar Convention has been a pioneer in the protection of wetland biodiversity for the past **50 years.** Following nine years of negotiation, **18 countries signed the first** worldwide intergovernmental treaty on the environment on February 2, 1971, after acknowledging the importance of wetlands for environmental protection and wise use of natural resources. This was a remarkable big success, especially considering it occurred during the Cold, War when political tensions and economic competitiveness were still high after World War II. India signed under it on **1st February 1982**. It provides for national and international action in the conservation of wetlands, as well as the wise and sustainable use of their resources. Ramsar lists wetlands of worldwide significance, particularly those that provide habitat for waterfowl.

The creation of a network of protected areas (Ramsar Sites) under the List of Wetlands of International Importance was a foundation of the Convention, allowing wetlands to be conserved and used sustainably. **With around 2,435 sites across 2.5 million sq. kilometres**, the "Ramsar List" is now the world's biggest network of protected areas. The main goal of the Ramsar List, according to our Strategic Framework's "**Vision for the List**," is to "build and maintain an international network of wetlands that are essential for the conservation of global biodiversity and for sustaining life by maintaining their ecosystem components, processes, and services/benefits.

World's First Ramsar site was identified in 1974, which was the Cobourg Peninsula in Australia**.**

The **United Kingdom** has the world's largest number of Ramsar sites i.e 175.

- ❖ February 2 is celebrated as International Wetlands Day as the Ramsar Convention was signed on February 2, 1971.
- ❖ The Ramsar Convention works with the collaboration of the following organizations:
  - International Union for Conservation of Nature (IUCN).
  - Birdlife International.
  - International. Water Management Institute (IWMI).
  - Wetlands International.
  - Wildfowl & Wetlands Trust (WWT).
  - WWF International.
- ❖ To research any of the Ramsar sites, one can check the *Ramsar Sites Information Service (RSIS).*
- ❖ The number of contracting parties for the Ramsar Convention as of December 2021 is 172.

- Though they cover only around 6% of the Earth's land surface, 40% of all plant and animal species live or breed in wetlands.

In reality, through the identification and management of appropriate wetland areas, all **nine** of the Criteria for recognizing Wetlands sites of International Importance contribute to the protection of biodiversity.

The Ramsar Convention's broad goals are to halt the global loss

of wetlands and to conserve those that remain via prudent use and management. International cooperation, policy development, capacity building, and technology transfer are all required. 172 Contracting Parties to the Convention have assigned over 2,435 wet land are as throughout the world to the Ramsar List of Wetlands of International Importance.

Contracting Parties agree to do the following:

- Identify at least one site for inclusion in the Ramsar List of Wetlands of International Importance that satisfies the Ramsar criteria.
- Encourage wetlands conservation and wise usage.
- Wetland protection should be a part of their national land-use planning.
- Create wetlands nature reserves and encourage wetland training, and
- Consult with other Contracting Parties regarding the Ramsar Convention's implementation.

What is Ramsar Convention?

Wetlands include a wide range of natural and man-made habitat types, from rivers to coral reefs, as defined by the Ramsar Convention. Marshes, lakes, mudflats, coral reefs, salt marshes, mangroves, fens, swamps, peat bogs, billabongs, and other bodies of water - natural or artificial, permanent or temporary - are all examples of wetlands. Water in these locations can be either flowing or static, fresh, brackish, or saline, and can include upland rivers as well as coastal or marine water up to a depth of 6 metres at low tide. There are even wetlands beneath the ground.

The Ramsar Convention promotes the designation of wetlands that are representative, rare, or unique, as well as wetlands that are vital for biological diversity conservation. These locations are added to the Convention's List of Wetlands of International Importance and become known as Ramsar sites once they have been identified. Countries agree to construct and oversee a management structure aimed at conserving the wetland and guaranteeing its sensible use when they designate a wetland as a Ramsar site. Under the Convention, wise use is defined as preserving a wetland's ecological identity.

Because of its ecological, botanical, zoological, limnological, or hydrological importance, wet lands might be added to the List of Wet lands of International Importance.

To be included on this list, a wetland must fulfill one or more of the criteria for recognizing wetlands of international significance.

List of Ramsar sites in India –

S.No.	Name	Location	Area (km^2)	Designated
1	Ashtamudi Wetland	Kerala	614	19 August 2002
2	Beas Conservation Reserve	Punjab	64	26 September 2019
3	Bhitarkanika Mangroves	Odisha	650	19 August 2002
4	Bhoj Wetland	Madhya Pradesh	32	19 August 2002
5	Chandra Taal	Himanchal Pradesh	0.49	8 November 2005
6	Chilka Lake	Odisha	1165	1 October 1981
7	Deepor Beel	Assam	40	19 August 2002
8	East Kolkata Wetlands	West Bangal	125	19 August 2002
9	Harike Wetland	Punjab	41	23 March 1990
10	Hokera Wetland	J & K	13.75	8 November 2005
11	KanjliWetland	Punjab	1.83	22 January 2002
12	Keoladeo National Park	Rajsthan	28.73	1 October 1981
13	Keshopur-Miani Community Reserve	Punjab	34	26 September 2019
14	Kolleru Lake	Andhra Pradesh	901	19 August 2002
15	Loktak Lake	Manipur	266	23 March 1990
16	Nalsarovar Bird Sanctuary	Gujrat	123	24 September 2012
17	Nandur Madhameshwar	Maharashtra	14	21 June 2019
18	Nangal Wildlife Sanctuary	Panjab	1	26 September 2019
19	Nawabganj Bird Sanctuary	Uttar Pradesh	2	19 September 2019
20	Parvati Aranga Bird Sanctuary	Uttar Pradesh	7	2 December 2019
21	Point Calimere Wildlife and Bird Sanctuary	Tamil Nadu	385	19 August 2002

22	Pong Dam Lake	Himanchal Pradesh	156.62	19 August 2002
23	Renuka Lake	Himanchal Pradesh	0.2	8 November 2015
24	Ropar Wetlamd	Punjab	13.65	22 January 2002
25	Rudrasagar Lake	Tripura	2.4	8 November 2005
26	Saman Bird Sanctuary	Uttar Pradesh	5	2 December 2019
27	Samaspur Bird Sanctuary	Uttar Pradesh	8	3 October 2019
28	Sambhar Lake	Rajsthan	240	23 March 1990
29	Sandi Bird Sanctuary	Uttar Pradesh	3	26 September 2019
30	Sarsai Nawar Jheel	Uttar Pradesh	2	19 September 2019
31	Sasthamkotta Lake	Kerala	3.73	19 August 2002
32	Sundarban Wetland	West Bengal	4230	1 February 2019
33	Surinsar-Mansar Lakes	Jammu and Kasmir	3.5	8 November 2005
34	Tsomoriri	Ladakh	120	19 August 2002
35	Upper Ganga River (Brijghat to Narora Stretch)	Uttar Pradesh	265.9	8 November 2005
36	Vemband-Kol Wetland	Kerala	1512.5	19 August 2002
37	Wular Lake	Jammu and Kashmir	189	23 March 1990
38	Asan Barrage	Uttaeakhand	4.44 stretch	21 July 2020
39	Kanwar Taal or Kabar Taal Lake	Bihar	26.2	21July 2020
40	Sur Sarovar	Agra District, Uttar Pradesh	4.31	13 November 2020
41	Lonar Lake	Buldhana District, Maharashtra	4.27	13 November 2020
42	Tso Kar	Leh district, Ladakh	95.77	17 November 2020
43	Sultanpur National Park	Gurugram, Haryana	142.5	14 August 2021
44	Bhindawas Wildlife Sanctuary	Jhajjar, Haryana	4.11	14 August 2021
45	Thol Lake	Mehsana, Gujrat	6.99	14 August 2021
46	Wadhvana Wetland	Vadodara, Gujrat	10.38	14 August 2021

Source: https://www.ramsar.org/

- **Sundarbans (4230 km^2)** is the largest Ramsar Site of India.
- Chilika Lake (Orissa) and Keoladeo National Park (Rajasthan) were recognized as the first Ramsar Sites of India.
- Uttar Pradesh has the most number of Ramsar Sites in India. It has 8 Indian Wetlands.
- Renuka Wetland in Himachal Pradesh is the smallest wetland of India.
- *India currently has 46 sites designated* as *Wetlands* of International Importance (*Ramsar Sites*), with a surface area of 1,083,322 hectares. This is the highest in South Asia.
- Further, according to recent estimates by Wetlands International South Asia, nearly 30% of the natural wetlands in India have been lost in the last three decades. Majorly, the loss of Wetlands is more prominent in urban areas.

To contribute successfully to biodiversity conservation and sustainable use, wetland management must play a significant part in economic development, poverty reduction, and improving people's livelihoods – we live in a globalized world with interdependent elements, and the Convention must address many existing and emerging issues that connect wetlands and human life, issues of water and food security, urban development, human health, energy, extractive industries, tourism pressures, and perhaps most famously, climate change adaptation and mitigation.

Finally, to tackle all of these problems, we must address critical capacity-building and training requirements within the Ramsar community. We can only expect to achieve the high ideals we've set for ourselves if we work together with worldwide multilateral environmental treaties and the devoted efforts of government and non-government practitioners everywhere.

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TILLING - IN THE ERA OF MODERN PLANT GENOMICS

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In general, the Targeting Induced Local Lesions IN Genomes (TILLING) is a powerful reverse genetic tool that employs non-transgenic techniques to combine chemical mutagenesis with modern PCR-based screening for detection of sequence variation in loci of interest. This technique enables the identification of SNPs and INDELS in a gene of interest that can help decipher the function of thousands of newly identified genes from a mutagenized population.

With the recent advancement of molecular biology, several new techniques have been developed to identify mutations to determine the function of genes. TILLING is an effective tool for functional genomic studies in several plants and animal species that can be mutagenized, despite its mating system, ploidy level, and genome size. This technique is well suited for plant species because they can be self-fertilized and their seeds can be stored for a longer duration. Many other reverse genetic tools have been used to bridge system biology with the resulting phenotype for gene knockout, RNAi, site-directed mutagenesis, and transposon tagging. But these approaches rely on the creation of transgenic which is not always feasible for many plants or animals. Thus, are less efficient with limited success and inefficient transgene expression in model species. Thus the Tilling has proven to be powerful and efficient tooling that ultimately gives rise to allelic series of induced mutations in a gene of interest.

TILLING: TOOLS AND TECHNIQUES

In essence, the tilling combines chemical mutagenesis with PCR-based screening to identify induced mutations that might alter the protein function. EMS is a widely used mutagenic agent, as it is stable and produces a high density of random mutations throughout the genome with very low aneuploidy and dominant lethality. Once a mutagenized population is created DNA samples are pooled together based on the ploidy level. Fluorescently labelled primers are being targeted for the gene of interest. SNP discovery methods used in TILLING include denaturing high-performance liquid chromatography (dHPLC), heteroduplex mismatch cleavage assay using CEL I endonuclease, detection of digested

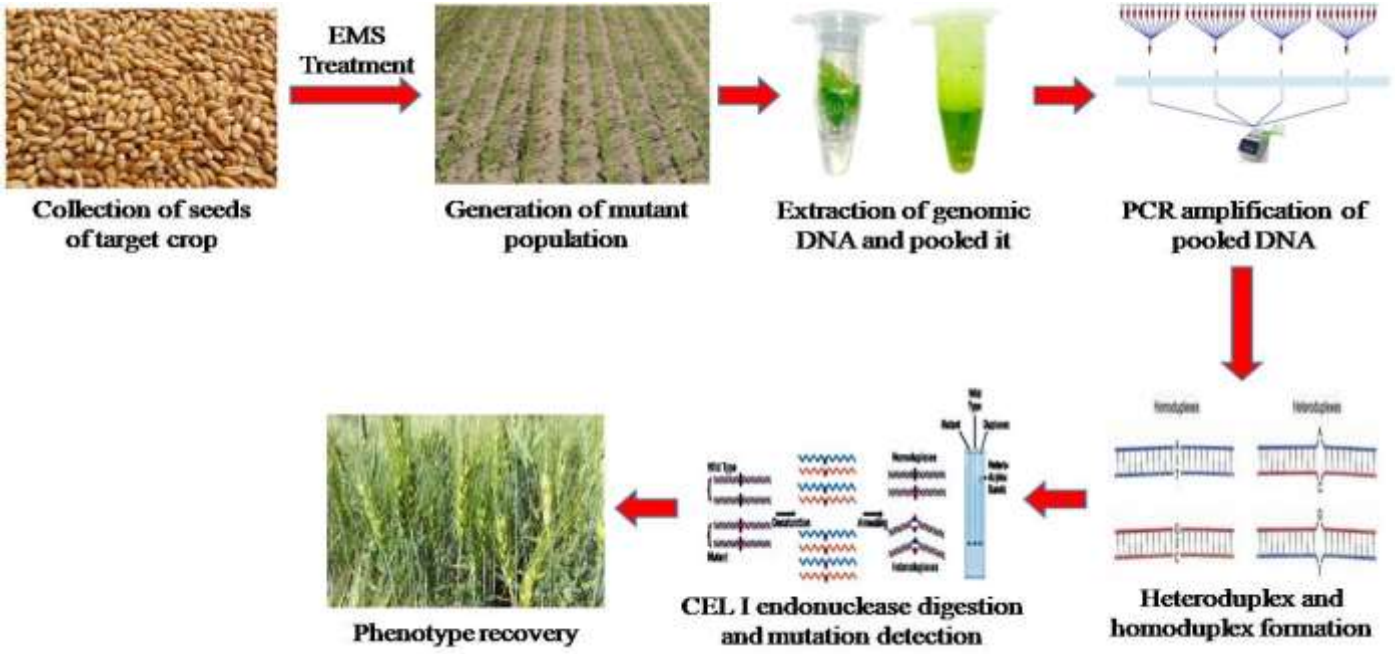

Figure 01: Systematic view of TILLING events for quality improvement in the model crop.

fragments followed by sequencing. CEL I endonuclease which is isolated from celery not only recognizes mismatches in the heteroduplex but also cleaves DNA on the 3' side of the mismatch. Other mutation scanning methods such as single-strand conformation denaturing gradient gel electrophoresis, and technologies such as pyrosequencing and mass spectrometry have myriad of advantages and disadvantages regarding sensitivity, high-throughput, cost, and simplicity.

TECHNICAL ASPECTS:

HOW DOES TILLING DETECT SEQUENCE VARIATION?

In general, the process of TILLING can be divided into three basic steps i.e., development of mutagenized population (mostly by EMS), DNA extraction & pooling, and finally, the discovery of mutation for sequence variation (Fig. 01). For this, the M_2 population is used for the detection of mutation as mutations are recessive and cannot be in detected at M_1. Furthermore, the M_3 population is used for phenotyping as M_2 is a segregating population having more variation. But earlier studies suggest that in most cases, a homozygous population is used for precise phenotyping for target trait variation.

A REVERSE GENETICS TOOL FOR CROP IMPROVEMENT

TILLING is an effective tool for crop improvement. Since its development, the TILLING has been extensively used for crop improvement for various quality traits. It has also been initially applied in *Arabidopsis* but after the huge success, it has been radiated to other agronomically important crop plants having complex genomes such as wheat, rice, maize, sorghum, and other minor crops. To attain better research, several TILLING service centers are now been available across the country for model plants and animals like *A. thaliana, Z. mays, O. sativa, M. truncatula, L. japonicus, B. napus, S. Lycopersicum, G. max, C. elegans,* and *Drosophila*. Due to the increasing population and maintaining plant & animal germplasm collections both nationally and internationally it is essential for supplying food for future generations. Thus in this context, the TILLING can be a promising and candidate reverse genetics tool for quality improvement of improved target crop (cultivars).

CONCLUSION AND FUTURE PERSPECTIVE

TILLING has proven to be a highly efficient reverse genetic tool for functional genomic studies in both plants and animals. Since the inception of this technique, many researchers have gained indispensable insight into gene function and have identified significant genic variants. With the advancement of molecular biology and functional genomics, more genomic information will become readily be available for other plant and animal species. Thus, reverse genetics approaches will be necessary to assign putative gene function. However, there are some technical challenges is involved while performing TILLING. The creation of a mutant population is a challenging task and sufficient time is needed for the development of a high-quality mutant population. Further, the different species responded differently to mutagen dose. Apart from these limitations, TILLING has been proven to be a powerful tool for modern crop improvement. With the current trends of the increasingly fast pace of collection of sequence data and the aspiration of geneticists to understand the function of all the genes, TILLING has been presumed to be the most efficient reverse genetics approach that will surely cultivate shortly.

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AI APPLICATIONS IN PLANT DISEASE DETECTION

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Plant diseases are the major cause of low agricultural productivity. Mostly the farmers encounter difficulties in precise diagnosis and detecting the plant diseases. Early detection is essential to take up the plant protection measures in-time to avoid the severe crop losses. Artificial intelligence (AI) with deep learning models helps in accurate identification of plant diseases. Deep learning is a novel method for image processing and plant disease detection with greater accuracy in the classification of various crop diseases. AI tools analyze huge amount of data and represent back to farmers in the form of useful suggestion helping them to make critical, timely, infield decision. Smartphone-based AI apps like crop diagnosis, saillago agrio, plantix could alert farmers about disease incidence, thus preventing the possible outbreak of diseases. For example, satellite and drone imagery and sensors on the cameras can detect small parts of a field that are infected by disease, and a farmer acts on that information and treats that tiny area with a targeted application. The ability to identify and address diseases quickly through AI has a huge impact on a farmer's time, resources, and ultimately on the productivity of their crops.

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions.

AI USES IN AGRICULTURE

Analysing satellite Images, Agricultural Robots, In-field monitoring, Predictive analyses assessing crop / soil health with Drones.

SCOPE OF AI IN AGRICULTURE

Agriculture is seeing rapid adoption of Artificial Intelligence (AI) and Machine Learning (ML) both in terms of agricultural products and in-field farming techniques. Cognitive computing in particular is all set to become the most disruptive technology in agriculture services as it can understand, learn, and respond to different situations (based on learning) to increase efficiency.

APPLICATIONS OF ARTIFICIAL INTELLIGENCE

MACHINE LEARNING (ML)

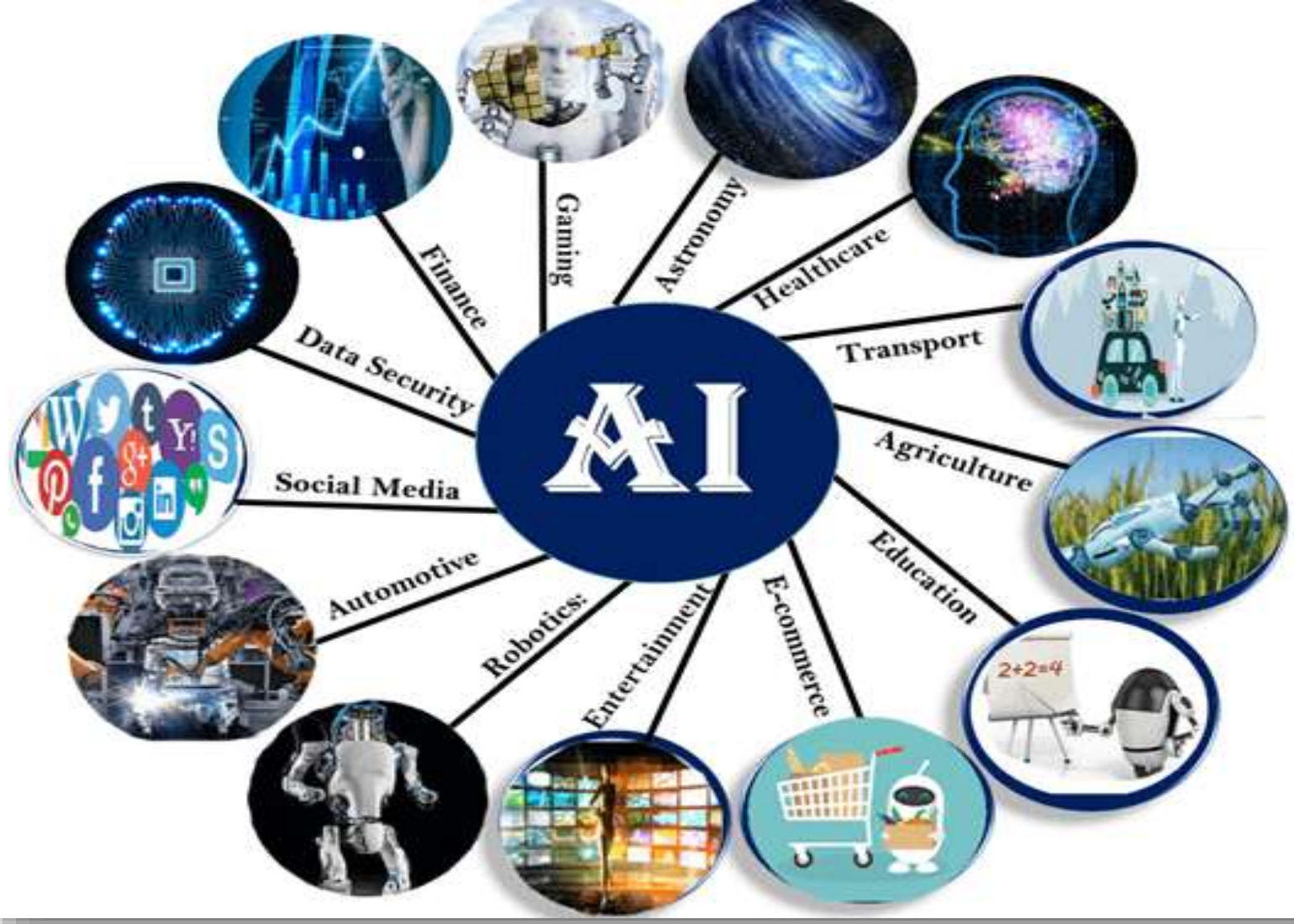
With machine learning, computer systems are programmed to learn from data that is input without being continually reprogrammed. In other words, they continuously improve their performance on a task for example, playing a game without additional help from a human. There are different ways of getting machines to learn. Some are simple, such as a basic decision tree, and some are much more complex, involving multiple layers of artificial neural networks.

DEEP LEARNING

Deep learning is the next frontier of machine learning. Just as machine learning is considered a type of AI, deep learning is often considered to be a type of machine learning some call it a subset. While machine learning uses simpler concepts like predictive models, deep learning uses artificial neural networks designed to imitate the way humans think and learn.

DEEP LEARNING IN THE DETECTION OF PLANT DISEASES

Wetterich *et al.*, 2013 detected HLB with SVM based on four features (uniformity, contrast, correlation and homogeneity) extracted from **fluorescence imaging spectroscopy**. By using this method, the highest classification **accuracy was 90%** for **HLB (Citrus greening)** - infected leaves from Brazil. Later Wetterich *et al.* used two machine learning algorithms, SVM and artificial neural network (ANN), to discriminate **HLB (citrus greening)** from **zinc-deficiency stress** on citrus leaves. The accuracy was 92.8% for SVM and 92.2% for ANN respectively. Prince G *et al.*, 2015 extracted both local and global statistics from thermal and visible light image data and used SVM to identify the **powdery mildew-inoculated** tomato leaves. They showed that the machine learning



system was able to identify the tomato leaves infected naturally by powdery mildew. By using deep convolutional neural networks (CNN), which is the latest generation of machine learning methods, Sladojevic *et al.*, 2016 has successfully recognized **13 different plant pathogens** and achieved precision between **91% and 98%.**

CONCLUSION

When compared to the conventional methods of plant disease detection, AI based detection systems are highly efficient, requires less time, involves less cost and also don't require trained professionals. The major advantage with AI is that it keeps on learning over the time. The best example is differentiating between the plant diseases and nutrient deficiencies, AI can be programmed accordingly so that it learns the changing pattern over time. The only disadvantage is that AI largely relies on the cloud data platforms, need longer software support and requires fast internet connectivity, but this can be solved as today the entire world is being driven by technology and AI is the new buzz word in the technological industry and the speed of internet was greatly increased with the introduction of 4G and 5G.

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MAJOR INSECT-PESTS OF MUSTARD AND THEIR MANAGEMENT

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Mustard is a most important oil seed crop which is cultivated as Rabi crop. One of the major concern in stabilizing the yield of mustard is incidence of insects which are causing damage to crop at different stages and responsible for huge yield losses. For the protection of crop, proper identification and management of crop should be adopted.

1. Mustard Aphid (*Lipaphis erysimi*)

Aphid attack on twig

Aphid attack on silique

Damaging symptoms: Mustard aphid is serious pest of mustard. The pest remains active in plains during November to March. It is small, pear shaped, delicate insect with soft and fragile body. Both nymphs and adults suck the cell sap from different parts of the plant i. e. inflorescence, leaf, stem, twig and pods as a result of which leaves acquire a curly appearance. In heavy infestation plant stunted, dries up resulting no pod and seed formation. Aphids secrete honeydew, which is responsible to the growth of black fungus known as "sooty mould" that hinders the photosynthesis.

2. Mustard Saw fly (*Athalia proxima*)

Early damaging symptom

Sever damaging symptom

Damaging symptoms: The grubs alone are destructive. They bite holes into leaves preferring the young growth and skeletonize the leaves completely. Sometimes, even the epidermis of the shoot is eaten up. Although the seedlings succumb; the older plants, when attacked, do not bear seed.

3. Cabbage butter fly (*Pieris brassicae*)

Damaging symptoms: The caterpillars alone feed on leaves, young shoots and green pods. When young, they feed gregariously but the grown-up caterpillars migrate from one field to another. The first instar caterpillars just scrape the leaf surface, whereas the subsequent instars eat up leaves from the margins inwards, leaving intact the main veins. Often, entire plants are eaten up.

Larvae of *Pieris brassicae*

Damaging symptoms of *Pieris*

4. Painted Bug (*Bagrada hilaris*)

Damaging symptoms: Both nymph and adults suck the sap from leaves, buds and pods. Curling may occur for infested leaves and at advanced stage plants may wither and die. Plants remain stunted and sooty molds grow on the honey dew excreted by the insects.

5. Diamondback moth (*Plutella xylostella)*

Damaging symptoms: Plant damage is caused by larval feeding. Although the larvae are very small, they can be quite numerous, resulting in complete removal of foliar tissue except for the leaf veins. Whitish patches due to scrapping of epidermal leaf tissues by young larvae and the leaves give a withered appearance but in later stages larvae bore holes in the leaves. It also bores into pods and feeds developing seed.

Integrated Insect Management

- Timely sowing of the crop before 15th October helps to escape infestation of mustard aphid.
- Apply balanced dosages of fertilizers i.e. (NPK-100:40:40). As application of only nitrogenous fertilizers makes the crop vulnerable to aphids.
- Seed treatment with Imidacloprid 70 WS @ 5.0 g/kg of seed should be done for management of painted bug and other insects during early stage of crop.
- Plough the field in summer season and follow the clean cultivation by weeding, hoeing and burning of debris in and around the field.
- Pluck and destroy the infested twigs or dip them in kerosenised/ insecticide treated solution from the border rows by 2-3 times at 10 days interval is very functional to avoid the further increase of insects in the crop season.
- Foliar application of insecticides such as Oxy-demeton methyl (Metasystox) 25 EC or Dimethoate (Rogar) 30 EC @ 1 ml/ litre of water is done when 26-28 aphids/plant is observed.
- If the pest populace builds up again, insecticidal spray can be repeated at 15 days interval or 5% neem seed kernel extract (NSKE) and 2% neem oil sprays are also effective to manage mustard insects.
- In case in severe infestation of aphid and saw fly spray the crop with Phasphamidan 85SL, Quinolphos 25 EC, Malathion 50 EC @ 1-1.5 ml/ litre of water.
- In ecofriendly management *Verticillium lecani* @10^8 CS/ml of water in combination with 5 % NSKE, 2% neem oil is effective in reduction of aphid population.
- Spraying should be done in the afternoon for avoidance of toxicity to pollinators.
- Thresh the crop as early as possible to avoid the further losses and dispose off infected plant debris immediately.

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BIOLOGICAL CONTROL OF WEEDS BY FUNGI: CHALLENGES AND OPPORTUNITIES

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Weeds are regarded as unwanted and undesirable plants, associated with declines in crop yields and quality, causing health and environmental hazards and account for more than 30% of total losses caused by all the pests. Weeds can reduce crop yields by an average of 12%, which translates to $32 billion in losses per year. Common methods of weed control that are, mechanical and chemical approaches, associate with some drawbacks including being: costly, energy intensive, troublesome, having undesirable effects to the environment, development of resistance and the potential for injury to non-target organisms. Generally, two basic methods are applied for biological control of weeds: the classical and the bio-herbicide approaches. In classical strategy a natural predator or pathogen of a weed species is simply released into weed populations. On the other hand, the bio-herbicide approach (also referred to as the inundative strategy) utilizes indigenous plant pathogens such as fungal or bacterial suspensions that are isolated from weeds and are cultured to produce large numbers of infective propagule.

SUCCESSFUL MYCOHERBICIDES

The mycoherbicide product Myco-Tech™ (*Chondrostereum purpureum*) was registered in 2002. This pathogen is an important fungal species which causes severe disease in many tree species in North America and is liable for the birch dieback in North American forests to a great extent. Several mycoherbicides for controlling some of the noxious weed species. Table 1 includes some of fungi with the high potential of phyto-pathogenicity. Besides, there are quite a few mycoherbicide candidates that have shown promise in greenhouse and/or field trials. The mycoherbicide DeVine is a formulation of the fungus *Phytophthora palmivora* that was twice registered in 1981 and 2006. The fungus was isolated from *Morrenia odorata* (strangler vine) in Florida and was applied to control the same plant. Though the product was re-registered in 2006, due to the limited market, it is not commercially available now. One of the most promising aspects of using mycoherbicides is that they are cost beneficial. According to Page and Lacey (2006), the aggregate results of benefit/cost ratio (B/C ratio) for many mycoherbicide indicate an overall B/C ratio of 23:1.In another project for controlling *Chondrilla juncea*, the evaluation of B/C ratio of utilized fungal pathogens to control this weed, it was found that the accrued benefits to the users have been significant such as a 100:1 to 200:1.

Table 1: A list of either successful or potential candidates of mycoherbicides

Bioherbicide agent	Target weed	Intended system	Stage of development
Colletotrichum gloeosporioides* f.sp. *aeschynomene	*Aeschynomene virginica* (Northern jointvetch)	Croplands	Registered as Collego
***Colletotrichum gloeosporioides* f.sp. malva**	*Malva pusilla* (Round leafmallow)	Croplands	Registered as BioMal
Phoma chenopodicola	*Chenopodium album* (Lamb'squarters)	Croplands	Research phase
Phoma macrostoma	Dicot plants	Turf	94-44B strain registered with EPA
Sclerotinia minor	*Taraxacum officinale* (Dandelion)	Turf	Registered as Sarritor.
***Chondrostereum purpureum* strain HQ1**	Re-growth of deciduous trees and shrubs	Woodlands	Registered as Mycotech Paste

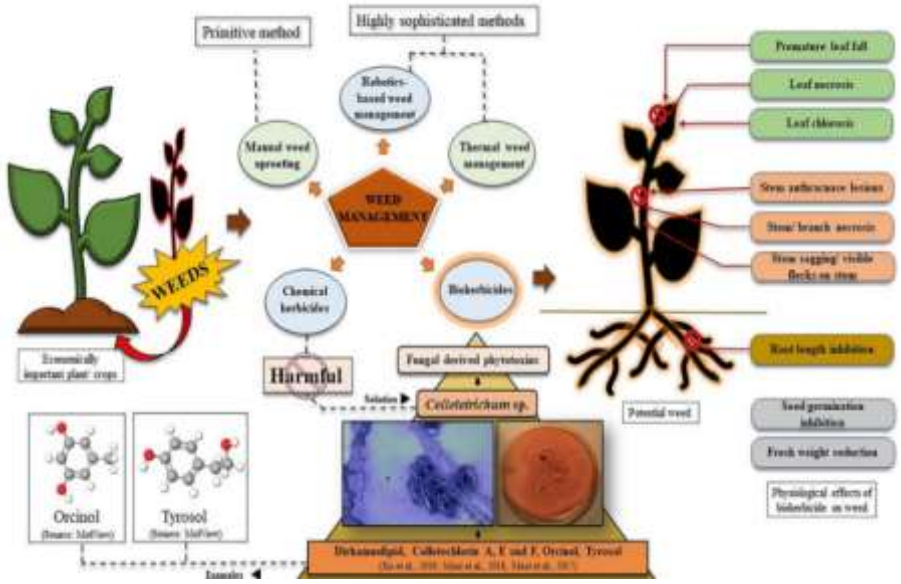

Fig 1: Methods and characterization of weed management

IMPROVING THE MYCOHERBICIDE AGENTS

The potential of a mycoherbicide, weed researchers must consider some important characteristics such as host specificity, ability to grow and sporulate on culture media, genetic stability and virulence. A large number of studies have shown that lack of these properties will lead to low success rates of mycoherbicide products in terms of commercialization. As it has been declared before, microorganisms can naturally modify their phenotypic characteristics by manipulating their genetic pool. Various genomic approaches have been evolved to track the molecular bases of these modifications. Fig.- 1.

EFFECT OF FUNGAL BIOHERBICIDES ON WEED PHYSIOLOGY

Fungal species inhibit weed plant growth by different mechanisms. For example, pathogenic fungi *Phoma macrostoma* attacks, colonizes and passes into the root part of the weed plant and develop its mycelium in the vascular trachea to obstruct the food uptake. *Curvularia* intermedia by producing the phytotoxin α, β dehydrocurvularin hinders mitosis in cells of root tip and inhibits seedling development. Besides, pectinase producing fungi can penetrate the cell wall of the weed plant by tearing apart the polysaccharide layers, enlarging the pores and releasing many lethal molecules into infected weed plant cells Moreover, the extracellular lipases of fungal species use the stored lipids in the endosperm of plant seeds for growth. Fig.-2

INTEGRATED WEED MANAGEMENT:

Integrated weed management, which includes, physical, cultural, chemical and biological methods, could be a promising option. In fact, numerous studies have shown the great potential of mycoherbicides in conjunction with other anti-weed agents. Instead of utilizing a single pathogen, a mixture of fungal species, *Phomopsis amaranthicola*, *Alternaria cassia*, *Colletotrichum dematium* f.sp. *crotalariae*, *Fusarium udum* f.sp. *crotalariae* were used to control three weed plant species (pigweed (*Amaranthus hybridus* L.), sicklepod (*Senna obtusifolia*) and showy crotalaria (*Crotalaria spectabilis* Roth.) and in the end, the results of greenhouse study showed that after weeds inoculation with the mixture of fungi's spore suspension, all of the seedlings were killed in 7 days. Strong synergy between *Fusarium oxysporum* and *Rhizoctonia solani* either with larvae or adults of flea beetle for controlling Euphorbia.

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Fig 2: Competitive plants for weed control

PRECISSION LIVESTOCK FARMING

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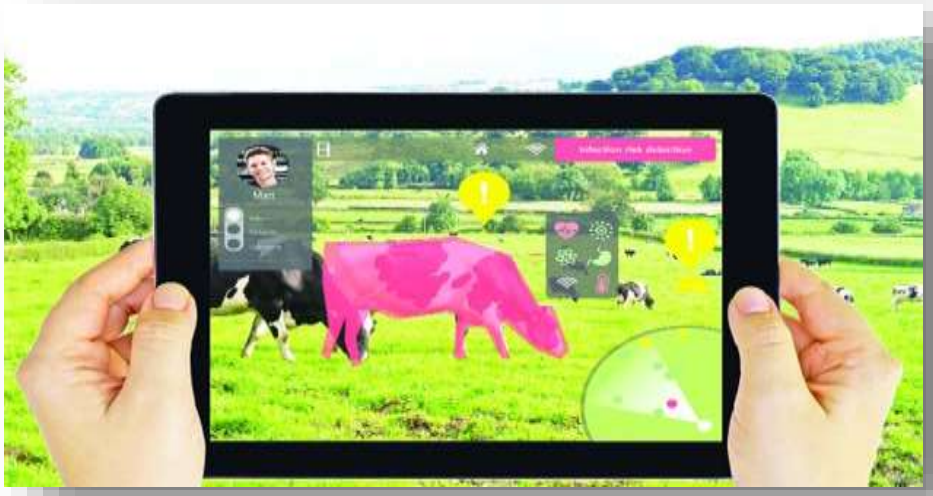

If the global consumption of animal products rises by 70% by 2050, we will be in big trouble. Those who argue that the solution is to cease or reduce meat consumption tend to overlook that stopping or forbidding people from eating meat and changing their behaviours is difficult. We need to find ways to foresee and solve problems as they arise. Traditional livestock management approaches have been supplemented with new sensing and driving technologies, as well as better information and communication technology, in order to mitigate these challenges. While the quantity of animals is increasing, the number of farmers is dropping. As a result, each farmer has a significantly larger herd. Farmers are finding it more difficult to keep track of all of their livestock in such large groups. The constant monitoring of animal health within large groups of animals will be a major concern for the next ten years.

Infections in such large numbers will have severe implications, and reducing antibiotic use will be a major issue. Another big concern will the transfer and control of the zoonotic diseases. To foresee developing difficulties, solutions must be found. The livestock industry is responsible for more than 90% of NH_3, 37% of CH_4, and 65% of N_2O in the atmosphere (Anne Mottet, FAO, unpublished). The livestock industry consumes up to 30% of all land and 8 to 15% of all water resources. Management of livestock in such a way that animal output is closer to genetic potential—less use of feeder, less manure, and higher productivity would make a significant contribution to environmental impact. In general, we keep too far away from the genetic potential of today's genetic lines in practice. Maintaining farmers' competitiveness in the international marketplace is a challenge, and animal productivity is a crucial component. Precession livestock farming (PFA) has the potential to be one of the most powerful advances among a number of intriguing new and forthcoming technologies that have the ability to transform the livestock agricultural industry. PLF's goal is to manage individual animals by monitoring their health, welfare, production/ reproduction, and environmental impact continuously (24 hours a day, seven days a week) in real time. Precision livestock farming (PLF) aspires to provide farmers with a real-time monitoring and management system. PLF's goal is to deliver a real-time alert when something goes wrong so that the farmer can take immediate action to remedy the situation. A live body is obviously far more complex than any mechanical, electronic, or information technology system. The animal is the most important and complicated component in the livestock operation. The monitoring of the PLF approach necessitates constant measurements of the animals' responses directly on the animal rather than in the environment surrounding the living organism due to the time-varying behaviour of animals as living beings. Sensors (e.g., temperature measurement, GPS position, accelerometer data, etc.), real-time picture analysis, or sound analysis are the most common methods for gathering real-time field data, also known as bio-signals, on the animal. PLF could if implemented in grass root level would increase product segmentation and improved marketing of livestock products, reduce illegal livestock trafficking; and improve the economic stability of rural areas if correctly implemented.

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SELECTION OF MEDICINAL AND AROMATIC PLANTS IN TERMS OF DOMESTIC MARKETING, EXPORT-IMPORT AND PROCESSING

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Medicinal and aromatic plants are a huge and commercially important group of plants that provide basic raw materials for medications, fragrances, tastes, and cosmetics. These plants and their products provide a valuable source of revenue for small-scale farmers and businesspeople, as well as precious foreign exchange through export. To address the growing need for plant based pharmac-euticals, perfumes, and flavour goods, India has a rich and wide array of plant resources. The availability of a wide range of soil and climate conditions in our country provides tremendous potential for the cultivation of these plants in the country as a whole, and in Uttar Pradesh specifically.

Even allopath doctors provide a huge number of medicines including medicinal plant or herbal ingredients, such as Ashwagandha, Arjuna, Amalki, Triphala, Neem, Lasuna, Brahmi, and formulations like Cream, Shankhapushpi syrup, and so on.

MEDICINAL & AROMATICS – INDIA SCENARIO

Indian Aromatic Industry

With a proportion of 16-17 percent in total essential oil production and a share of 21-22 percent in value, India ranks third in the world. With a CAGR of 8.7% from 2016 to 2022, the essential oil market is expected to reach USD 11,188 million. The global market for aromatic plants, essential oils, aroma compounds, and spices is continuously rising, and the demand for Indian aromatic plants is rapidly increasing. To meet the growing demand for essential oils in various industries, leading essential oil market companies such as doTERRA International and Moksha Lifestyle Products develop a broad variety of essential oils, such as ginger oil, basil seeds oil, and others.

Indian Medicinal Plant Industry

After China, India is the world's second largest exporter of medicinal plants, producing more than 70% of worldwide herbal product demand. Ayurveda and Siddha are the only codified systems of traditional medicine in India. It features a diverse range of agro-climatic zones and biodiversity hotspots, resulting in a significant amount of medicinal plant biodiversity - 8000 different medical plant types and 6200 indigenous herbal plant kinds. About 8500 licensed herbal units, hundreds of extractors or semi-processors, export houses, and cottage-level operations producing herbal based products make up India's herbal sector. In 2014-15, the domestic herbal sector in India had a revenue of almost INR 20,000 crore. Indian government has established National Medicinal Plants Board (NMPB) under Ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha & Homeopathy (AYUSH) for matters concerning to Medicinal Plants and Support Policies and Programs for growth of trade, export, conservation and cultivation.

Recent Initiatives of GOI are:

NMPB created "e-charak," a virtual market place for medicinal plants and initiated a 365-day awareness campaign on medicinal plants to raise awareness. Seven Regional Centres for Facilitation are being established in various parts of the country. The development of a national raw drug repository and eight regional raw drug repositories for medications used in the ASU and H medical systems is currently underway. Guidelines for voluntary certification of raw material for Good Agricultural Practices and Good Field Collection Practices were designed to assure a steady supply of high-quality raw materials to the industry while also increasing farmer revenue.

- The Uttar Pradesh government has sought minimum support price (MSP) for medicinal and aromatic plants (MAP). Farmers need a safety net of MSP before they adopt the cultivation of medicinal and aromatic plants in a big way, since the demand for herbal and

natural products is rising in the world.

- In Uttar Pradesh, over 250,000 hectares come under herbs cultivation, especially in Ghazipur, Sitapur, Kannauj, Aligarh, Sonebhadra and Mirzapur districts.
- Bithoor near kanpur city, plants such as Ashwagandha or asgandh (*Withania somnifera* Dunal), Sarpagandha (*Rauvolfia serpentina* Benth. ex Kurz.), Satawar (*Asparagus racemosus* Willd.), Artemissia (*Artemisia absinthium* Linn.), Ghritkumari or guar ka patha (*Aloe vera* L.), Madhuyasthi or mulethi (*Glycyrrhiza glabra* Linn.), Madhupatra or stevia {*Stevia rebaudiana* (Bertoni) Bertoni}, Khas {*Vetiveria zizanioides* (Linn.) Nash}, Lemon grass {*Cymbopogon citrates* (DC.) Stapf.} and Rose (*Rosa damascena* Mill.) are grown.
- These plants, their parts or derivatives are much in demand by various agencies. At present, all the plants mentioned above are also being successfully grown in Kanpur, Kannauj, Unnao, Barabanki, Moradabad, Chandausi, Bareilly, Badaun, Sitapur, Sultanpur and Faizabad under favorable conditions. Many people from these areas have been attracted towards this business in view of the continuous and huge demand of these crops.

Marketing of Aromatic Crops

The important marketing channels involved in the disposal of these aromatic plants were:

Channel-I: Producer - Local trader - Industry (company)

Channel-II: Producer - Processor - Industry (company).

It was found that about 75 per cent of these aromatic plants growers used Channel-I and only 25 per cent used Channel-II to sell their produce.

Processing

Private agencies are erecting small processing plants, and the raw form of the product is supplied to pharmaceutical firms. If done correctly by a medical plant grower, it can be a profitable venture. However, preparation is required. Typically, people begin developing MPs without first analyzing the demand, which results in a loss. After examining the state and current requirements at the indigenous and global levels, such a situation can be avoided. By approaching the concerned patronage, you may contact the buyer. There may be some additional effort required at first, but once contacts are formed, it becomes routine for both the customer and the producer. The demand for raw materials will increase in the near future. The majority of the output is now processed and transported abroad. Because people are now aware of the side effects of allopathy treatments, western countries have higher standards. Herbal medications have become popular among indigenous peoples, and meeting their needs, as well as those of foreigners, has become difficult. This condition necessitated the production of herbal remedies in a methodical manner. Forests were formerly the primary supply of raw materials, but with rising population and demand around the world, they are no longer sufficient.

Export and import of medicinal plants

As indicated by trade statistics, global trade in plant-based raw materials for pharmaceuticals, medications, perfumery goods, and cosmetics is growing rapidly. Despite the fact that India exported and imported a huge number of medicinal plants, phytopharmaceuticals, and their derivatives, it had a small share of global commerce. During the years 1997-99, the biggest export from India was Psyllium husk and seeds, followed by Ayurvedic and Unani herbs (NES) and Senna leaves and pods. The problem of constipation that Western people confront as a result of their eating and sedentary work habits is one of the reasons for the large export of Psyllium (isabgol) and Senna.

Table 1 : Medicinal plants used in ISM that are exported from India(NES)

Species	Common name	Plant part exported
Acorus calamus	Vacha	Rhizome
Adhatoda vasica	Vasa	Leaves
Berberis aristata	Daruhaldi	Roots
Colchicum luteum	Colchiicu-m	Rhizome
Hedychium spicatum	Kapur-kachri	Rhizome
Heracleum candicans	Kaindal	Rhizome
Aconitum spsecies	Vatsanabh	Root
Inula racemosa	Puskarmo-ol	Root
Juglans regia	Akhrot	Bark
Juniperus species	Aarar	Fruits
Picrorrhiza kurroa	Kutaki	Rhizome

Punica granatum	Anar	Flower, Root bark
Cassia angustifolia	Senna	Leaf, Pod
Plantago ovata	Isabgol	Seeds
Podophyllum hexandrum	Bankakri	Rhizome
Rauvolfiaa serpentina	Sarpgandha	Root
Rheum emodi	Revandehini	Rhizome
Saussurea lappa	Kuth	Rhizome
Swertia chiraayita	Chirata	Whole plant
Valeriana wallichii	Tagar	Roots

Source: Medicinal & Aromatic Plants: Chapter VII

Table 2: Medicinal plants that are imported in India (Under NES)

Sr. No.	Name of species	Common name
1.	*Anacyclus pyrethrum*	Akarkara
2.	*Borago officinalis*	Gauzoban
3.	*Centurea behan*	Bahman safed
4.	*Cydonia oblonga*	Bihidana
5.	*Glyeyrrhiza glabra*	Mulethi
6.	*Cuscuta epithymum*	Aftimum vilayati
7.	*Lavendula stoechas*	Ustukhudus
8.	*Operculina turpethum*	Turpeth
9.	*Pimpinella anisum*	Anise
10.	*Paeonia officinalis*	Udsaleeb
11.	*Smilex chinensis*	Chobehini
12.	*Thymus vulgaris*	Hasa
13.	*Volutarella divaricata*	Badawar
14.	*Panax ginseng*	Ginseng

Source: Medicinal & Aromatic Plants: Chapter VII

Strategy to improve trade of medicinal plants and their products

- Intensification of R and D
- Export of quality material
- Processing technology for quality produce
- Toxicity and efficacy tests
- Cultivation of exotic plants in demand
- Development of phytomedicinal monographs
- Devising cropping schedules integrating medicinal plants

CONCLUSION

Because of the high cost and limited accessibility to modern medicine, medicinal plants are always regarded as a highly essential source of medicine, particularly for the inhabitants of rural areas and tribes. Traditional knowledge of the area has been substantially impacted by modernity and other reasons, and there is an urgent need to safeguard the indigenous people's cultural legacy and traditional knowledge by justifying the therapeutic potential and biological activities of the plants using scientific methods. A well-organized marketing and commerce of medicinal plants and their diverse products is also required. It is now necessary to create high-quality raw materials in large numbers to suit domestic and worldwide needs. This can only be achieved to promote the domestication and cultivation of medicinal plants which have internal demand in large quantity and have export and import potential.

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SCIENTIFIC CULTIVATION OF TULSI

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There are many lifestyle-related chronic diseases which are leading to the cause of morbidity and mortality all over the world and many of these can be treated with the help of Aryurveda's herbs. One of the most important herb Tulsi (*Ocimum sanctum* Linn) is in the studies for verification of its health benefits .This ayurvedic herb not only has spiritual but also has practical values and helps in the connecting the grower to nature's creative energies. Therefore, in this paper we have briefly described the scientific cultivation of Tulsi.

INTRODUCTION

The Ayurvedic herb, Tulsi has proven to reduce the metabolic stress as well as psychiological stress by helping in lowering the cholesterol level, blood sugar and blood pressure and improving memory and cognitive performance. Among all the varieties of Ocimum genus *Ocimum sanctum* is known as scared basil or Holy basil and *Ocimum basilium* is known as sweet basil or French basil.

When proper care is taken by giving a good amount of water and not letting it wilt then the plant has a life span of 3 years maximum. The leaves, stems, flowers, roots and also the oil are used for the Ayurvedic medicine .Also other than medicinal uses many parts are used for non – medicinal uses. Tulsi is a plant which can survive 4 hours direct sunlight per day.

Sweet Basil: It is often used as perfumery compounds. It provides nutrients and adds flavour to meals and most importantly have health benefits.

Holy Basil: Helps to lower the sugar level and reduce the cholesterol level and also helps to ease the joint pain. It also provides protection against the infection.

Krishna Tulsi: Krishna Tulsi has dark green or purple leaves .It is also known as Shyama Tulsi. It is very useful for curing the throat infections, skin problems, earaches and respiratory problems. Oil from Krishna Tulsi is often used as ear drops and also used to cure malaria, cholera, insomnia and indigestion.

Krishna Tulsi

Kapoor Tulsi: This variety of Tulsi is famous for its scent that drives away insects and often acts as a natural mosquito- repellant. It smells and tastes of clove And drinking Tulsi water regularly help to remove toxins out of our body.

Kapoor Tulsi

Nimboo Tulsi: This Tulsi is known for its beneficial anti- bacterial properties. It helps to increase our immune.

Nimboo Tulsi

MEDICINAL UTILITY

When it comes to herbal treatment, *Ocimum Sanctum* is generally referred to as Tulsi, which is also known as the "Queen of Herbs." In the Ayurvedic and Siddha medical systems, each portion of the plant has its unique significance.

- Tulsi has been discovered to provide protection to organs and tissues from chemical stress as well as physical stress.
- Tulsi has antimicrobial activity throughout a broad spectrum, including activity against a

variety of human and animal diseases.

- Anti-diabetic, anticancer, anti-arthritic, wound healing, antiinflammatory, antiviral, antifungal, antioxidant, anti-asthmatic, antipyretic, memory enhancer, anticoagulant, and antiulcer are only a few of the pharmacological activities of this plant.

IMPORTANCE OF TULSI CULTIVATION

- Tulsi can manage physical, physiological, metabolic, and psychological stress through a unique mix of pharmacological activities, according to a large body of research.
- It's also been suggested for usage as a hand sanitizer, mouthwash, water purifier, wound healer, and food preserver.
- Tulsi farming is both religious and practical, as it ties the planter to nature's inventive forces.
- Tulsi organic farming can help with food security, alleviating rural poverty and hunger, and preventing environmental damage and climate change.
- Tulsi's inclusion in everyday rituals demonstrates Ayurvedic intelligence and serves as an example of old wisdom providing solutions to modern challenges.
- Tulsi is used in a variety of Ayurvedic medications, which empowers Indian farmers by selling herbs and creates a disease-free society by employing tulsi as medicine.
- Tulsi (*Ocimum sanctum*) as a potential alternative crop and source of income, particularly for rural women farmers.
- Tulsi is prized for its medicinal and fragrant characteristics, especially in Ayurvedic medicine.
- Tulsi cultivation and value chain development can be used to investigate alternate livelihoods.
- Tulsi farming provides marginal women farmers with not only a sustainable extra source of income, but also an opportunity to create money from unirrigated, uncultivated land.

Cultivation of Tulsi

Soil Requirements for Tulsi

Fertile soil with high organic content and good draining properties. pH range between 4.4 to 8.2.

Field Preparation

A proper seedbed should be prepared of dimensions 4-5x1x0.2 m.

Climatic Requirements

The plant needs a warm climate for its growth and is susceptible to frost and cold climate.

Propagation of Tulsi

The plant is propogated through two methods by seeds and plant cutting.

a) Seeds:- The seeds are sown before the onset of monsoon. The seeds should be sown 2cm below the soil surface of nursery bed. The seeds generally grow in about 7-15 days, and he soil should be kept moist until the day of germination.

b) Plant Cutting:- The plant cutting should be of length 10-15cm with 8-10 nodes planted in nursery beds.

Irrigation

Tulsi plant should be first irrigated just after sowing thereafter it should be irrigated every month during summer.

Inter-cultural practices

Weeds are to be managed so that the main crop can get enough sunlight and nutrients.

First weeding is done after 1 month of plantation and the second after 4 weeks later.

Integrated Pest Management

Common pests found in tulsi are leaf roller and tulsi lace wing, which can be managed by spraying Azardirachtin 10,000 @5 ml/l and common diseases found in Tulsi are Leaf Spot, SCAB & Blight which can be controlled by spraying Bordeux mixture @ 1% on foliar parts.

Seed production

The flower of tulsi blooms in about 95 days after which the ovule gets converted into seeds and is ready to harvest in full sunny days.

CONCLUSION

Tulsi is a plant that is practically found in every Indian household, with a wide range of medicinal benefits. Tulsi is also planted for oil production. The value of Ocimum sanctum can be found in both the old and current systems of medicine. In today's world, tulsi is increasingly used in cough treatments, immunity boosters, soap, hair shampoo, perfume, and cosmetics. Tulsi is a crop with religious and therapeutic significance that is bringing happiness to farmers these days.

To market and expand the area under organic agriculture, increase revenue and livelihood for growers, and prevent soil and environmental damage, it is necessary to keep the above tulsi.

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BIOCHAR AS A POTENTIAL TOOL TO INFLUENCE GERMINATION DYNAMICS OF VARIOUS CROPS IN AGRICULTURE

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Germination is a complex as well as punctuated process which involve many phases from imbibition of moisture which is supplemented with rapid aerobic respiration, protein synthesis, mobilization of reserve material to embryo and finally to protrusion of radicle and coleoptile. Sprouting is considered as primary incidence for the further development of plant. Uniform germination is the key for healthier establishment of plants and yield in case of every crop in agriculture but it highly gets affected by seasonality, photoperiod, temperature fluctuation, availability of light and other abiotic factors which involve fertility status of soil, depth of sowing, soil water potential and availability of oxygen. Germination declines some time either due to internal or external factors. Internal factors comprise seed dormancy which inhibit seed emergence even under the favourable condition of environment due to genetic makeup of crop or hard seed coat while external factors majorly embraces soil moisture availability, pH and nutrient status of particular soil. Germination percentage also declines due to low vigour of seed, mishandling during the post-harvest operations, embryo damage of seed and ageing. To overcome all these issues of poor emergence and to enhance germination of seed, innumerable seed priming techniques have been established like hydropriming (hydration and dehydration of seed for a specific interval), osmo-priming (use of osmotic solution for seed soaking), bio-priming (seeds treated with some specific bio agent), magneto- priming (exposure of seeds to magnetic radiation). The returns of all these methods depend upon intensity and duration of priming, plant species, surrounding atmosphere and crop management techniques. Apart of all these physical pre sowing treatments now a day's biochar, an excellent carbon source and produced through the partial incineration of organic waste in the absence of air is attracting researchers for the improvement in seed germination in controlled and under farm conditions. Characteristics of biochar can have large variability due to the material used in formulation. It may possess negative or positive properties according to their beneficial alteration or negative changes on soil biota.

Biochar is a source of huge attention because results of many researches have shown its dynamic impact on boosting the seed sprouting in every type of soil and production of agriculture crop under variable climatic condition. Biochar not only enhancing the total soil quality because of its high surface area, cation exchange capacity, micro and macro porosity, water holding capacity, total soil organic carbon which subsidises soil nutrient retention but also managing the ecological factors which are difficult to rectify. Biochar is considered as energy source, carbon sequester which also reduce the emission of greenhouse gasses, produce renewable source through wide range of feed stocks. Biochar composition and application affect soil physico-chemical and biological individualities through improvement in soil fertility status and increased resistance of soil toward water deficiency. Basic cations like Calcium, Magnesium, Potassium and sodium get accumulated in biochar during pyrolysis process which amends the prominent qualities and nutrient status of soil.

Many investigations have been done in laboratory as well as on farm to observe the influence of biochar derived from different feed stock on seed germination. Similar to the soil qualities, biochar affect total germination percentage, speed of emergence and establishment of seedling in field under variable substrate conditions which also give an indication of impact of biochar on plant performance. In some case biochar stimulate the germination of seed while sometimes due to the presence of phytotoxic elements and heavy metals, germination declines below normal. It is not the source of nutrients itself but it consists of utilizable carbon for plant growth. Few biochar have the potential to influence germination indices clearly which also indicates their impact on soil chemical and biological status too. Enhanced germination in biochar amend soil may be attributed to the extraordinary water holding capacity of soil, great nutrient accessibility and more pore spaces.

Germination eminently gets affected through thermal variation, acidity and basicity, water and presence of oxygen in soil. Biochar upsurges capillary water holding capacity with the additional increment of non- capillary pores which eventually improves soil airing resulting in uniform and quick seed germination.

CONCLUSION

Different type of priming methods playing the potential role in improving seed germination under favourable as well as adverse conditions. Priming strengthens the seeds under biotic and abiotic stress conditions, delayed sowing and enhances the germination drastically. In the same way biochar also increases germination and soil physical as well as nutritional quality.

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CHITOSAN AS A SOIL AMENDMENT

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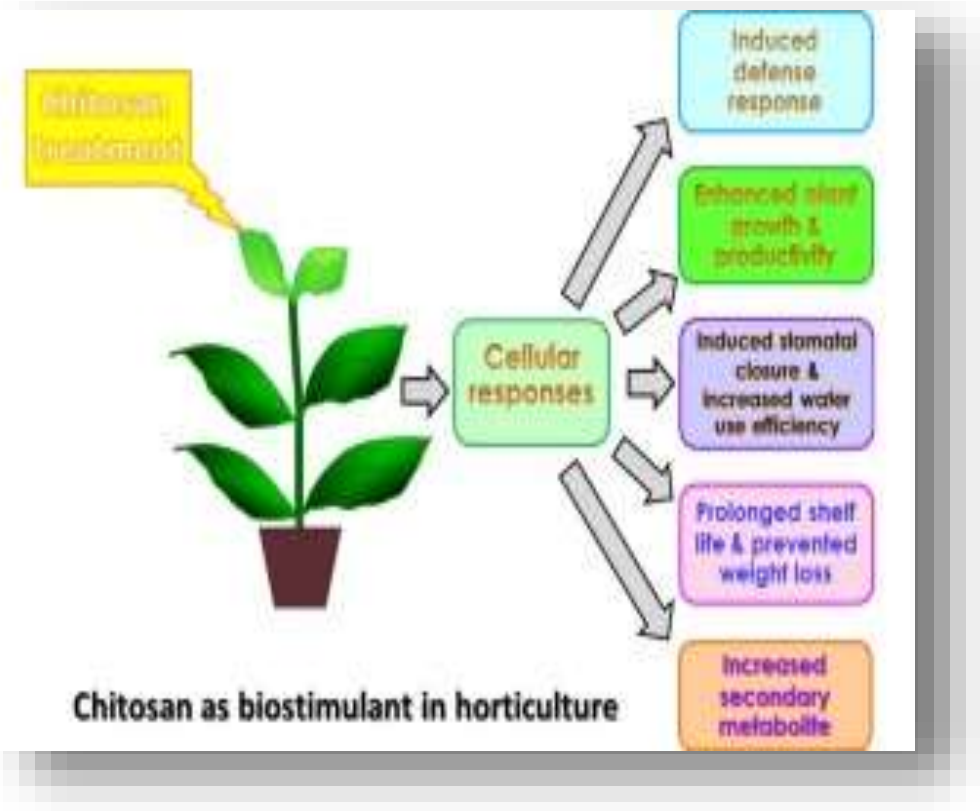
Chitosan is the deacetylated form of chitin, which is the second most abundant polysaccharide on the planet and the main component of fungal cell walls, insect exoskeletons, and crustacean shells. It was initially reported as an elicitor of plant responses, since it induced phytoalexin (pisatin) production, and as a proteinase inhibitor in plants. Since then, biochemical and molecular responses in plants exposed to chitosan have been investigated and they include increases in cytosolic calcium ion, activation of mitogen-activated protein kinases, oxidative burst, callose apposition, increase in pathogenesis-related gene mRNA and protein synthesis, phytoalexin accumulation and hypersensitive response, synthesis of jasmonic acid and abscisic acid, and accumulation of hydrogen peroxide. Chitosan has also been extensively studied as a plant protectant to reduce disease incidence and severity in many crops by inhibiting microbial growth and decreasing microbial membrane integrity.

In addition, chitosan has gained interest as a crop bio stimulant suitable for use in sustainable agriculture. Extensive application of synthetics as fertilizers, herbicides and pesticides, to increase crop productivity has been widely practiced to meet food demand around the world. However, they can cause considerable damage to the ecology of agricultural systems and reduce the nutritional quality of crops.

As a soil amendment, chitosan has been found to enhance plant height, canopy diameter, leaf area of chili pepper, improve soybean nodulation and seed yield, and increase plant height, DW, leaf number and area, and chlorophyll index of tomato, rice, lettuce, and radish. Soil-applied chitosan also significantly prompted seedling growth and induced early flowering of many ornamental crops. Soil-applied chitosan increased lettuce leaf number, area, FW, DW, and chlorophyll index. The synergetic effects of many factors, such as suppression of plant diseases, insects, and nematodes, increased biomass and activities of beneficial microbes, high nitrogen and calcium content, improved physical structure of soil and nutrient availability, and direct plant growth stimulation, may have resulted from chitosan as a soil amendment.

Chitosan as a soil amendment has repeatedly been shown to have strong insecticidal activity, to reduce pathogenic nematode populations, and to control fungal and viral diseases in numerous crops. In addition, a substantial body of evidence suggested that the addition of chitosan alters rhizosphere conditions to shift the microbial balance in favour of beneficial organisms and to the detriment of plant pathogens. Chitosan can provide a carbon source for microbes in the soil, accelerate transformation of organic matter into inorganic matter, and assist roots in absorbing more nutrients from the soil.



Chitosan, and all other chitin derivatives, have a high nitrogen content of 6% to 9%, comparable with other organic fertilizers such as dried blood and bone meal. Plants can access the nitrogen in chitin via microbial breakdown and the release of inorganic nitrogen, or by directly taking up monomers as organic nitrogen. Chitosan can be used to add organic matter to soils without raising the carbon: nitrogen ratio. In addition to nitrogen, chitosan also contains substantial levels of calcium minerals, which provide structural rigidity to the exoskeletons of crustaceans.

Although chitosan contains nitrogen and calcium, its positive effects on crop growth and yield were not only due to its nutrients, since in some studies the nutrients in chitosan were equalized in the control plots treated with inorganic fertilizers.

The cationic properties of chitosan also make it suitable as a medium for supplying additional essential nutrients. The functional hydroxyl and amino groups on deacetylated chitosan allow the formation of coordination compounds with ions of copper, zinc, iron, and others, but not with those of alkaline metals (e.g., potassium) or alkaline earth metals (e.g., calcium or magnesium). This makes chitosan a sustainable alternative to synthetic chelation agents, such as ethylenediaminetetraacetic acid, that are routinely used to deliver iron and other nutrients to overcome their poor solubility in calcareous/neutral soils. Due to its high molecular weight and porous structure, chitosan can form gels that absorb substantial volumes of water to increase soil water holding capacity.

Plant growth stimulation by chitosan as a soil amendment might also result from its direct effect on plant nutrient status and metabolism, and photosynthesis. Soil-applied chitosan increased the content of nitrogen, phosphorus, potassium, total sugars, and soluble proteins as well as total amino acids of radish. Foliar application of chitosan was reported to increase leaf nitrate reductase activity in Indian spinach (*Basella alba*) and okra (*Abelmoschus esculentus*). Soil-applied chitosan has been reported to increase leaf chlorophyll content in many crops. As a biostimulant, chitosan could also improve chlorophyll fluorescence and increase photosynthetic rate.

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ROLE OF FOURTH GENERATION BIOREGULATOR TO MANAGE ENVIRONMENTAL STRESS

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The abiotic stress, which includes factors such as salinity, drought, and extreme temperatures, causes tremendous losses in agricultural production at the global level. Plants have a varied degree of responses to abiotic stresses. It is necessary to use a combination of biotechnological tools for genetic enhancement to increase the tolerance to abiotic stress in plants. It requires a detailed understanding of the mechanisms involved in the tolerance of plants against adverse factors. It has been found that a complex network of hormonal signals controls the plant's response to abiotic stress. The Abscisic acid (ABA), ethylene, and Jasmonic acid (JA) are plant growth regulators with a well-documented plant response to abiotic stress.

1. ABA

ABA is the main hormone that provides tolerance to abiotic stresses, especially to salinity and drought. It is known that the salinity, as well as the drought and low temperatures, ameliorates the ABA biosynthesis. The activated genes that encrypt the enzymes mandatory for the biosynthesis of this growth regulator may be catabolized at the end of the stressful time.

2. Brassinosteroid

BRs are the steroidal phytohormones, best known for their role in plant growth and development for the last two decades. The molecular and physiological aspects of BRs under stress condition has resulted in a better understanding. The intrinsic mechanisms concerning these processes are still elusive. This mini-review explored the role of BR in singling cascades and regulating physiological processes such as photosynthesis, nutrient metabolism, water status, hormonal cross-talk at the molecular level, and positive role in plant growth and abiotic stress tolerance.

3. Salicylic acid

Salicylic acid (SA) plays many roles in plant physiology. Besides pathogenesis-related resistance, SA is involved in the response to abiotic stress. However, the effects of SA on plant resistance to abiotic stress were found contradictionary, and the actual role of SA in abiotic stress remains unresolved. Generally, deficiency of SA or a very high level of SA increase the plant susceptibility to abiotic stress. The optimal levels for the highest stress tolerance range from 0.1 mM to 0.5 mM for most plants. But the role of SA at a certain level in moderate and severe abiotic stress may be different. This can be attributed to redox regulations in plant cells.

4. Jasmonic acid

The Jasmonic acid and its derivatives are considered to be components of the transduction of signals in the defense mechanisms of the plants and increases have been recorded in their endogenous levels in plants subjected to water stress. They induce the expression of genes that encode specific proteins, which may include protease inhibitors, enzymes involved in the biosynthesis of flavonoids, osmotics, and lipoxygenase, and different proteins associated with the pathogenesis.

Conclusion

Plant confronts several abiotic stresses during their growth cycle and tries to manage them with the help of phytohormones, often called growth regulators. Phytohormones are chemical messengers that regulate the normal development of plants and their response to environmental stimuli. They regulate tissue growth and differentiation, determining when plants grow and mature. Plant growth regulators such as Abscisic acid, ethylene, Jasmonic acid, Brassinosteroid and salicylic acid are essentials in the abiotic stress plant response. In addition, plants can detect unfavorable environmental conditions through hormones. Biosynthesis of phytohormones by the plants equips them with a mechanism to adapt themselves according to the prevailing situations.

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POPULAR ORGANIC FARMING SYSTEMS IN INDIA

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India has been an agricultural country since the time unknown. More than 65 per cent of population are involved in agricultural practices. New farming practices involving crop intensification, high doses of chemicals fertilizers, pesticides, insecticides, weedicides are used to produce crop with higher yield but simultaneously this approach degrade the fertility and regenerative capacity of soil, leads to the soil, water and air pollution bonus with the deteriorate quality of produce. To save the environmental conditions many states are heading towards the organic farming. During 2016, Sikkim became the first state that has converted its entire cultivable land (more than 75000 ha) under organic certification. Organic farming is native to India. Organic farming produces the product without the use of chemical fertilizers and pesticides, preserve the reproductive and regenerative capacity of the soil, good plant nutrition, and sound soil management, produces nutritious food rich in vitality which has resistance to diseases.

As per IFOAM yearbook, 2020 India acquire 8th position in terms of World's Organic Agricultural land and top position in terms of total number of producers. In 2021 total area registered under National Programme for Organic certification was 4.3 Mha. Madhya Pradesh reported the largest area under organic certification followed by Rajasthan, Maharashtra and Chhatisgarh. In 2020-21 India produced India produced around **3496800.34 MT** of certified organic products including Oil Seeds, Sugar cane, fibre, Cereals & Millets, Pulses, cotton Aromatic & Medicinal Plants, Tea, Fruits, coffee Spices etc.

ORGANIC FARMING SYSTEM POPULAR IN INDIA

1. Vedic Krishi

Vedic period is the period between c.1500-c.500 BCE. The texts like Krishi parashara, kautilay's Arth-shstra, the Sangam literature of early tamils etc. contains information about Vedic Krishi. These texts provide information about the agricultural practices horticulture, arboriculture and plant biodiversity followed in Vedic period. They described about the cultivation of cereals, vegetables and fruits, animal husbandry, ploughing of soil, sequence cropping, use of cow dung as manure and irrigation practices. Vedic Krishi apply natural law in agriculture in more effective way and in addition brings harmony between the farmer and the environment. The cows and the farm lives are very much associated with the Vedic farming. "Panchakavya" composed of mainly five ingredients namely cow manure, mow urine, milk, yoghurt and ghee are the original organic fertiliser used in this farming. When all these ingredients mix with water they are known as 'Amrit pani' which is a nutritious nectar for plantings and yields healthy crops. Village settlement is also a part of Vedic Krishi in which few families of the same clan inhabitant an agrarian centre. These inhabitants were the pastoral people and the tillers of soils. Irrigation known to vedic people were of two types a) natural by rain/river and artificial by non-flowing streamlets from which water is drawn by wooden buckets and b) well irrigation.

2. Zero budget natural farming

A concept introduced by Mr. Subhash Palaker known to save the Indian farmers from the crises of dept and end their reliance on loans as it cuts off the production costs. Zero Budget Natural Farming (ZBNF) is a concept of organic farming with the use of natural fertlisers and local seeds and with the ecological friendly techniques. As crop protection is done by using cow dung, uring,

natural fertlisers and earthworms, helps in maintaining the fertility of soil and decreases the farmer's investments. There are generally four basic inputs under ZBNF:

a) **Jeevamrutha:** It is the first and important input of ZBNF. It is a pure liquid organic fertilizer composed of a mixture of Indian/desi breed cow urine and dung with black jaggery, water, gram flour, pulse, soil from the roots of Banyan tree. When this liquid organic fertilizer is applied to the farmland, it increases the quality of soil and increases the earthworm count in soil which leads to porous soil with higher water holding capacity and aeration. It is an excellent source of nitrogen, phosphorus, potassium and other micronutrients.

b) **Bijamrita:** It is the second input of ZBNF. It is used as seed treatment and naturally protect them. It is composed of Indian cow dung and urine, water, tobacco, green chillies and neem leaf pulp for the insect and pest control.

c) **Acchadana (Mulching):** It is the third component of ZBNF. There are three types of mulching namely soil, straw and live. Soil mulch protect the top soil while cultivation and from tilling. Straw mulching is done by the dead parts of any living material. While the living mulch is the symbionts of intercrops and mixed crops.

d) **Waaphasa (Aeration):** It is a condition in which soil contains both the water molecules and air. It helps to cut back the additional irrigation requirement.

3. Biodynamic agriculture

It is an ecological, ethical and holistic approach which treats the farm as living system and interacts with environment to build healthy living soil that produces food that nutrify, vitalises and helps to maintain human kind. Fermented extracts of mineral, plant and animal product applied in small portions to the compost, manure, soil and directly to the plants are used in biodynamic approach. Examples:

a) **Cow horn manure:** Prepared by burying the cow horn in sep/nov so the cosmic earth convert it into manure. It is lifted up in Feb/march. It increases the fertility of soil and improves the deteriorated fertility of soil yarrow flowers in bladder of stag: Provides sulphur, potash and micronutrients to soil

a) **Chamomile plant flowers combined with cow intestine:** Provides sulphur, potash, calcium and nitrogen

4. Homoeo farming

It has its origin from Vedas and follow the principle that "you heal the atmosphere and healed atmosphere will heal you". Sanskrit mantras (Agnihotra puja) at specific times before the holy fire are chanted in this type farming. It is believed that the ashes from pooja broadcasted in field will energies composts, plants, animals etc. No special agricultural practices are recommended apart from this.

5. Natueco farming

Natural ecological farming focuses on neighbourhood resource enrichment via additive regeneration rather than using external commercial inputs. It's focuses on harvesting the sunlight via farming for energy conservation and regeneration and not on the farm output by weight. Amrit jal, amrit mitti, and gagan chakra are used in this system. There are three relevant of Natueco farming:

Soil enrichment by recycling of biomass though forming a proper energy chain.

Root development and maintenance of wide feeder zone for the plant for efficient absorption of nutrients.

Canopy development for proper harvesting of the sunlight for efficient photosynthesis

6. Permaculture farming

Permaculture is term used to describe land management and settlement design that are adopted to flourishes natural ecosystem. Permaculture farming denotes intentional system of agriculture and settlement that aims to reflect the interrelationships and sustainability of natural ecosystems. It takes into consideration long lasting view to make best use of land so that future generations continue to make use of that land in more productive manners. It looks at every part of the farm whether it is land, animals, plants living on it and also combine social structures to follow three basic ethics: care for earth, fair share and care for people.

7. Yogic agriculture

It is an integrated approach between yoga and organic farming. Yogic agriculture is known by other name also referred as "Sashwat yoga Kheti"/ Gou Mata Kheti/ Vaishnav kheti, Ahinsa farming, Adhvoot Shivanand farming, and rishi Krishi. Here yoga plays an integral part of farming where seeds empowerment through meditation, mind and heart of farmers are build strong and healthy through meditation and organic farming using Indian/desi cow products, crop rotation and integrated pest management through natural means are followed.

8. One straw revolution

It is a "Do-Nothing" approach to farming described by Masanobu Fukuoka. It doesn't mean lack of efforts in farming but means lack of evasion of manufactured inputs and equipment's by the farmers. Practices like weeding, tilling, pruning, use of fertilisers and pesticides are given up in this thus also called as lazy man approach. Mulching is preferred over deep ploughing the field. He himself carry out experiments and proved that food could be produces in non-polluting, sustainable manner and obtained equal or even yield with nutrition in food. This approach provides minimum cost of production and maximum nutritious food.

Conclusion

Organic farming could be the solution of today's problem faced by the farmers, as it produces the product without the use of chemically synthesized fertilizers and pesticides. Thus, improves the soil fertility, rejuvenates it and cutoff the cost of production for farmers also. There is various system of organic farming followed by the Indian farmers namely Vedic Krishi, Zero Budget Natural Farming, Biodynamic agriculture, Homoeo farming, Natueco farming, Permaculture, yogic agriculture and one straw agriculture. All these systems have their distinct principles, motives, strategies of farming and components. One thing that is common in all the systems is that they maintain harmony between the environment and mankind, thus can save our geo-ecological environment for the future generation also.

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REGULATORY MECHANISM FOR ORGANIC CERTIFICATION IN INDIA

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To provide a focused and well directed development of organic agriculture and quality products, Ministry of Commerce and Industry, Government of India, launched a National Program on Organic Production (NPOP) in the year 2000, which was formally notified in October 2001 under the Foreign Trade & Development Act (FTDR Act). This document provides information on standards for organic production, systems criteria, and procedures for accreditation of Inspection and Certification bodies, the national organic logo and the regulations governing its use. The standards and procedures have been formulated in harmony with international standards such as those of Codex and IFOAM.

SCOPE AND OPERATIONAL STRUCTURE

The National Programme for Organic Production proposes to provide an institutional mechanism for the implementation of National Standards for Organic Production, through a National Accreditation Policy and Programme. The aims of the National Programme for organic production, inter alia, includes the following:

a. To provide the means of evaluation of certification programmes for organic agriculture and products as per the approved criteria.
b. To accredit certification programmes.
c. To facilitate certification of organic products in conformity to the National Standards for Organic Products.
d. To encourage the development of organic farming and organic processing.

SCOPE

The National Programme for Organic Production shall, among others, includes:

(a) Policies for development and certification of organic products.
(b) National standards for organic products and processes.
(c) Accreditation of programmes to be operated by Inspection and Certification Agencies.
(d) Certification of organic products.

OPERATIONAL STRUCTURE

The operational structure of the National Programme for Organic Production is given in Fig. 1. The programme will be developed and implemented by the Government of India through its Ministry of Commerce and Industry as the apex body. The Ministry will constitute a National Steering Committee for National Programme for Organic Production, whose members will be drawn from Ministry of Commerce and Industry, Ministry of Agriculture, Agricultural and Processed Food Products Export Development Authority (APEDA), Coffee Board, Spices Board and Tea Board and other government and private organizations associated with the organic movement. To advise the National Steering Committee on relevant issues pertaining to National Standards and Accreditation, sub-committees will be appointed. The National

Steering Committee for National Programme for Organic Production will formulate a National Accreditation Policy and Programme and draw up National Standards for Organic Products, which will include standards for organic production and processes as well as the regulations for use of the National Organic Certification Mark. National Accreditation Policy and Programme will be administered by the National Accreditation Body, which will define the overall policy objectives for the Accreditation programmes and operations. The National Steering Committee may amend the Accreditation procedures whenever it deems fit. The National Accreditation Policy and Programme is subject to periodic internal review, which will be conducted by the Technical Committee, which will advise the National Steering Committee about the need and content of such amendments in the National Programme for Organic Production.

NATIONAL ACCREDITATION BODY

The National Steering Committee would also function as the National Accreditation Body. The members of the National Accreditation Body shall comprise of representatives from Ministry of Agriculture, Ministry of Commerce

and Industry, APEDA, Coffee Board, Spices Board and Tea Board. The Chairman of the Body shall be the Chairman of the National Steering Committee. The work of the National Accreditation Body will include:

(a) Drawing up procedures for evaluation and Accreditation of certification programmes.

(b) Formulating procedures for evaluation of the agencies implementing the programmes.

(c) Accreditation of inspection and certification agencies.

Every certifier will implement a certification programme and a programme cannot be accredited without accrediting the certifier.

EVALUATION COMMITTEE

Eligible Inspection and Certification Agencies implementing certification programmes will be evaluated by an Evaluation Committee. The Evaluation Committee will be appointed by the National Accreditation Body. The members of the Evaluation Committee will comprise of members drawn from the APEDA, Coffee Board, Spices Board, Tea Board, Ministry of Agriculture and Export Inspection Council of India (EIC) / Export Inspection Agencies (EIAs). APEDA, on behalf of the National Accreditation Body, will receive and screen applications from the certification agencies, will coordinate and arrange evaluation visits etc. to ascertain the credentials of certification programmes of the applicants. The Evaluation Committee will submit its recommendations to the National Accreditation Body for considering accreditation.

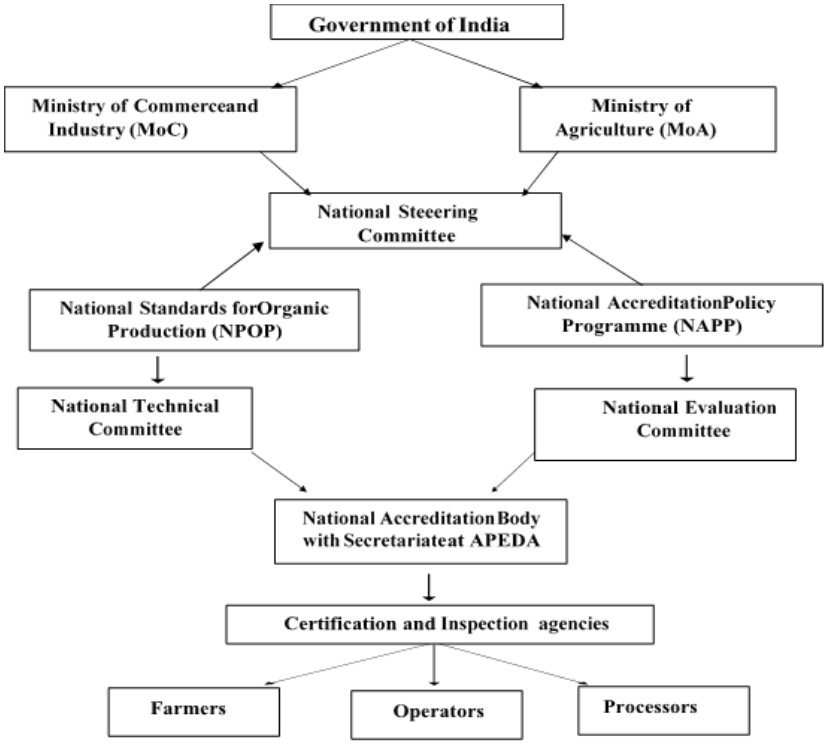
Accredited Inspection and Certification Agencies

Based on the recommendations of the Evaluation Committee, eligible Inspection and Certification Agencies will be accredited by the National Accreditation Body. These agencies should be well versed with the operating procedures, the NSOP and the international standards. Their programmes should have been in operation for at least one year and they should be able to provide the supporting documents.

Inspectors

The inspectors, appointed by the accredited Inspection and Certification Agencies will carry out inspection of the operations through records maintained by the operators as per specified formats and also by periodic site inspection. Based on compliance with the standards and certification programmes, accredited Inspection and Certification Agencies will certify the organic status of products and operations, specifying their conditions and recommendations.

Operational Structure of National Programme for Organic Production (NPOP)



ROLE OF PHYTOALEXINS IN PLANT DISEASES DEFENCE MECHANISM

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Phytoalexins are low molecular weight antimicrobial compounds that are produced by plants as a response to biotic and abiotic stresses. It take part in an intricate defense system which enables plants to control invading microorganisms. Elucidation of the biosynthesis of numerous phytoalexins also permitted the use of molecular biology tools for the exploration of the genes encoding enzymes of their synthesis pathways and their regulators. This has led to potential applications for increasing plant resistance to diseases. Phytoalexins display an enormous diversity belonging to various chemical families such as for instance, phenolics, terpenoids, furanoacetylenes, steroid glycoalkaloids, sulfur containing compounds and indoles. Phytoalexins are otherwise called as Stress compounds.

CHARACTERS

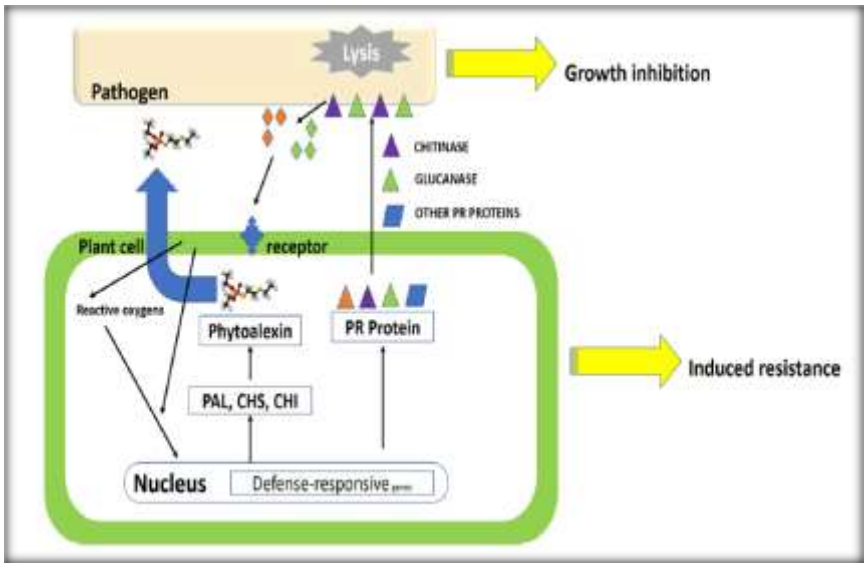
- ✓ Phytoalexins are key components in plant defense responses and several elicitors are known to trigger production of phytoalexins.
- ✓ Phytoalexins are Secondary metabolites
- ✓ Its effective against fungi, bacteria, nematodes and Virus
- ✓ 300 Phytoalexins are identified
- ✓ Biocidal and Biostatic effects
- ✓ Most Phytoalexins are Lipophilic molecules
- ✓ Biosynthesis of Phytoalexins – PAL
- ✓ Phytoalexins occur when pathogen affect in the plants

FACTORS RESPONSIBLE FOR THE PRODUCTION OF PHYTOALEXIN:

- ✓ Antimicrobial plant substances that either are absent or are present at non detectable levels in healthy plants.
- ✓ Accumulate to high levels in response to attack by a pathogen.
- ✓ Glucans, produced by *Phytophthora* and *Pythium*, derived from oomycete cell wall, induce phytoalexins.
- ✓ Chitin oligomers, by higher fungi, from chitin of fungal cell wall, induce phytoalexins and lignification.
- ✓ Fosetyl-Al has been reported to stimulate defense reactions and the synthesis of phytoalexins against oomycetes.

Role of phytoalexins in activation of plant immune response

Time course accumulation of phytoalexin in relation to inhibition of pathogen development at the infection site and relationship of phytoalexin tolerance to pathogen virulence have been elucidated. Induction of glyceollin synthesis in soybean plants against *Macrophomina phaseolina* following alteration in antigenic pattern is presume to be mediated by an initial recognition process between plant and pathogen. Induced resistance in plants against pathogen attack occurs following a series of biochemical events such as elicitor-receptor recognition, formation of signal molecules, activation of gene leading to de-novo synthesis of defense enzymes mainly chalcone synthase (CHS), chalcone isomerase (CHI) andphenyl alanine ammonia lyase (PAL) involved in phytoalexin biosynthesis. Enzymes in phytoalexin biosynthetic pathways of sorghum and maize plants and their possible application in technology, medicine and agriculture.



Terpenoid phytoalexin biosynthesis from monocot, their induction and role in disease resistance have also been documented. Chemical diversity of phytoalexins and their antimicrobial and biological activities, different biosynthetic pathways and their role in plant defence mechanism, molecular events for induced immunity in plants, transport and metabolism in fungi as well as their role in human health have been extensively reviewed.

SYNTHESIS OF PHYTOALEXIN

Biosynthesis of phytoalexin is up- or down regulated by expression of salicylic acid (SA), jasmonic acid (JA), auxin, ethylene, cytokinins, abscisic acid (ABA), to some extent gibberellins as well as transcriptional regulators, defence genes, phosphorylation and cascades. Mechanism of regulation for phytoalexin biosynthesis depend on the nature of plant infection by the pathogen and also nature of the phytoalexin induced following interaction. When Arabidopsis plants were challenged with *Botrytis cinerea*, JA was found to be involved in the regulatory signalling pathways of camalexin (phytoalexin) biosynthesis, while in the interaction of Arabidopsis with *Alternaria basssicicola*, camalexin accumulation was found to be independent from JA. However, camalexin production in Arabidopsis is also governed by either SA-independent or SA-dependent signalling pathways. JA-dependent and independent pathways in diterpenoid phytoalexin biosynthesis was evident in an interaction between rice and *Magnaporthe oryzae*. Other phytohormones such as auxin and ABA were found to be negatively involved in biosynthesis of phytoalexin.

BIOSYNTHESIS OF NUMEROUS PHYTOALEXINS

Glyceollin in soybean, Kievitone in bean, Rishitin & Lubimin in potato. These are all downregulated by ABA. In Arabidopsis plants following treatment with microbe-associated molecular patterns (MAMPs), mitogen-activated protein kinases (MAPKs) was found to be associated with enhanced accumulation of phytoalexin (camalexin). Two MAP kinases such as MPK3 and MPK6, take part in the upregulation of several enzymes of camalexin biosynthetic route. About 400 fold increase have been noticed upon over expression of these two MAPKs. Camalexin has also been found to be associated in the elicitation of fungal apoptotic programme cell death in *B. cinerea*.

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AZADI KA AMRIT MAHOTSAV: THE CELEBRATION OF 75 YEARS OF INDEPENDENCE OF INDIA

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Azadi ka Amrit Mahutsav is an intense national campaign which focuses on the citizen participation, that will be transformed into a "janandolan", where small changes, at the local level, will add to the great national achievements.

Azadi ka Amrit Mahutsav means the celebration of the culmination of 75 years of the country's independence. As you know, **August 15, 1947** was the historic day that our country was liberated from British rule. For the sake of this freedom, many Brave Freedom fighters and leaders sacrificed themselves. Thus, this year India celebrates the 75th anniversary of its independence with the name of Azadi ka Amrit Mahutsav.

Azadi ka Amrit Mahotsav was launched on March 12, 2021 by Prime Minister Narendra Modi ji on the occasion of completion of the 91-year's Dandi March from Sabarmati Ashram, Ahmedabad. This Mahotsav will end post one year after the 75th Independence Day, which is August 15, 2023. The purpose of the celebration of Azadi ka Amrit Mahotsav is to create a vision for India in the year 2047.

Azadi ka Amrit Mahotsav is celebrated on the basis of five pillars, i.e. The fight for independence, ideas of 75 years, 75 years of achievements, actions of 75 years and decisions that lasted 75 years. It also includes 75 years of independence of progressive India and the glorious history of its people, culture and achievements. These Azadi ka Amrit Mahotsav aim to educate younger generations about history and the struggle for independence. Other than this Mahotsav, the younger generation must be aware of the achievements, actions and decisions of the country in the last 75 years to inspire them to move forward and realize the dreams of an independent India. Azadi ka Amrit Mahotsav is a thank you for our freedom fighters and the freedom movement.

Let us celebrate this Azadi ka Amrit Mahotsav with great enthusiasm and joy. On this occasion, let us greet all the brave freedom fighters and leaders of the country who gave their lives for the freedom of the homeland.

The celebrations began 75 weeks before the 75th anniversary of our independence and "Azadi ka Amrout Mahotsav" means "the elixir of the energy of freedom".

Amrut Mahotsav Freedom is the nectar of the energy of freedom, that is, the nectar of inspiration for freedom fighters. Freedom Nectar Festival means the nectar of new ideas, new decisions and the nectar of independence. To understand the Feast of the Nectar of Freedom, it is necessary to know the meaning of the Feast of the Nectar of Freedom.

There are five pillars of the nectar festival of independence:

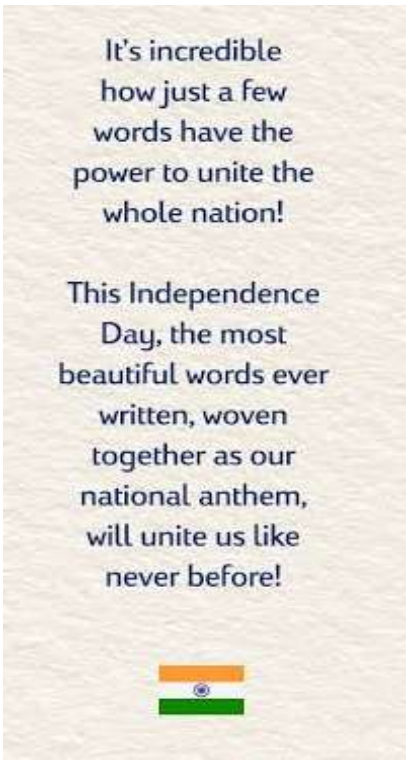
- The struggle for independence
- New ideas for the advancement of the nation on the occasion of the 75th anniversary of independence
- Achievements made on the occasion of the 75th Anniversary of Independence
- Measures to be taken on the occasion of the 75th Anniversary of Independence and
- Decisions taken by the peoples of the country on the occasion of the 75th anniversary.

Nectar Independence Day is celebrated on these five bases. A website called india75.nic.in was started at the beginning of Amrut Mahotsav's independence. It speaks better of the concept of India. It will also discuss current developments in India in all languages and all states

are included in it. The project to show India on the world stage will also be carried out through this web portal.
Indeed, for us the nectar of freedom will be the nectar of inspiration for freedom fighters, the nectar of new ideas and new decisions, and the nectar of an independent India.

The Ministry of Higher Education and the Department of School Education and Literacy together have planned various activities under the title "आजादी का अमृत महोत्सव"

In this festival various social and cultural programs will be organized, as well as presentations of technical and scientific achievements. Therefore, Mahotsav (Great Celebration / Festival) will be celebrated as "Jan-Utsav", that is, the festival of People of India in the spirit of "Jan-Bhagidari", that is, we are all partners and actors in the development of our country.
The Slogan of **"Azadi ka Amrit Mahutsav".**



Themes for "Azadi ka Amrit Mahutsav" (Celebration of 75 years of the independence of India)

1. Vishva Guru Bharat

A teacher is someone who has the ability to see greatness in even the smallest man and has the ability to elevate it.

Since the beginning of civilization, India has been the teacher of the whole world. While the whole world groped in the dark, India was learning the identity of man with the Supreme. People from all over the world flocked to India to benefit from his invaluable wisdom. In fact, the country that has shown the entire world its academic brilliance through Sushrutha, Kanad and Aryabhatta deserves to earn the same foundation for being a "Vishwa Guru" again.

Now that the world has openly embraced "namaste" as a way of welcoming, Indian values hold a treasure trove of beliefs that can change the entire world for the betterment. From Ayurveda to Indian science, there is much more to India than the world needs to know, learn, and accept. Bharat can also become a Vishva Guru due to his message of great love and compassion for everyone. We believe in "Vasudhaiva Kutumbakam", the world is a family. And now it was time for the whole world to absorb the soul as well.

2. The rich cultural heritage of India

The Indian word for culture is "Sanskrit". From time immemorial, the Indians described their culture as "human culture" (Manav Dharma / Sanskrit). It has a universal appeal. The principle of "unity in diversity" is the implicit law of nature, the universe and life. In India people from different societies coexist harmoniously, speaking different languages, having different foods, practicing different customs. Therefore, the spirit of India's cultural heritage is that it is a global confluence of religions, traditions, customs and beliefs.

Over the years, many styles of art, architecture, painting, music, dance, festivals and customs have developed in India and this great diversity has made Indian culture incomparable and still admired around the world. India's cultural heritage continues to thrive while retaining its original features and changes, which is an important indication of its strength.

3. Atmanirbar Bharat

The idea of an autonomous nation is embodied in all its aspects by the pioneering vision of our esteemed Prime Minister. During the pandemic, India has shown that it can handle a painful situation. Aatmanirbharta also provides a financial cushion to many companies and encourages entrepreneurs to produce as many goods and services as possible in the country. This year, India not only launched the world's largest vaccination campaign, but also exported it to various countries. The whole concept of self-sufficiency will reduce unemployment on many levels. India is a large and fast growing market for most product categories and with the motto of 'Local Voice', the issuance of local brands, manufacturing and supply chain will give a boost to the industry and the Indian economy.

4. Celebrating the Unsung Heroes

During the 'Azadi ka Amrit Mahotsav' events, exhibitions (online and offline), publications and development museums will be

planned that protect the unacknowledged and unacknowledged heroes of India's freedom struggle. Many freedom fighters do not find their place in the traditional arena of the freedom movement. Moreover, from tribal groups or marginalized from society. An example of this is Veer Gundandhur, who led the Bastar tribes in the fight for freedom. Then there are Velu Nachiyar, Bhikaji Cama, and many others whose contributions have yet to see the light of day. Ideals of human purpose, kindness, and self-denial will be celebrated and promoted during events. With the element of inclusion in the traditional setting, local history will find its place under "Dekho Apna Desh". Each state and the UT's events around this theme. The premiers in each state and the UT's plan two or three historical events of local significance. The Unsung Heroes theme will be closely related to Visit India 2022, where the region's regional arts, culture, heritage, wellness and yoga will be promoted.

5. Ideas, achievements and resolve

The idea is to celebrate the notion of India - to be "best in class" in the social, political and economic sphere - that all Indians share. A patriotic spirit will fill the air as the nation's achievements are commemorated. We have come a long way since independence and we still have a long way to go. During the events, achievements in various fields will be highlighted, for example agriculture, science and technology. The Aatmanirbhar Bharat Design Center will be developed as part of the Red Fort Museum Complex (Delhi) and will focus on original products from all states and UT. In addition, decisions that ignite the spirit of challenge in all citizens will be encouraged, such as #RiseUp Engagement on social media platforms. Programs of a similar nature will not only dedicate each individual to the nation-building process, but will also help Indians overcome the challenges of daily life. This approach will enhance our accomplishments as a nation and new dreams and opportunities will emerge.

6. Independence 2.0

Over the years, the idea of India has largely revolved around the narrative of diversity. Taking into account the broader vision of the nation, both now and in the future, the focus is now on local manufacturing ("made in India" and "Vocal" over "local"). Before the nation gets any closer to going global, the goal remains to create world-class products that enhance investment and value pricing in the country itself. This will create a fair trade ecosystem, taking into account the Sustainable Development Goals (SDGs). Not only will sustainability continue to be a key but there will also be a greater involvement of local artisans. To achieve a successful Independence 2.0, the feelings of India's rich cultural heritage will be harnessed. All of the above elements (such as Visva Guru Bharat, Aatmanirbhar Bharat) will be imbibed with the spirit by implementing this vision. Along with the themes of 'Azadi ka sAmrit Mahutsav' (Celebrating 75 Years of India's Independence) with imbibing ethos, marketing battles will also have to be fought in the fast evolving world of consumer. Once this goal is achieved, the same philosophy will apply globally, with Indian products competing in international categories. Therefore, India is on the path of India's long-awaited aspirations as a "future's nation".

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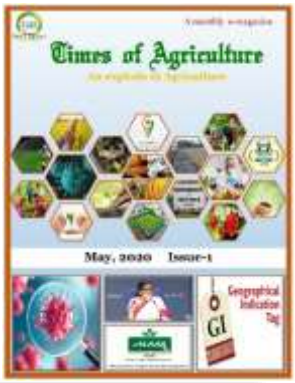

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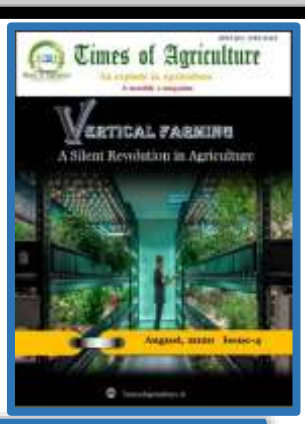

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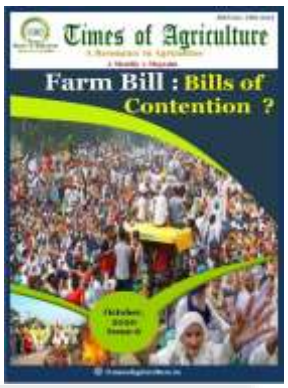

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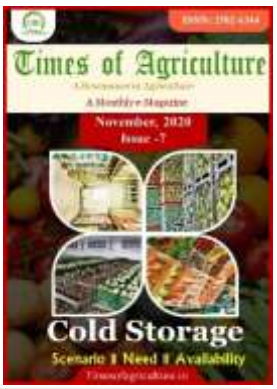

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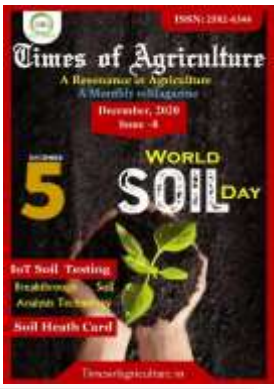

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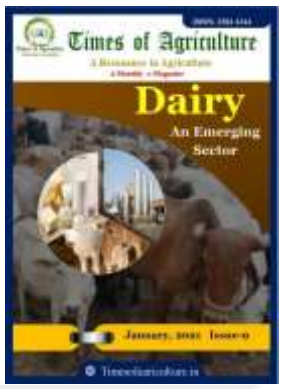

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