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DECEMBER 5

WORLD SOIL DAY

IoT Soil Testing

Breakthrough Soil Analysis Technology

Soil Heath Card

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From the Editor`s Desk

Happy "World Soil Day" to all intellectual readers. World Soil Day is celebrated every year on 5 December. In today's circumstances, celebrating Soil Day has become necessary for the whole world. Because only the soil has the ability to satisfy the hunger of the creatures of the whole creation. Today, we are seeing a wide-ranging change in the form of soil that we received through creation. Because of the unjudicial use of fertilizers, pesticides and weedicides, by the farmers which are polluting our gold yielding land by changing the composition of it. In such a situation, we all need to pay attention to the prevention of soil by giving all the information related to the health of our soil along with being a threat to life. Because healthy soil will produce healthy crops and due to healthy food, our lives will also be healthy and happy.

'सुबीजम् सुक्षेत्रे जायते संवर्धते'

This issue of the "Times of Agriculture" e-magazine provides extensive information on soil specificity. So today on "World Soil Day", all of us take pledge to be ever vigilant about the health of our soil.

Dr. Devaraj Singh
Editor-In-Chief

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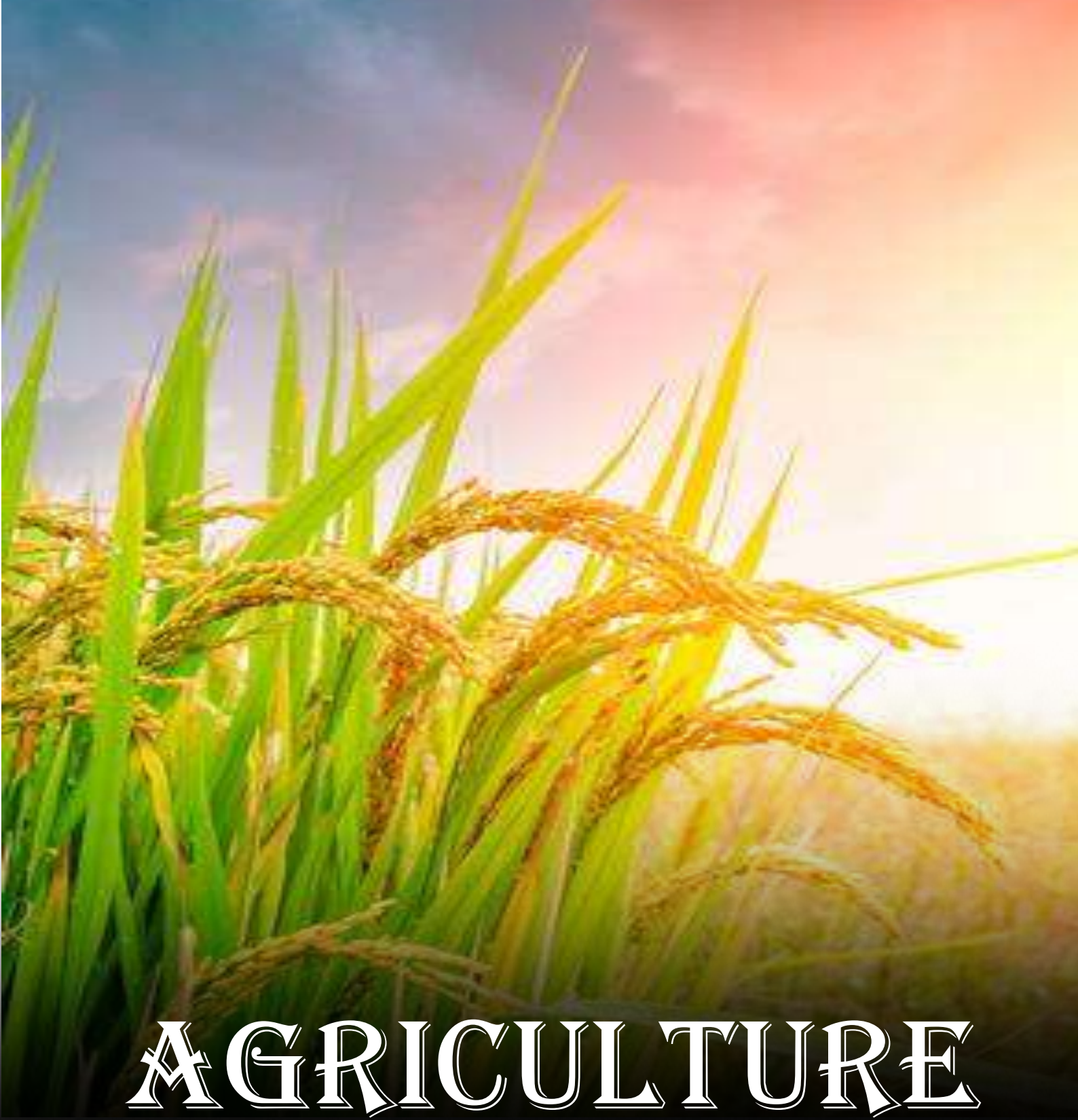
Cover Story

IoT: Breakthrough | Soil Analysis | Technology



AGRICULTURE UPDATES

CHINA buys Indian rice for first time in decades

China has started importing Indian rice for the first time in at least three decades **due to tightening supplies and an offer from India of sharply discounted prices**.

Indian traders have contracted to **export 100,000 tonnes** of broken rice for Dec-February shipments at around **$300 per tonne**. China's traditional suppliers, such as Thailand, Vietnam, Myanmar and Pakistan, have limited surplus supplies for export and were quoting at least $30 per tonne more compared with Indian prices, according to Indian rice trade officials.

Varsha joshi to take over as interim NDDB chief

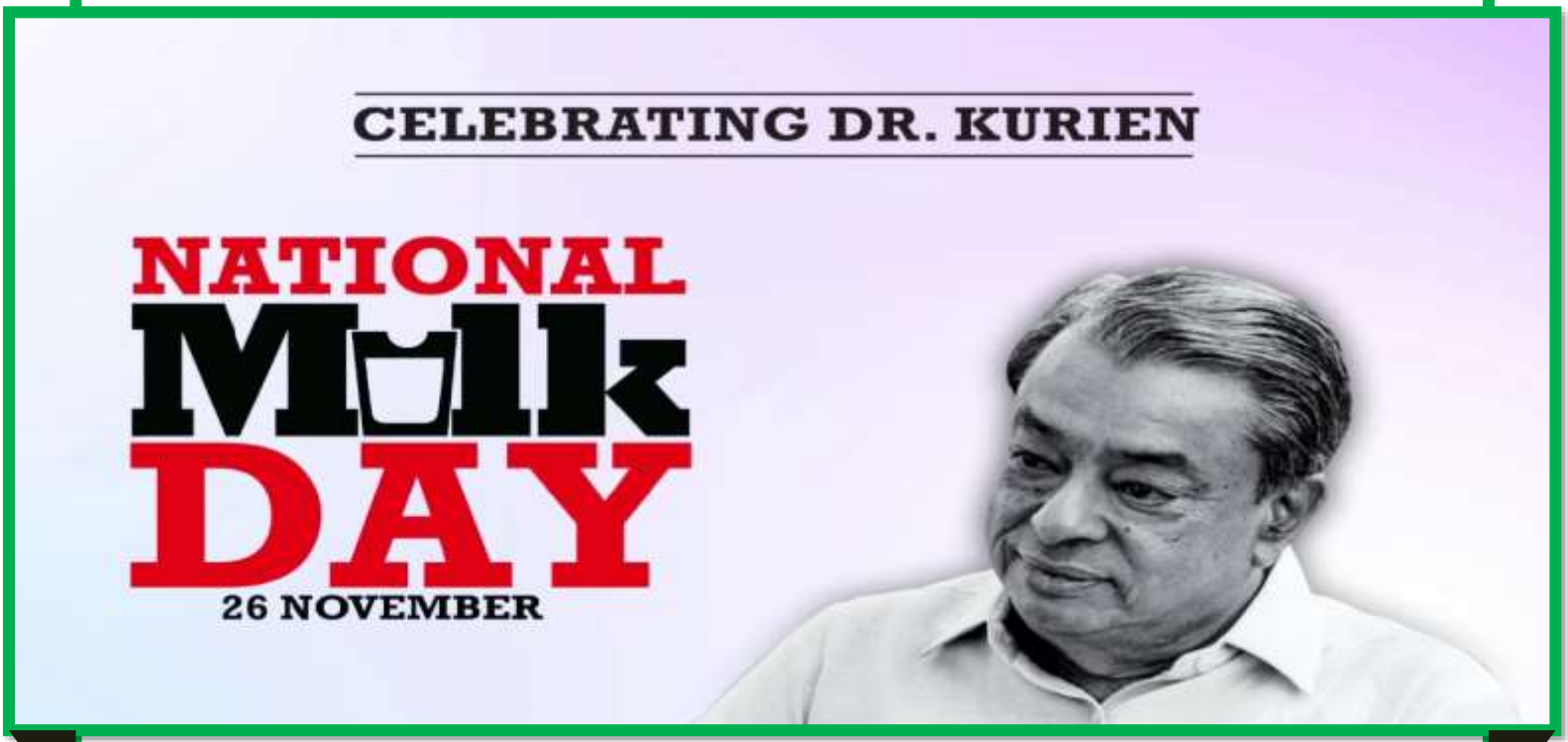
The govt of India on November 30 appointed **Varsha Joshi** as the new chairperson of **National Dairy Development Board (NDDB).**

Joshi is the joint secretary Department of Animal Husbandry and Dairying, Ministry of fisheries, Animal Husbandry and Dairying, Government of India.With incumbent Dilip Rath's tenure as chairman of NDDB ends on November 30 2020, Joshi's appointment is made effectivefrom december1,2020 until further order.

Uttar Pradesh : best performer in inland fisheries, Odisha as marine state

Uttar Pradesh was awarded as **best performing state in inland fisheries** sector while **Odisha** got the award of the **best Marine state** on the occasion of 'World Fisheries Day' observed on November 21 by the Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India. The Minister of State for Fisheries, Animal Husbandry and Dairying, Pratap Chandra Sarangi, was the chief guest at the occasion.

National Milk Day



The National Dairy Development Board (NDDB), the Indian Dairy Association (IDA), and 22 state-level milk federations in 2014 together decided to celebrate the birthday of **Dr. Verghese Kurien** who was known as the father of India's White Revolution on 26 November. Therefore, the first National Milk Day was observed on **26 November, 2014.**

In 1970, India's National Dairy Development Board (NDDB) started a rural development programme known as Operation Flood. It is one of the largest programmes and its aim was to develop a nationwide milk grid. It helps in reducing the malpractices by milk traders and merchants and resulted in making India one of the largest producers of milk and milk products. Therefore, it is also known as the White Revolution.

Release of Interest Sub-vented Loan from Micro-Irrigation Fund (MIF)

Micro Irrigation Fund with a corpus of **Rs. 5000 crore** created with NABARD was operationalised in 2019-20. The objective of the Fund is to facilitate the States in availing an interest subvented loan for expanding coverage of Micro Irrigation by taking up special and innovative projects and also for incentivising micro irrigation beyond the provisions available under PMKSY-Per Drop More Crop to encourage farmers to install micro irrigation systems. Steering Committee of MIF has approved projects for loan of Rs. 3971.31 crore comprising Rs. 764.13 crore for Gujarat, Rs. 1357.93 crore for Tamil Nadu, Rs. 616.13 crore for Andhra Pradesh, Rs. 276.55 crore for West Bengal, Rs.790.94 crore for Haryana Rs. 150.00 crore for Punjab and Rs. 15.63 crore for Uttarakhand.

NABARD released loan of Rs 659.70 crore to Haryana, Tamil Nadu and Gujarat. Thereby a total amount of Rs. 1754.60 crore has been released so far, comprising Rs. 616.13 crore to Andhra Pradesh, Rs. 937.47 crore to Tamil Nadu, Rs. 21.57 crore to Haryana and Rs. 179.43 crore to Gujarat.

World Fisheries Day

The World Fisheries Day is observed on the **21st November** every year. **On the occasion of the World Fisheries Day, for the first time in the Fisheries Sector, the Government of India will award best performing States**. World Fisheries Day is celebrated to demonstrate solidarity with all fisherfolk, fish farmers and concerned stakeholders throughout the world. It was started in the year 1997.

India is the **4th largest exporter** of fish in the world as it contributes 7.7% to the global fish production. Fish constituted about 10% of total exports from India and almost 20% of agriculture exports in 2017-18. The fisheries and aquaculture production contribute around 1% to India's GDP and over 5% to the agricultural GDP. Around 28 million people are employed in the fisheries sector in India.

India's First Green Energy Convergence Project: Goa

On 17 November, Energy Efficiency Services Limited joint venture of public sector undertaking under the ministry of power and the department of new and renewable energy Goa signed and MoU to discuss rolling out of India's first green energy convergence project in the state. It is the country's first project to generate green energy for rural and agricultural consumption in the state of Goa and is in line with the International solar Alliance a GOI initiative.

The Memorandum of understanding was signed-in August 2020 in the presence of RK Singh, Union Minister of state for power and new and renewable energy and Nilesh cabral power minister of Goa. The state has set a target to generate **150MW green energy** in the next two to three years and will also set up 100MW solar power plant across the state.

Secha Samadhan: online services for farmers

CM of Odisha Naveen Patnaik launched **'Secha Samadhan'**, a bilingual mobile application, to address the irrigation problems faced by farmers without them having to visit the offices concerned. He also launched four other online services to resolve the issue of water distribution for industries, commercial establishments and other institutions.

With the launching of the application, farmers need not run to the offices of the Water Resources department and can send their grievances through photographs or videos. The farmers will be informed about the status of their complaints through SMS. Besides, immediate steps will be taken to redress the grievances of the farmers.

India Gets its 1st Sandalwood Museum

India's first Sandalwood Museum is being established in Aranya Bhavan in Ashokapuram, **Mysuru, Karnataka**. The museum is set up by the Regional Forest Department to educate farmers about the significance of cultivation of sandalwood. This will also provide technical support, information on the availability of saplings, marketing facilities, pest control measures, incentives and schemes provided for sandalwood growers by the government.

India gets it's 1st Moss garden

India's first **Moss garden** has been setup in **Ling adhar village Kurpatal area of Nainital district.** The moss garden was opened for public from November 20 but the amid of covid 19 cases, this garden has been closed. It will be reopened once the situation gets better. The main aim behind developing the garden was to conserve various species of moss and other bryophyte. Another reason was to make people aware of its significance in the environmental besides creating a recreation center for tourist.

Tripura Govt launched **Mukhymantri Unnoto Godhan Prakalp**

The Government of Tripura has launched a **3-year plan** to **introduce sex-sorted artificial insemination of cattle under the Mukhyamantri Unnoto Godhan Prakalpa (MUGP) scheme**. It is aimed at making Tripura self-sufficient in milk production by ensuring that more cows are born through selective chromosome selection. With this system, it is estimated to achieve 90% cow births, while the current conventional artificial insemination method has a varying mix of cow and bull births. Earlier to Tirpura, Kerala, Haryana, Odisha and Maharashtra have adopted the sex sorted artificial insemination of livestock.

COVER STORY

IoT Soil Testing

Breakthrough || Soil Analysis || Technology

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People are dependent on soils, and, conversely, good soils are dependent on people and use they make of the land. Soils are the natural bodies in which plants grow. They provide the starting point for successful agriculture. Soil testing and plant analysis are useful tools for making recommendations for the application of fertilizers to crops. Whereas soil testing gives a measure of the availability of nutrients to crops, plant analysis indicates the actual removal of the nutrients from the soil.

Soil analysis is a set of various chemical processes that determine the amount of available plant nutrients in the soil, but also the chemical, physical and biological soil properties important for plant nutrition, or "soil health". Chemical soil analysis determines the content of basic plant nutrients; nitrogen (N), phosphorus ($P2O_5$), potassium (K_2O), pH, EC (Electrical Conductivity), humus content, total $CaCO_3$, available lime, organic matter, total Sulphur (S), trace elements, and other physical characteristics (capacity, permeability, density, pH - value).

Introduction

Agriculture is considered as the basis of life for the human species and it is the main source of food grains and other raw materials. It had the least exposure to technology but with technology reaching every nook and corner of the globe, the agricultural landscape is also moving towards modernization. Technologies like Cloud, Internet of Things (IoT), and Big Data are revolutionizing the global agricultural industry leading to an increase in crop productivity. In such a scenario, an Internet of Things system for agriculture is proving to be the latest technology trend within the industry.

In India, every state around **9 to 10 lacs soil samples** have been reviving in laboratories and it is very difficult to test all the soil sample in the stipulated. But soil analysis is the major role for farmers to cultivate and produce to the proper crop. Soil Testing Device has been developed for soil testing of agricultural farm. The N P K & pH values vary from one type of soil to others. N P K & pH values of soil sample are measured in real-time and compared with the pre-stored values received from the agricultural department. The system also provides the information about the crops that can be grown in respective soils. Wireless communication system has been incorporated for interacting with the experts.

Historical background of Soil Testing

The soil testing programme was started in India during the year **1955-56** with the setting-up of **16 soil testing laboratories** under the Indo-US Operational Agreement for "Determination of Soil Fertility and Fertilizer Use". In 1965, five of the existing laboratories were strengthened and nine new laboratories were established with a view to serve the Intensive Agricultural District Programme (IADP) in selected districts. To meet the increasing requirement of soil testing facilities, 25 new soil-testing laboratories were added in 1970. In-field, sensor-based measurements are expanding to provide new, more granular details, such as moisture levels, salt concentration, fertilizer efficacy, and plant response to variables, including canopy temperature and light. This enables farmers to take real-time actions when a field condition, such as low water levels, elicits a stress response.

The idea to create the mobile soil testing facility was to serve the farmers almost at their doorsteps. The capacity of the soil testing laboratories in the intensive agricultural districts was initially created to analyse 30,000 soil samples annually by each laboratory

Aims of Soil Analysis?

The aims of soil analysis are:

- To determine the level of availability of nutrients or the need for its introduction
- To predict the increase in yields and profitability of fertilization (poor soils do not always provide yield increase due to fertilization because of possible limiting factors)
- To provide the basis for calculating the required fertilizing of each crop
- To evaluate the status (supply) of each nutrient element and simultaneously determine the compensation plan (nutrient management).

Soil Testing Methods

A-Conventional Soil Testing

Steps Invoved in soil testing:

- **Collection of Soil Samples:**
- **Soil Testing**

There are mainly two types of soil testing methods.

1. **Soil testing in laboratory**
2. **Mobile soil testing**

1

Soil Testing In Laboratory

This method involves soil testing in laboratory. It may take weeks or days to test the soil. The people take soil samples and give them to the laboratories for soil testing.They detect the NPK values of soil by using chemical analysis.

1

Mobile Soil Testing

In this type people do the test and give suggestions on the tests regarding, the fertilizers and it is done once per crop. So this method is not suitable for effective crop production and it does not give the accurate results. There are three methods are used for detecting the soil fertility i.e. Spectroscopy Conductivity and Electro chemical sensor methods. These are cost effective and will not give the accurate results.

Collection of Soil Samples

01 Divide the fields according to the slope, colour, depth, texture

02 Divide each portion into 2 parts. Draw the zigzag line having about 8 to 10 corners on both the sides of middle line

03 Collect the soil samples between the lines

04 Collect the soil samples (10 to 20 spots) between the lines with proper sampling tools like auger soil tube, phawada (spade) or khurpi (trowel), core sampler.

05 Before taking the sample scrap away surface litter or any stone etc. At each corner of the zigzag line, take the samples by auger at depth of 15-20 cm or with the help of trowel and spade by digging the 'V' shaped pit up to plough depth (9-20 cm).

06 Then cut out uniform thick 2 cm. Slice from bottom to top of the exposed soil surface of 'V' shaped pit. Collect the sample on the blade or in your hand and place it in clean bucket

07 If the sample is wet or moist, dry it in shade before putting into a plastic bag

B- Next Generation of Soil Testing

Importance of IoT:

The Internet of Things (IoT) was first developed in 1999 by the network radio frequency identification (RFID) system proposed by the Massachusetts Institute of Technology (MIT) Auto-ID Labs. With the application and development of new information technologies, the connotation and extension of IoT have undergone major changes. IoT can be defined as a huge internet-based network connecting physical and virtual "things" with standard and interoperable communication protocols. To be specific, everything, such as a sensor and an actuator possessing unique identity and attribute, exchange messages and communicate with each other to realize intelligent positioning, tracking, identification, perception, monitoring and management via kinds of networks anytime and anywhere. IoT has penetrated pervasively most aspects of human life everywhere such as health care, smart home, smart city, industrial control and so on. Agriculture is an ideal candidate for the deployment of IoT solutions because it occurs in wide areas that need to be continuously monitored and controlled.

Farmers need variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities, etc. Cloud computing has been used for storage of agriculture data by Government and private agencies. Cloud support various services to farmers to interact with cloud by using any cheaper ways like sensors, mobile devices, scanners, etc. IoT is a kind of intelligent technology, including identification, sensor and intelligence.

Use of IOT along with Cloud Computing can help a lot to Indian farmers to increase the production by providing the correct communication between objects and charging according to the usage of service. Also, if pH rate of the soil is low the application suggests the pesticides to be used to improve cultivation. This will be very helpful to the farmers who are away from the land, and improves the crop cultivation.

Automated Soil Testing:

Automated soil testing device is an electronic device which can be used to measure moisture, humidity, temperature values to ensure the fertility of soil in the field of agriculture to select the suitable crop and also the type of fertilizer to be used. The ionic particles present in soil sample are sensed by sensor and the output of sensor is processed by signal conditioning circuit. It is a portable device which can be used either in laboratories or on the identified spot selected for farming so that the farmer need not take the pain of visiting the soil testing laborites which are normally located in district headquarters. Automated soil testing device is a simple and user-friendly device so that any person can test the soil without the presence of an operator, it is an economical device and thus a common man can easily afford it.

Nowadays, awareness about implementing technology for agricultural environment has increased into the industries. Manual collection of data for desired factors can be sporadic, not continuous and produce variations from incorrect measurement taking. This can cause difficulty in controlling environmental important factors. Wireless distinct sensor node scan reduces time and effort required for monitoring the environment.

Sensors

1 Soil detector / soil nutrient monitoring / soil integrated sensor

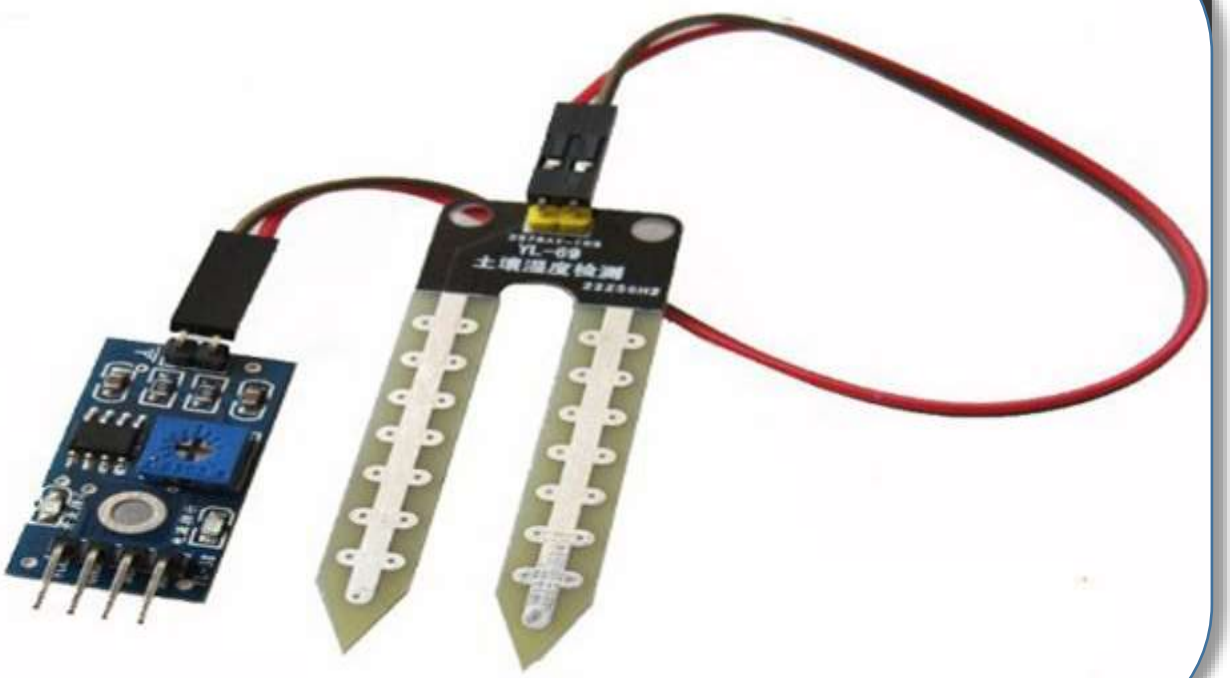
Monitoring Parameters: pH, NPK, temperature, humidity, water potential, tension, heat flux, conductivity and other parameters in soil.

2 Soil speedometer / soil multi in one detector

Monitoring Parameters: pH, NPK, conductivity, moisture, temperature and humidity.

3 Soil Moisture Sensor

It is a high precision and sensitive sensor for measuring soil moisture, temperature and electrical conductivity. It is an important tool for observing and studying the occurrence, evolution, improvement and dynamics of saline soil. By measuring the dielectric constant of the soil, the true moisture content of various soils can be directly and stably reflected. The soil moisture sensor measures the volume percentage of soil moisture and is a soil moisture measurement method that meets current international standards.



4 Three Way Soil Meter with pH Detector

Three Way Soil Meter with pH Detector is a Perfect tool to test the soil conditions (Moisture/Light/ PH) of fruits, flowers, vegetables, shrubs, etc. It's an Ideal and necessary tool for gardeners, vegetable and fruit growers, and all those who plant trees and grass. The meter can be simply inserted into the soil and switch to the setting you want to measure and read the scale. The moisture meter will quickly tell whether your plants are doing well. It helps you to control pH level in soil, acidic or alkaline is suitable for your plants. Above all, equipped with this meter, you can give the best care to your plants and keep the soil and lawn healthy and happy.

Note: Please remove probes from soil and wipe clean after each use.

Software and Hardware Requirements

Hardware:

1. Soil Moisture Sensor
2. Room Temperature & Humidity Sensor (DHT-11)
3. Jumper Cables
4. Breadboard
5. Raspberry Pi

Software

1. Operating System
2. Python IDE
3. AWS Cloud Service

CONCLUSION

In this paper, by obtaining a survey about applications of IoT soil testing we can conclude that, technological advancement in soil testing, analysis and data management are necessary. Farmers need variety of data and services to improve crop production based on land, crop, climate conditions, finance availability, irrigation facilities, etc. Use of IOT and Cloud Computing can help Indian farmers to increase the production by providing the correct communication between objects and charging according to the usage of service. Cloud support various services to farmers to interact with cloud by using any cheaper ways like sensors, mobile devices, scanners, etc. IoT is a kind of intelligent technology, including identification, sensor and intelligence.

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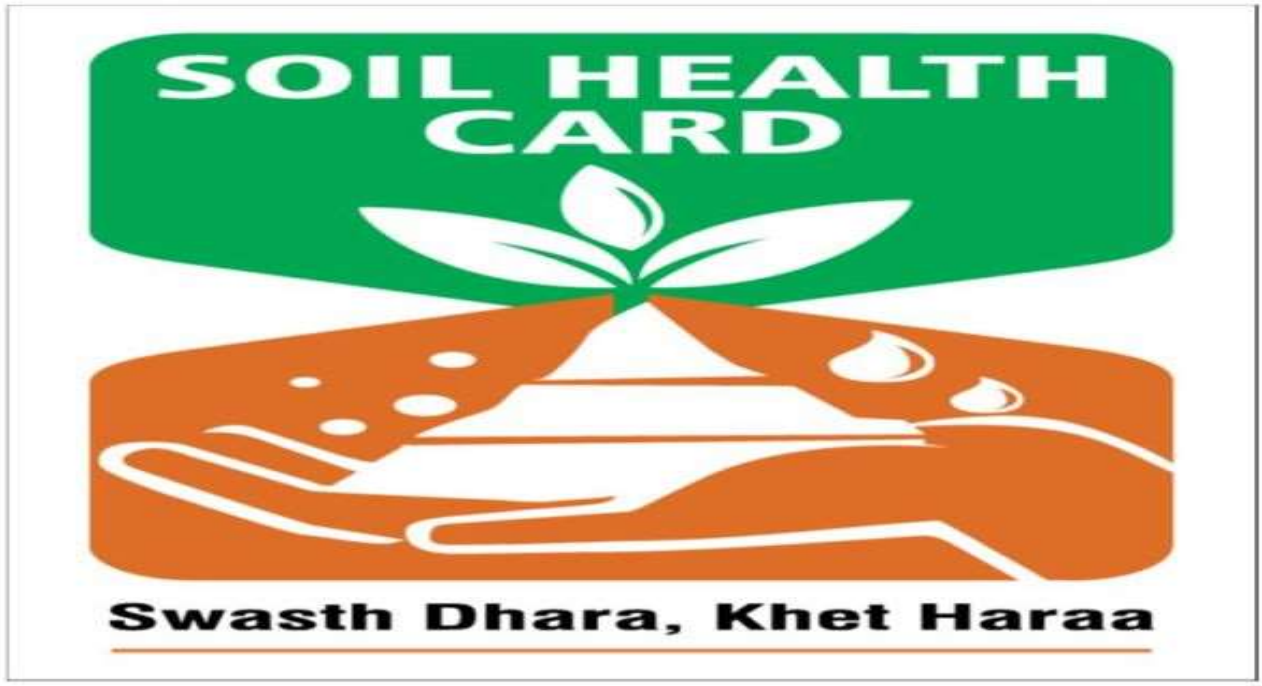

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> "The country wide application of soil health card has led to a decline in the use of chemical fertilizer by 10%. A study conducted by the National Productivity Council (NPC) says the application of Soil Health Card recommendations has led to a decline of 8-10% in use of chemical fertilizers."

Ministry of Agriculture of India is currently implementing an **$86 million Soil Health Card (SHC)** Scheme to provide nutrient recommendations to farmers based on local soil health tests, with the expectation that it will promote balanced nutrient management practices. Launched in 2015, the program provides SHCs to every farmer at two-year intervals. The cards contain soil test results and crop-wise recommendations of nutrients and fertilizers to help improve productivity through judicious use of inputs.

About **100 million cards** have been distributed to farmers across the country, and that number continues to rise. But many farmers say the cards would be much more effective if better designed and composed.

What Is Soil Health?

To define soil health appropriately, we need to consider the words that form "soil health." "Soil" is defined by the Soil Science Society of America (SSSA) as "the unconsolidated mineral or organic material on the immediate surface of the earth that serves as a natural medium for the growth of land plants." "Health" is defined by Merriam-Webster as "the condition of being sound in body, mind, or spirit." We can

restructure this definition of health to apply to the soil. Combined with the SSSA's definition of soil, "soil health" can be defined as **"the state of the soil being in sound physical, chemical, and biological condition, having the capability to sustain the growth and development of land plants."**

Government of India has launched soil health card scheme is **19, February, 2015** to issue soil health card to the farmers under the scheme. It carries crop-wise recommendations of nutrients and fertilizers required for the individual farms to help farmers to improve crop productivity through judicious use of inputs. For getting this information all soil samples are to be tested in various soil testing labs across the country. Thereafter the experts will analyze the strength and weaknesses (micro-nutrients deficiency) of the soil and suggest measures to deal with it. The result and suggestion will be displayed in the cards.

The government plans to issue the cards to 14 crore farmers. Soil Health Card contains the status of soils with respect to 12 parameters, namely-N, P, K (Macro-nutrients), S (Secondary-nutrients), Zn, Fe, Cu, Mn, B (Micro-nutrients) and pH, Electrical Conductivity, Organic Carbon (Physical Parameters). It not only provides the status but also provides crop wise fertilizer recommendations. Soil Health Card helps farmers to improve productivity by maintaining soil health. SHC also promotes the judicious use of the fertilizers thus reducing the cost of cultivation.

Current Scenario

Under the Central Government's Soil Health Card Scheme Phase-I (Years 2015 to 2017) 10.74 crore cards were distributed, while under the Phase-II 11.69 crore cards have been give away during the period 2017-19.

In the current financial year, a pilot project "Development of Model Villages" is being implemented under which the sampling and testing of cultivable soil is being encouraged in partnership with the farmers. Under the project a Model Village has been selected for aggregation of soil samples and analysis of each agricultural holding. As part of the scheme 13.53 lakh Soil Health Cards have been distributed during the year 2019-20.

For setting up of soil health laboratories under the scheme, the states have been sanctioned 429 static labs, 102 new mobile labs, 8,752 mini labs, 1,562 village-level laboratories and strengthening of 800 existing labs.

Status in Cycle I

Status in Cycle II

Status in Model Village Programme

Farmer's understanding of these cards

In 2017, researchers with the Cereal Systems Initiative for South Asia (CSISA) convened 21 focus group discussions with more than 100 farmers in Bihar and Odisha to determine whether farmers were able to understand the cards, trust them to provide accurate information, and change their practices based on the cards' recommendations. Farmers in these areas were also surveyed and five key informants interviewed.

The focus groups revealed several basic problems that made the SHC hard to understand and follow, even for the most well-read respondents (most of whom had studied at least until the fifth grade and one of whom was an MBA) in our sample. Many complained the cards were poorly designed and not user-friendly. The information they contained was too technical, more relevant for scientists than for farmers. They also lacked relatable visuals and contained too much text in small print, making it difficult to pick out the relevant information.

Too scientific for farmers

Many respondents were not familiar with all nutrients and micronutrients listed on the cards. For example, farmers are expected read a table with their soil's pH, EC (electrical conductivity) and OC (organic carbon) content—all three of which were unintelligible to many farmers in the local language. With a little probing and assisted reading, some farmers could follow and identify the nutrients listed on the SHCs, albeit with local reference terms.

In both states surveyed, we found a mix of cards in English, Hindi, and Oriya languages and where there were translations, they were mostly phonetic translations of English words. For example, "pH" was represented as an "f" sound in the local language. Literal translations of some of the most common nutrients were also confusing. Some farmers could infer meanings with prompting, and some were able to read recommended values of nutrients if these were explained. For those who could not read, it is a different story altogether.

Not more than a handful of farmers in our sample understood the recommendations for input application, which listed the names of individual chemical nutrients rather than formulated fertilizers. This is potentially risky for farmers who may end up choosing the wrong input.

Not from my field

Farmers also complained that the card test results—from single samples in grid squares of 2.5 hectares for irrigated areas and 10 hectares for rainfed areas—were not site-specific to their fields, undermining trust in the program's recommendations. When the values were in the range of their existing practices, recommendations were perceived as correct. But when the values were different from their expectations or practices (particularly in Odisha, where the urea recommendations were almost twice the present application rates in the villages we went to), the immediate response was to discard the recommendations, ostensibly because soil samples were not taken from their own fields.

Redesigning of Soil Health Card

If farmers do not understand the content, the program adds little value. So with the help of development communications specialists, we redesigned the SHCs to simplify and clarify the contents and make them more understandable to farmers. Illustrations help to overcome language barriers, and hence should be the focus of a scheme that aims to reach out to the masses. We added several illustrations, including pictures of fertilizer

blends. We also reduced the total amount of text and increased font sizes, and used symbols to represent levels (low, medium and high).

These new designs were retested in two rounds in Bihar in coordination with the Bihar Agricultural University (BAU), Sabour. Several iterations of the new designs were made to test for the optimal colors and symbol designs. A final design that farmers found attractive and easy to understand was submitted to the BAU for all their SHC work moving ahead. This new design was also launched by the Union Minister of Agriculture, Shri Radha Mohan Singh, on Feb. 24. BAU will distribute these new cards to several hundred farmers. We plan to undertake an assessment of the recipients' experiences with them, including their interpretability and eventual impacts on nutrient application behavior. Further research and more concrete evidence on the usability of these redesigned SHCs will help inform policy makers of potential changes in the national Soil Health program to encourage greater adoption.

Level of Utilization and Impact of the SHC Scheme

- About **66% of the farmers** are able to understand the content of the SHC, about 57% mentioned that the recommendations are suitable for their farms, and about **53% are able to follow recommendations.**
- The SHC scheme is inclusive in nature; small and marginal farmers are proactive in the adoption of recommendations based on SHC.
- There was a reduction in the use of urea and DAP by 20 to 30% in paddy and cotton in some states, resulting in decreased cost of cultivation. The reduction in the cost of cultivation ranged between Rs. 1,000 and Rs. 4,000 per acre.
- The use of micro-nutrients (especially gypsum) was slightly increased after SHC distribution.
- There was a significant increase in yield for farmers who practiced recommended practices as per the SHC.
- With decrease in the cost of cultivation and increase in yields, net incomes of the farmers increased between 30 and 40% after the SHC scheme.

Scheme objectives

Objectives of scheme Soil Health Card are as follows:

I. To issue soil health card to all the farmers of the country every 3 years, So as to provide all the information regarding nutrient deficiencies in fertilization practices

II. To strengthen the functioning of Soil Testing Laboratories (STLs) through capacity building, involvement of agriculture students and effective linkage with Indian Council of Agricultural Research (ICAR)/State Agricultural Universities (SAUs)

III. To diagnose constraints related to soil fertility with standardized sampling procedures uniformly across the states. Analyzing and designing block level fertilizer recommendations in targeted districts

IV. To develop and encourage soil test based nutrient management in the area for enhancing nutrient use efficiency

V. To build capacities of area level staff and of progressive farmers for promotion of nutrient management practices

How can a farmer use a SHC?

The card will contain an advisory based on the soil nutrient status of a farmer's holding. It will show recommendations on dosage of different nutrients needed. Further, it will advise the farmer on the fertilizers and their quantities he should apply, and also the soil amendments that he should undertake, so as to realize optimal yields.

Norms of sampling?

Soil samples will be drawn in a grid of 2.5 ha in irrigated area and 10 ha in rain- fed area with the help of GPS tools and revenue maps.

Who will draw the soil sample?

The State Government will collect samples through the staff of their Department of Agriculture or through the staff of an outsourced agency. The State Government may also involve the students of local Agriculture / Science Colleges.

Ideal time for soil sampling

Soil Samples are taken generally two times in a year, after harvesting of Rabi and Kharif Crop respectively or when there is no standing crop in the field.

How will soil samples be collected from a farmer's field?

Soil Samples will be collected by a trained person from a depth of 15-20 cm by cutting the soil in a "V" shape. It will be collected from four corners and the centre of the field and mixed thoroughly and a part of this picked up as a sample. Areas with shade will be avoided. The sample chosen will be bagged and coded. It will then be transferred to soil test laboratory for analysis.

Who and Where will the soil sample be tested?

The soil sample will be tested as per the approved standards for all the agreed 12 parameters in the following way:

1. At the STLs owned by the Department of Agriculture and by their own staff.
2. At the STLs owned by the Department of Agriculture but by the staff of the outsourced agency.
3. At the STLs owned by the outsourced agency and by their staff.
4. At ICAR Institutions including KVKs and SAUs.
5. At the laboratories of the Science Colleges/Universities by the students under supervision of a Professor/ Scientist.

Conclusion

Soil testing is a great tool to assess soil fertility and nutrient supplying capacity**.** The most crucial step in the whole programme is timely reporting of soil test results to farmers. Speed and reliability of operation is also most important. Appropriate systems and processes should be in place for effective implement of the scheme and to get desired results. Instead of planning the training for soil samplers/collectors' soil and water testing**.** Lab analysis and soil and water testing lab assistants, the training should be given to diploma holders, in Agriculture as they already have a preliminary idea about the subject, its importance and during the slack season their services could be utilized for other agricultural related activities. Thus, it can be said that our 'New India' is inching closer to the dream of 'Doubling the Farmer's Income'. Soil Health Cards are ushering in the new era of healthy soil management in the country, especially ending the menace of overuse of urea or nitrogenous fertilizers.

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The Second Kisan Rail- Connecting A Fruit Bowl of Southern India to Northern States

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> "Indian Railways aims to help double farmer's income with the launch of Kisan Rail. Kisan Rail will help in bringing perishable agricultural products like vegetables, fruits to the market in a short period of time from Andhra Pradesh, Anantapur- New Delhi."

Introduction

Kisan Rail For the timely transportation of vegetables, fruits, dairy products, etc., to consumers, Piyush Goyal-led Indian Railways is introducing another Kisan Rail train service that Indian Railways has flagged off India's second and South India's first Kisan Rail train service, from Anantapur- (Fruit bowl of Southern India) in the state of Andhra Pradesh to Adarsh Nagar in Delhi. The inaugural run of the train started on 9 September 2020.

Fruit Bowl of Southern India

Anantapur district of Andhra Pradesh (Fruit Bowl of Southern India) from where the kisan train originates can be referred to a fruit basin, given the strong growth of horticulture in the region. 15.6% of the country's fruit production came from Andhra Pradesh as it is

grown in 17.42 lakhs hectares, but only 10 to 15% of the produce is consumed locally and the rest is sent by either road or sea. The kisan rail will prove very beneficial to farmers of this region more than 80% of the 58 lakhs MT of fruits and vegetables in the district are marketed out of the state, particularly to the north Indian states of Delhi, UP, Punjab and Haryana among others. Earlier this was begin transported by roadways. Starting a Kisan Rail will be particularly helpful to small farmers and traders in marketing their product across the country in a safe, economical and speedy manner.

Union Minister Narendra Singh Tomar and Chief Minister of Andhra Pradesh Y. S. Jagan Mohan Reddy and other officials participated and flagged off the Kisan Rail train via video conferencing.

Kisan Rail train service between Anantapur- New Delhi will cover a distance of 2,150 kms in 40 hours. The rake is loaded with 14 parcel vans- 04 vans load meant for Nagpur and another 10 Vans load for Adarsh Nagar- totaling 332 tonnes. The crates to the requirements of small farmers and traders for transportation of their perishable produces

District collector Gandham Chandrudu, Anantapur MLA Anantha Venkatarami Reddy, Hindupur MP Gorantla Madhav and other officials participated in the function at Anantapur railway station, AP.

such as fruits and vegetables. It will take less time and cost in comparison of road transport ensuring less damage to the farm produce while transportation.

The concept of Kisan Rail works to complement the recent landmark reforms in agriculture market that the centre announced amidst the Corona crisis. Now, the farmers can sell their produce anywhere. Here comes the utility of Kisan Rail farmers who can secure right price for their produce before it perishes to those places where the demand persists.

The first-ever multi-commodity train service, the Kisan Rail carries vegetables such as cauliflower, capsicum, cabbage, drumsticks, chilies, onion, etc., as well as fruits like grapes, pomegranate, banana, etc. Equipped with frozen containers, the Kisan Rail train service is building a seamless national cold supply chain of meat, milk, and fish. The inaugural Kisan Rail loaded with Tomato, Bananas, Sweet Orange, Papaya, Muskmelons and Mangoes, as *Anantapur is the Fruit Bowl of Andhra Pradesh.*

Kisan Rail Yojana 2020

Kisan Rail Yojana has been started with the aim of providing relief to the farmers in the movement of vegetable fruits, etc. The main work of the farmers rail, vegetables, fruits etc. which are spoiled over a long period of time, get them to the destination i.e. Mandis within a certain time. **Kisan Rail Yojana** was announced by the Central Government in their budget. **The Kisan Rail Yojana** has been started by the Central Government and the **Indian Railways** on 7 August 2020 with the objective of benefiting the farmers. **A** train will be run for the farmers under the **Kisan Rail Yojana** which will provide relief to the farmers in the movement of their vegetables, fruits or other agricultural produce.

Motto of Kisan Rail

Earlier, Indian Railways had run single commodity special trains like Banana Specials etc. About, 45000, metric tonnes of banana were exported last year from Tadipatri in Ananthapur district by Desai Fruits via JNPT in Mumbai. Now, the Indian Railways believes that the Kisan Rail train service will cater to the needs of small farmers or traders by carrying their perishable items to distant places. The move is a step towards achieving the goal of doubling the incomes of farmers by 2022, according to the Railway Ministry.

Important Features of Indian Kisan Rail service

- This is the multi-commodity train service, which will carry vegetables like capsicum, cauliflower, cabbage, chillies, drumsticks, onion, etc., and fruits like banana, pomegranate, Sweet Orange, Papaya, Muskmelons and Mangoes etc.
- The train has been equipped with frozen containers and apart from fruits and vegetables; it is expected to build a seamless national cold supply chain of milk, meat and fish.
- The train has a composition of 10 +1 VPs and initially, it will be operated on a weekly basis. However, further modifications can be done based on user experience.
- The Kisan Rail train service will cater to the requirements of small farmers and traders for carrying their perishable supplies to distant places.
- According to Railway Ministry, Kisan Rail is a step towards realizing the goal of doubling farmers' incomes by the year 2022.
- For Kisan Rail, aggressive marketing is being done with local farmers, loaders, individuals and APMC. The demand for this is being aggregated.
- This train's freight will be charged as per Indian Railways' parcel tariff of normal train (P Scale).
- It is being expected by Indian Railways that the train will be patronized well and it will be a great help to the farmers.

'Kisan Rail' will help Farmers in following ways

- With the running of the Kisan Rail, 50 percent of the fruit and vegetable produced in this area will be saved.
- According to the Ministry of Agriculture Welfare, the running of this train will make the path easier for the farmers and their produce which will be saved from destruction and give right price to the farmers.
- This will also make it easier to achieve the goal of doubling their income by 2022.
- In this train, fruits-vegetables, fish-meat, milk and perishable food items will be transported. Apart from this, the shortage of onion which occurs in this season every year will also get relief.

Benefits of Kisan Rail

- It will take less time and cost in comparison of road transport.
- It helps the small farmers in better price realization for their produce.
- It will ensure less damage to the farm produce while transportation.
- Small farmers and traders related to fruits and vegetables like Sweet lime, Pomegranate, Water Melons, Papaya, Guava, Tomato etc., will be benefited.
- Balances the Fruits and Vegetables supply across the country.

Conclusion

The government plans on reviving the agricultural sector and doubling the income of farmers by 2022, in better price realization for their produce and facilitate smooth and fast transport of perishable goods to assist the farmers a target set by Prime Minister Shri Narendra Modi.

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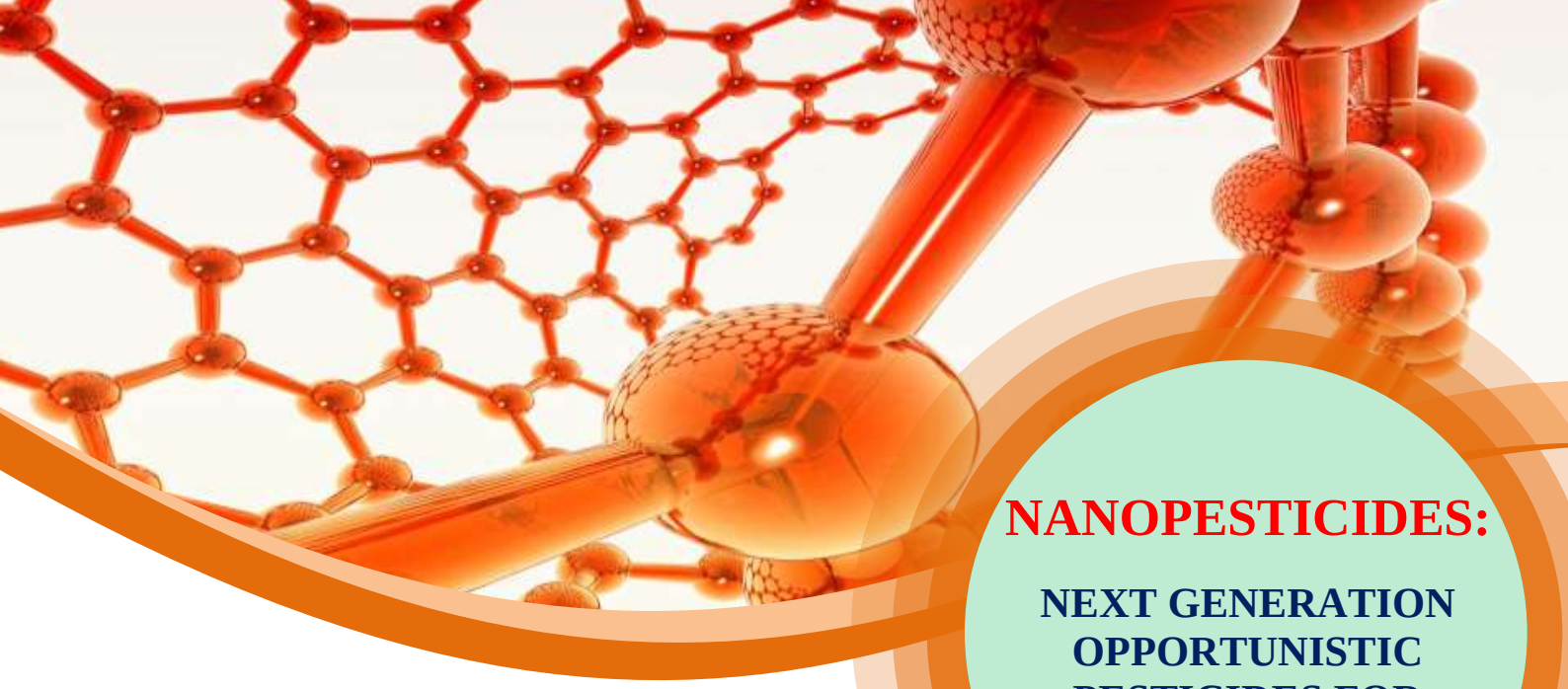

NANOPESTICIDES:

NEXT GENERATION OPPORTUNISTIC PESTICIDES FOR SUSTAINABLE CROP PROTECTION

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"Nanotechnology have the capacity to transform the entire food industry into much more conventional and affordable way including the production, processing, packaging, transportation, storability and consumption of food materials and also prevent the environment through the use of renewable energy supplies, filters and catalysts to reduce the pollution."

Introduction

Food security in the world is challenging due to the limited available resources for the rising population in recent time. Various efforts are being practiced by governments, organizations and researchers to mitigate the demand and supply gap in human food chain. Agriculture took the roots of growth prior to industrial revolution, in almost all around world. Besides changing in global climatic condition and cropping pattern scenario throughout the world and indiscriminate application of synthetic pesticide have aggravated the pest population such as pest resurgence, secondary pest outbreak that leads to pesticidal resistance among common insect pests. With the advent of biotechnology recently transgenics for insect-pests and disease resistance came into the scenario but due to the complexity of regulations most of the transgenics didn't released. In this consequent a newer option, Nano pesticides have appeared with the advancement of technologies.

Nanotechnology is the application of scientific knowledge to manipulate and control matter in the nanoscale (1nm-100nm) limit in order to make the use of size and structure dependent properties and phenomena as distinct from those associated with individual atoms or molecules or with bulk or normal size materials. It is a modern approach that use nanoparticles in crop protection which acts as carrier of active ingredients including pesticides as well as pheromones. While Nano pesticide considered either very small particles of chemically active ingredient or other small engineered structures with useful pesticide properties having some characteristics over traditional ones such as increased solubility of water insoluble active ingredients, elimination of toxic organic solvents in comparison to normally used insecticides, improved stability for the prevention of early degradation, smaller size but higher insecticidal activity, target specificity, larger surface area resulting in extended longevity and safer towards beneficial fauna (Sasson *et al.* 2007).

Formulations of Nano-Pesticides

The research in nanotechnology has led to the development of different nanoformulation *viz.*, nanoinsecticides, nanoherbicides, nanofungicides and nanonematicide which can be applied in crop protection.

1. Nano-emulsions: Generally, an oil-in-water (O/W) emulsion is more common as a nano-emulsion where, active ingredient of the chemical is dispersed as nanosized droplets in water, with surfactant molecules confined at the pesticide-water interface.

Nano-emulsions get further classified based on the quantity and type of surfactants, as thermodynamically stable and kinetically stable. When the pesticide is partially soluble in the aqueous solvent and spontaneous formation of a stable emulsion happens when surfactant, pesticide and water components are brought together, that is called thermodynamically stable nano-emulsion. The insolubility of the active ingredient makes the pesticide and surfactant to initially form a two-phase system and thus, a through shearing make them to mix together and pesticides droplets in the nano-emulsion will remain dispersed for an extended period of time and so are considered to be kinetically stable. Eg: Oil in water nano-emulsion of neem oil has been developed for insect management using Tween 20 as the surfactant.

2. Nano-suspension: Nano-suspensions or nano-dispersions, are formulated by dispersing the pesticide as solid nano sized particles in aqueous media. In nano dispersions, the surfactant molecules get confined at the particle surface where polar portions extending

into the aqueous solution and the non-polar portions associating with the solid pesticide. Eg: Aqueous dispersions of nano-permethin, novaluron and β-cypermethrin .

3. Nano-encapsulation: Nano-capsules or nano-encapsulation are heterogeneous reservoir type structure containing an inner central cavity which confines the hydrophobic or hydrophilic active ingredient, surrounded by a polymer coating or membrane. Eg: Controlled-release nano-formulation of the neonicotinoid (acetamipirid and Imidacloprid) insecticide have been developed.

4. Nano-fibres: Nano-fibres are developed through electrospinning, thermal induced phase separation. Researchers have developed electospun nano-fibers loaded with the chemical, (Z)-9-dodecenyl acetate, an ingredient of pheromone which get embedded in the polymer matrix for the management of many lepidopteran insect pests (Rajna *et al*., 2019).

5. Nanospheres: These are homogeneous vesicular structures, in which the bioactive ingredient is uniformly dispersed throughout the polymer matrix. Eg: Polymer stabilized bifenthrin nanoparticles are developed as nanospheres. Nanogels or hydrogel nanopartciles. These are formulated by cross linking of polymeric particles having hydrophilic groups, thus absorb higher quantities of water. Eg: Chitosan nanogel.

6. Polymer based nano-particles: Polymer-based pesticide nanocarriers are majorly deployed in the slow and controlled release of active ingredients to the target site. Moreover, they can serve to improve dispersion in aqueous media and also as a protective reservoir. Nano-encapsulation, nano-spheres, nano-gels, nano-fibers, etc are some of them falling in this category.

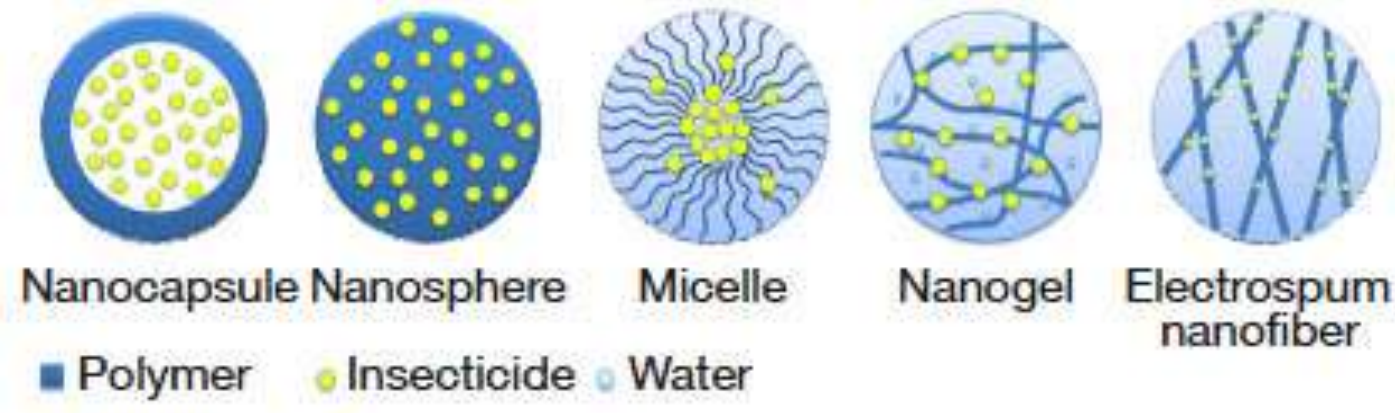

Fig 1: Different structure of polymeric nanopesticides.
(Source : https://popups.uliege.be/1780-4507/index.php?id=18497)

Table: Examples of some common polymers often used for coating in nanopesticide production

Active compound	Nanomaterial	Polymer	References
Azadirachtin	Particles	Carboxymethyl chitosanricinoleic acid	Feng and Peng (2012)
Beta-Cyfluthrin	Capsule	Polyethylene glycol	Loha *et al*., (2012)
Garlic Essential oil	Capsule	Polyethylene glycol	Yang *et al*., (2009)
Imidacloprid	Capsule	Lignin-polyethylene	Flores-Cespedes *et al*.,(2012)
Imidacloprid or Cyromazine	Clay	Alginate-bentonite	Fernandez-Perez *et al*., (2011)
Imidacloprid or Cyromazine	Granules	Lignin	Fernandez-Perez *et al*., (2011)
Pheromones	Resin	Vinylethylene and vinylacetate	Wright (1997)

Mechanism of Nanoparticles and application against various pest population

The use of nanoparticles to protect plants can occur via two different mechanisms: (a) nanoparticles themselves providing crop protection, or (b) nanoparticles as carriers for existing pesticides or other actives, such as double-stranded RNA (dsRNA), and can be applied by spray application or drenching/soaking onto seeds, foliar tissue, or roots.

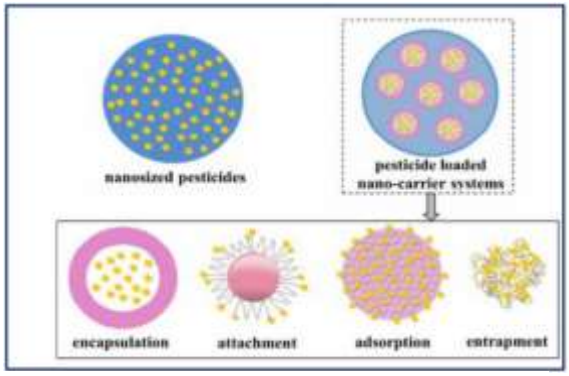

Fig 2: Mechanism of Nanobased pesticide formulation (Urkude, 2019).

Nanoparticles play an important role in the formation of pest repellents, pesticides and insecticides. A process named "nanoencapsulation" is used for the slow release of a chemical towards the particular host plant, which carries nanoparticles in form of pesticides and allows the proper absorption of the chemical into the plants. Nanoencapsulation involves the mechanisms like diffusion, dissolution, bio-degradation and osmotic pressure. This technology has also been proved beneficial for the transfer of certain chemicals and DNA into the plant tissues for the protection from particular insect pests.

These nanoparticles are also effective against the stored grain pests such as garlic essential oil loaded with nanoparticles if found to be effective against *Tribolium castaneum*

Herbst (Yang *et al*., 2009). Combination of SiO_2 and Ag nanoparticles is an effective pesticide on the larvae and adults of *Callosobruchus maculates* (Rouhani *et al*., 2012).

It was estimated that the bulk-sized silica (individual particle greater than 1micro meter) could be replaced with surface-functionalized silica nanoparticles (SNP). When the toxicity was tested against rice weevil *Sitophilus oryzae* it was found that the SNP was highly effective causing more than 90% mortality.

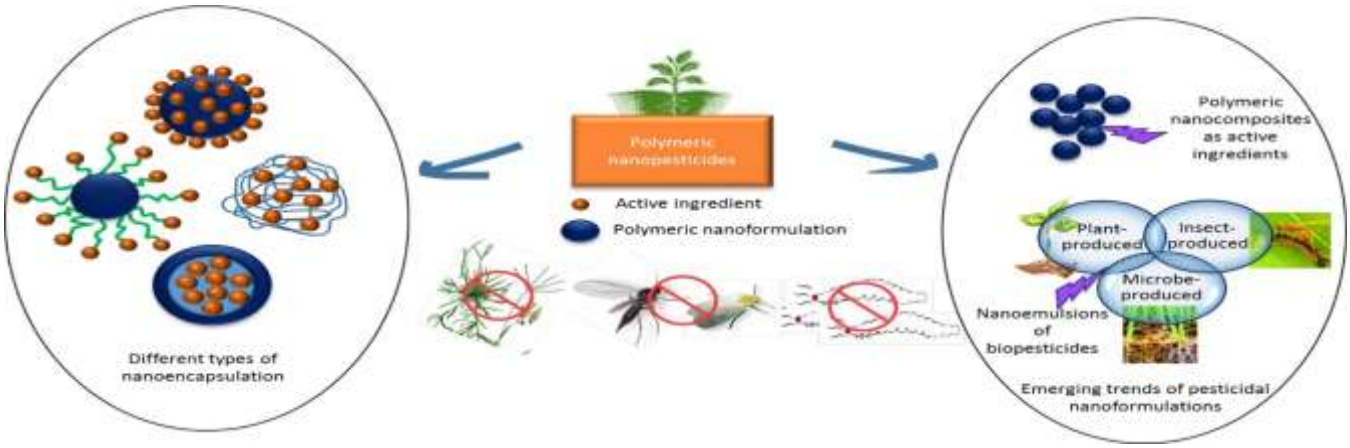

Fig 3: General mechanism of Nano-based pesticidal formulations against various pest population.

(**Source**: https://ars.els-cdn.com/content/image/1-s2.0-S0168365918307090-ga1_lrg.jpg)

Advantages of Use of Nano-Pesticides over Conventional Pesticides

Nanotechnology offers a tool for developing novel formulations of eco-friendly safe pesticides as majority of nanopesticide formulations are highly target specific.

1. Generally, controlled release and targeted delivery of nano-pesticides can improve pesticide utilization and reduce residue level and pollution. For example, Nano-microcapsule formulations have slow release and protection performance because they have been prepared using light and thermo-sensitive, humidity preference, enzyme-sensitive and soil pH-sensitive high polymer materials to deliver pesticides.
2. Nano-pesticide formulations improve adhesion of droplets on plant surface (reduces drift losses) which intern improves the dispersion and bio-activity of active ingredient (a.i.) of pesticide molecules. Therefore, Nanopesticides will have high efficacy compared to the conventional pesticide formulations and due to their small size, improvable pesticide droplet ductility, wettability and target adsorption when sprayed in fields has made these nano-pesticides provide efficient and environmental friendly advantages.
3. Silver, copper and gold nanoparticles are used as bio-nanosensors and electrical-nanosensors to detect a potential pathogen problem in plant body and postharvest foods.
4. The metal oxide-based nanomaterials such as ZnO, TiO_2, Cu and SiO_2 are increasingly used in pesticides and fungicides to protect crops from bacterial disease and control microbial activity.

Scope of Nanoparticles in Future

1. Nanotechnology have the capacity to transform the entire food industry into much more conventional and affordable way including the production, processing, packaging, transportation, storability and consumption of food materials.
2. Modern agricultural research is possible only due to the nanotechnology tools for disease detection and their molecular treatment, enhancement in the absorption of nutrients by the plant.
3. Nanotechnology will also prevent the environment through the use of renewable energy supplies, filters and catalysts to reduce the pollution.

Limitations in the Usage of Nano-Pesticides

1. The risk that nano-particles (nano-pesticides) may pose to human and environment health is not yet fully understood.
2. Nano-pesticides may also create new kinds of contamination of soils and waterways since nano-pesticides are apparently much more persistent and have higher degrees of toxicity when compared to their traditional counterparts.
3. Nanoparticles of size lower than 50 nm usually adversely affect human health and the potential routing could be through inhalation, ingestion and dermal exposure.
4. The level of nanotoxicity in soil, plant and water mainly depend on the composition, size and concentration of the nanoparticles.

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MULCHING: AN APPROACH TO COMBAT BIOTIC AND ABIOTIC STRESSES IN VEGETABLE CROPS

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“ Mulching is the process or practice of covering the soil/ground to make more favourable conditions for plant growth, development and efficient crop production. Mulch technical term means ‘covering of soil’. When compared to other mulches plastic mulches are completely impermeable to water; it therefore prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface. ”

Introduction

Mulching is the process or practice of covering the soil/ground to make more favourable conditions for plant growth, development and efficient crop production. Mulch technical term means ‘covering of soil’. While natural mulches such as leaf, straw, dead leaves and compost have been used for centuries, during the last 60 years the advent of synthetic materials has altered the methods and benefits of mulching. When compared to other mulches plastic mulches are completely impermeable to water; it therefore prevents

direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface.

Advantages of Plastic Mulching

- It is completely impermeable to water.
- It prevents the direct evaporation of moisture form the soil and thus limits the water losses and conserves moisture.
- By evaporation suppression, it prevents the rise of water containing salts.
- Mulch can facilitate fertilizer placement and reduce the loss of plant nutrient through leaching.
- Mulches can also provide a barrier to soil pathogens.
- Opaque mulches prevent germination of annual weeds from receiving light.
- Reflective mulches will repel certain insects.
- Mulches maintain a warm temperature even during night time which enables seeds to germinate quickly and for young plants to rapidly establish a strong root growth system.
- Synthetic mulches play a major role in soil solarization process.
- Mulches develop a microclimatic underside of the sheet, which is higher in carbon-di-oxide due to the higher level of microbial activity.
- Under mulch, the soil structure is maintained during cropping period.
- Early germination almost 2-3 days.
- Better nodulation in crops like Groundnut.
- Less nematodes population.
- Water erosion is completely averted since soil is completely covered form bearing action of rain drops.
- When compared to organic mulches, it serves for a longer period.

Limitations

- They are costly to use in commercial production when compared to organic mulches.
- Probability of 'burning' or 'scorching' of the young pants due to high temperature of black film.
- Difficulty in application of top dressed fertilizer
- Reptile movement and rodent activities are experienced in some places.
- More runoff
- Environmental pollution
- Difficult in machinery movement

- Can not be used for more than one season using thin mulches
- Weed penetration with thin films
- Toxic to livestock

Types of Mulch Film

A wide range of plastic films based on different types of polymers have all been evaluated for mulching at various periods in the 1960s. LDPE, HDPE and flexible PVC have all been used and although there were some technical performance differences between them, they were of minor nature. Owing to its greater permeability to long wave radiation which can increase the temperature around plants during the night times, polyethylene is preferred. Today the vast majority of plastic mulch is based on LLDPE because it is more economic in use.

Importance of Parameters of the Plastic Film

a) Thickness

Since it is sold by weight it is advantageous to use as thin a film as possible but at the same time due consideration should be given for the longevity of the film. The early mulch films used were of 60-75 micron (240-300 gauge) thickness, and today it is possible to have 15 micron thick film due to advent of film extrusion technology. These films are mechanically weak, as shown by their easy tearing when pulled tension.

b) Width

Normally a one to one and half meter width film can be easily adapted to different conditions.

c) Perforations

The capillary movement of water and fertilizer distribution will be better and more uniform under unperforated condition. But for prevention of water stagnation around the plants, perforation is better. But it has got the disadvantages of encouraging weed growth.

d) Mulch colour

Transparent film - Deposits more salt on soil surface

Black film - Restricts water movement and upward movement of salt is reduced.

Weed flora - Black film

Insect control - Opaque while film acts as golden colour and attracts insects

Selection of Mulch

The selection of mulches depends upon the ecological situations and primary and secondary aspects of mulching:

Rainy season	Perforated mulch
Orchard and plantation	Thicker mulch
Soil solarization	Thin transparent film
Weed control through solarization	Transparent film
Weed control in cropped land	Black film
Sandy soil	Black film
Saline water use	Black film
Summer cropped land	White film
Insect repellent	Silver colour film
Early germination	Thinner film

Mulch Laying Techniques

Mulch should be laid on a non-windy condition. The mulch material should be held tight without any crease and laid on the bed. The borders (10 cm) should be anchored inside the soil in about 7-10 cm deep in small furrows at an angle of 45°. The mulch material should be punctured at the required distances as per crop spacing and laid on the bed. The seeds/seedlings should be sown/transplanted in the holes.

Mulching techniques for vegetables /Close Space Crop

- Very thin film is used for short duration crops like vegetables. Required length of film for one row of crop is taken and folded in 'thaan' form at every one metre along the length of the film.
- Round holes are made at the centre of the film using a punch or a bigger diameter pipe and a hammer or a heated pipe end could be used.
- One end of the mulch film (along width) is anchored in the soil and the film is unrolled along the length of the row of planting.
- Till the soil well and apply the required quantity of FYM and fertilizer before mulching.

- Mulch film is then inserted (4-6”) into the soil on all sides to keep it intact
- Seeds are sown directly through the holes made on the mulch film.
- In case of transplanted crops, the seedlings could be planted directly into the hole.
- For mulching established seedlings, the process of punching the hole is the same. One end of the film along the width is burried in the soil and the mulch film is then unrolled over the saplings. During the process of unrolling, the saplings are held in the hand and inserted into the holes on the mulch film from the bottom side, so that it could spread on the topside.

Precautions for Mulch Laying

- Do not stretch the film very tightly. It should be loose enough to overcome the expansion and shrinkage conditions caused by temperature and the impacts of cultural operation.
- The slackness for black film should be more as the expansion; shrinkage phenomenon is maximum in this color.
- The film should not be laid on the hottest time of the day, when the film will be in expanded condition.

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KEEPING FOOD SAFE:
A GLOBAL RESPONSIBILITY

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> "Growth in the agriculture sector has been found, on average, to be at least twice as effective in reducing poverty as growth in other sectors. Food insecurity –often rooted in poverty- decreases the ability of countries to develop their agricultural markets and economies."

What is Food Security?

Food security, as defined by the United Nations' Committee on World Food Security, means that all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their food preferences and dietary needs for an active and healthy life.

Food security, as defined by the World Food Summit (WFS) and the Food and Agricultural Organization, 'exists when all people at all times have physical and economic access to sufficient, safe and nutritious food that meets their dietary and food preferences for an active life1'. Food security is also linked with a host of other factors, such as, socio-economic development, human rights and the environment. It has political ramifications as well. Food security is the combination of the following three elements:

- **Food availability** i.e. food must be available in adequate quantities and on an unfailing basis. It considers stock and production in a given area and the capacity to bring in food from elsewhere, through trade or aid.
- **Food access** i.e. people must be able to regularly acquire adequate quantities of food, through purchase, home production, barter, gifts, borrowing or food aid.
- **Food utilization:** Consumed food must have a positive nutritional impact on people. It entails cooking, storage and hygiene practices, individual's health, water and sanitations, feeding and sharing practices within the household.

Food security is closely related to household resources, disposable income and socioeconomic status. It is also strongly interlinked with other issues, such as food prices, global environment change, water, energy and agriculture growth.

Why Food Security is Important for a Nation?

- For boosting the agricultural sector.
- For having a control on food prices.
- For economic growth and job creation leading to poverty reduction.
- For trade opportunities.
- For increased global security and stability.
- For improved health and healthcare.

Recent Government Initiatives

- **National Food Security Mission**
  - It is a Centrally Sponsored Scheme launched in 2007.
  - It aims to increase production of rice, wheat, pulses, coarse cereals and commercial crops, through area expansion and productivity enhancement.
  - It works toward restoring soil fertility and productivity at the individual farm level and enhancing farm level economy.
  - It further aims to augment the availability of vegetable oils and to reduce the import of edible oils.
- **Rashtriya Krishi Vikas Yojana (RKVY)**
  - It was initiated in 2007, and allowed states to choose their own agriculture and allied sector development activities as per the district/state agriculture plan.
  - It was converted into a Centrally Sponsored Scheme in 2014-15 also with 100% central assistance.
  - Rashtriya Krishi Vikas Yojana (RKVY) has been named as Rashtriya Krishi Vikas Yojana- Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR) for three years i.e. from 2017-18 to 2019-20.

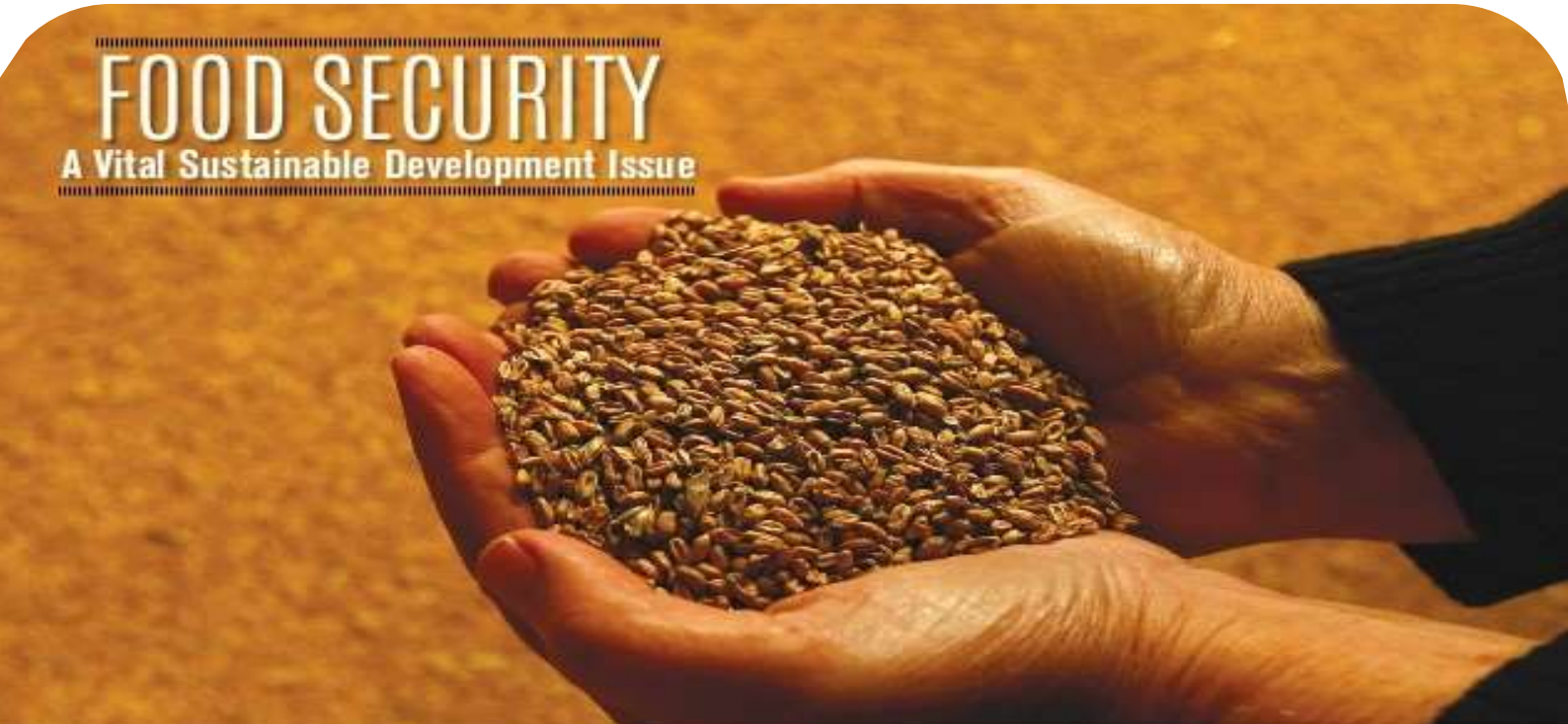
Objectives: Making farming a remunerative economic activity through strengthening the farmer's effort, risk mitigation and promoting agri-business entrepreneurship. Major focus is on pre & post-harvest infrastructure, besides promoting agri-entrepreneurship and innovations.

- Integrated Schemes on Oilseeds, Pulses, Palm oil and Maize (ISOPOM).
- Pradhan Mantri Fasal Bima Yojana.
- E-marketplace: The government has created an electronic national agriculture market (eNAM) to connect all regulated wholesale produce markets through a pan-India trading portal.
- Massive irrigation and soil and water harvesting programme to increase the country's gross irrigated area from 90 million hectares to 103 million hectares by 2017.
- The government has also taken significant steps to combat under- and malnutrition over the past two decades, through:
  - The introduction of mid-day meals at schools. It is a Centrally-Sponsored Scheme which covers all school children studying in Classes I-VIII of Government, Government-Aided Schools.
  - Anganwadi systems to provide rations to pregnant and lactating mothers.
  - Subsidized grain for those living below the poverty line through a public distribution system.
  - Food fortification,

- **The National Food Security Act (NFSA),** 2013, legally entitles up to 75% of the rural population and 50% of the urban population to receive subsidized food grains under the Targeted Public Distribution System.
  - The eldest woman of the household of age 18 years or above is mandated to be the head of the household for the purpose of issuing of ration cards under the Act.

International Organizations involved in ensuring Food Security

- **Food and Agricultural Organization (FAO)**
  - Established as a specialized agency of the United Nations in 1945.
  - One of FAO's strategic objectives is to help eliminate hunger, food insecurity, and malnutrition.
- **World Food Programme (WFP)**
  - Founded in 1963, WFP is the lead UN agency that responds to food emergencies and has programme to combat hunger worldwide.
- **International Fund for Agricultural Development (IFAD)**
  - Founded in 1977, IFAD focuses on rural poverty reduction, working with poor rural populations in developing countries to eliminate poverty, hunger, and malnutrition.
  - It is a specialized agency of the United Nations and was one of the major outcomes of the 1974 World Food Conference.
- **World Bank**
  - Founded in 1944, the World Bank is actively involved in funding food projects and programmes.
- **United Nations Environment Programme (UNEP)**
  - It was established in 1972 as the international arm providing guidance and governance to environmental issues. One of the topics that UNEP addresses currently is food security.



Conclusion

Importance of Global Food Security

Growth in the agriculture sector has been found, on average, to be at least twice as effective in reducing poverty as growth in other sectors. Food insecurity –often rooted in poverty- decreases the ability of countries to develop their agricultural markets and economies.

Access to quality, nutritious food is fundamental to human existence. Secure access to food can produce wide ranging positive impacts, including:

- Economic growth and job creation.
- Poverty reduction.
- Trade opportunities.
- Increased global security and stability.
- Improved health and healthcare.

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HOME SCIENCE EDUCATION AS A WHOLE

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“ In addition to dealing with the growth of moral character and cognitive ability of youth, higher education promotes technological know-how, utility skills, fosters careerism, a sense of responsibility and prosperity among young people of the country. Home science is an applied and integrated science that aims to enhance the individual, the family and the society’s quality of life. It is a multipurpose research programme taken up by both boys and girls and has undergone transformation in the first quarter of the last century since its inception. State Agricultural Universities have a full-fledged college and faculty of Home Science under ICAR, where Home Science is a department under the faculty of social sciences/ science as in the conventional set up. ”

In addition to dealing with the growth of moral character and cognitive ability of youth, higher education promotes technological know-how, utility skills, fosters careerism, a sense of responsibility and prosperity among young people of the country. Home science is an applied and integrated science that aims to enhance the individual, the family and the society’s quality of life. It is a multipurpose research programme taken up by both boys and

girls and has undergone transformation in the first quarter of the last century since its inception. State Agricultural Universities have a full-fledged college and faculty of Home Science under ICAR, where Home Science is a department under the faculty of social sciences/ science as in the conventional set up.

"Home science education is worth life education". From time immoral down the ages of civilization, "Home and Family" has been the core of all human development and the society at large. By catering to the physical, emotional and spiritual needs of the members, the home gives meaning to life and refines the life of citizen leading to better living and thus building a healthy and developed country. Home science can be defined as "Education for better living". It explores the plausibility of the establishment of the perfections in the social orders starting from the home life to the community level. On the whole, the goals of Home science can be spell out as "for prosperous living and achieving the highest happiness".

Home science is a dynamic and ever growing field of education. It is an applied field built upon both the discipline of science and humanities for the purpose of achieving the welfare and wellbeing of the family in an ever changing society. It is the education for "better living" and the core of this education is the "family ecosystem". It is the study of reciprocal relations between the family and its natural and man-made environments. Educated mentally strong youth.

Significance of home science education

1. Use of scientific knowledge in managing Home life

Great advances have been made in the areas of health, nutrition, textile, psychology, housing and managerial skills, which the home maker requires in her day-to-day life of managing and maintaining the household.

2. Use of available services and facilities

Modern day society has changed a great deal in terms of availability of various services to each and every household. Moreover, use of modern technologies, its maintenance and management also is of great importance, which Home science education tries to fulfil.

3. Economic necessities

Home science education tries to train and educate one to make a perfect interface between these two spheres of women's life.

4. Managing day to day family affairs

Human relations are undergoing sea- change during the last few decades. Family values, ethos are severely affected. People are becoming more and more individualistic in nature, contrary to our Indian collectivism. Today family problems are in rise, leading to various types of domestic violence, abuse, crimes etc. Home Science education tries to educate and acquire the ability to manage this crisis at right time with proper emphasis.

5. Enables the person for many career opportunities

Use of new techniques and modern equipment's has helped the housewife to make efficient use of her resources.

6. Home science has an important role to play in society

Home science aims at promoting satisfactory personal family and community life by developing the qualities needed for responsible and creative living.

Relevance of home science in improving quality of life

The study of Home Science improves the quality of life of people through the following ways:

- Helps people lead a more satisfying personal, family and community life through the dissemination of knowledge and appreciation of cultural and spiritual values.
- Offers maximum opportunity to express one's ability to understand and manage their resources and develop leadership qualities.
- Develops qualities needed for responsible citizenship.
- Helps student to recognize the importance of food in ensuring health.
- Teaches about food safety that needs to be adapted right from farm to fork.
- Imparts knowledge about healthy food preparation techniques.
- Provides practical tips in preparing a balanced diet.
- Provides necessary guidelines about entrepreneurship so as to help young students identify and pursue income generating activities.
- Gains technical knowledge and information from various branches of Home Science for both personal and professional use.

Major areas in home science

❖ Human development

Human development deals with the development of a child from conception to old age. Physical, motor, emotional, language, cognitive and social developments of human beings are included in this. Behavioural problems of children, exceptional children, disorders, specific problems and issues that hinder the development of human beings are also dealt with. Geriatrics is also a part of the study since the life span of an individual is longer today.

❖ Family and community resource management

Under Family and Community Resource Management, time, money, energy and space management are the main topics for study. A good time plan is essential for time management. For money management resources have to be utilized judiciously. A family budget fulfils this aim. Energy management is a difficult task as the activities in a person's life is different from another individual. Energy management study aims at reducing the amount of energy required for doing each work. A work simplification technique enables this process. Consumer education is also included under this subject. The consumer is provided with information regarding food safety, safety against adulteration, common adulterants, health hazards and Consumer Protection Act. Major principles and basics of design and arts are also detailed in this area.

❖ Food and nutrition

In Food and Nutrition food science and nutrition are included. Chemistry of food, nutrient retention, and sources of nutrients, nutritive value of food and judicial mixing of food are scientifically instructed in food science. Nutrition imparts the knowledge of various nutrients, their composition, functions, sources, requirements and deficiency status.

❖ Textile science

Textile Science includes all details about textile fibres and fabrics, fabric construction processes namely spinning, weaving, printing, dyeing etc. Basic principles of apparel designing and construction are also taught.

❖ Extension education

In Extension Education, basics programme planning, preparation of audio visual aids, social work, applied nutrition, methods of communicating with the society etc. are included.

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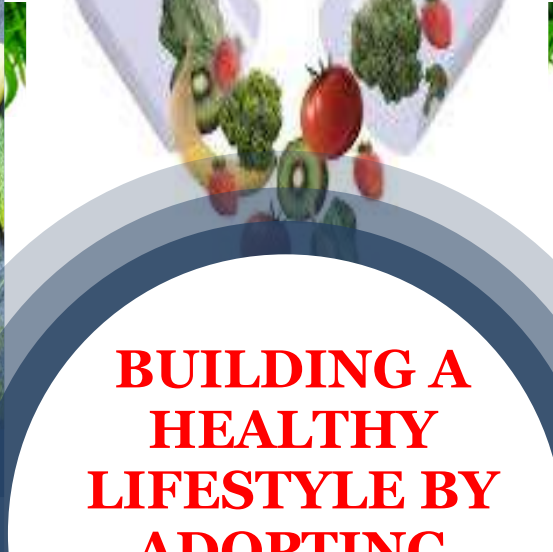

BUILDING A HEALTHY LIFESTYLE BY ADOPTING HOLISTIC NUTRITION

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"When we talk of living a holistic lifestyle, a guiding principle holds true: the whole is more than the sum of its parts. There are four recognized aspects of holistic health: physical, emotional, mental and spiritual. Having a healthy digestive system is so important for overall health. The healthiest, most detoxifying diet is a plant-based, whole and raw food diet. In adopting holistic and healthy life style some point consider: individualized nutrition, plant-based medicine, restful sleep, joyful movement, Practice of Gratitude, self-care, and social support. Practicing yoga helps to balance your mental, spiritual, and physical health, and then there should be no doubt practice yoga. For the adopting healthy life style should be avoid alcohol, spicy food, and junk food."

Holistic Health

When we talk of living a holistic lifestyle, a guiding principle holds true: the whole is more than the sum of its parts.

This phrase, first coined by the philosopher Aristotle, defines the modern concept of synergy and refers to the need for harmony between all pieces of our lives.

There are four recognized aspects of holistic health: physical, emotional, mental and spiritual. It is believed that what happens to one aspect of holistic health can affect all other aspects.

A holistic health approach all four aspects into account and focuses on how they work together to make us whole and healthy as an individual.

Holistic Nutrition

A nutritious and detoxifying diet both are the cornerstone of a holistic lifestyle. Though every aspects of this way of living works together to create better overall health. This diet has the potential to make the biggest impact on your life.

The gigantic majority of cells in our bodies are constantly replacing themselves, however some at a slower rate than others. If a cell is fed an opulence of energy and the right materials, it can replace itself with a stronger and better cell which leads to a healthier body.

Healthy Holistic Eating

The healthiest, most detoxifying diet is a plant-based, whole and raw food diet.

Raw foods are whole plant foods in their most natural state, and/or not heated above 118°F. By this way, the enzymes, vitamins, and minerals remain intact. It includes vegetables, fruits, nuts, seeds, and super foods.

Healthy Digestion

Having a healthy digestive system is so important for overall health. It precisely affects every process of the body. Leading balance to the digestive system is a key principle in bringing balance to the whole body.

Many people suffer from some type of digestive disorder, to include problems such as irritable bowel syndrome, bloating, heartburn, acid

reflux, and many others. These digestive issues can lead to allergies, arthritis, rashes, autoimmune disease, chronic fatigue, acne, mood disorders, autism, dementia, cancer, and more.

Holistic Lifestyle

Holistic lifestyles are as unique as fingerprints because we all have own definitions of health. Here are guiding principles for living a holistic lifestyle, defined by 7 Pillars of Holistic Wellness:

1. **Individualized Nutrition:**

   Individualized nutrition understands that each body is biologically unique, so that diets we need to care for them need to be unique as well.

2. **Plant Based Medicine:**

   Living a holistic lifestyle allows for the intersection of both Eastern and Western medicine for the best outcome possible.

   Holistic living simple and easy means that you know when it is appropriate to reach for a natural remedy to cure a common ailment, while also knowing when it is appropriate to consult with a physician for a more serious, potentially life-threatening condition.

3. **Restful Sleep:**

Restful sleep plays an important role in holistic lifestyle, although for so many people, it can be difficult to take restful sleep.

4. **Joyful Movement:**

Often times women with the misconception that a holistic lifestyle is simply about drinking green smoothies, practicing yoga all day long, and rejecting conventional medicine – but that couldn't be further from the truth.

Practicing yoga helps to balance your mental, spiritual, and physical health, and then there should be no doubt practice yoga.

5. **Compassionate Self-care**

Self-care refers to the activities and practices that we engage in on a regular basis to reduce body stress and maintain and enhance our short and long-term health.

Good health is the result of a healthy body, mind and soul, and self-care serves as the balance between all these three forces.

6. **A Practice of Gratitude**

Many people believe that good health will lead to increased happiness, but I believe that increased happiness leads to good health.

Research also suggests that a conscious focus on blessings may have many emotional and interpersonal benefits that can boost your happiness throughout the day.

7. **Social Support**

Health is much more than just a doctor's appointment and the food that we eat. It is the result of our genetics, hormones, environment, and the state of our mental, emotional, and spiritual well-being.

It is also a result of the social support we have in our lives. Whether our social support comes from our family, friends, mother, sister, husband and kids, having strong social connections can help support our holistic lifestyle.

Things to avoid for Holistic Health

The things which have to avoid for holistic living are as follows:

- Avoid Alcohol;
- Keep away from junk foods;
- Fight shy of taking stress;
- Extra spicy food;
- Try to stay away from stressful relationships either it is personal or professional.

Benefits of Holistic Living

The main benefits of this type of living are as follows:

- Balanced emotional and physical well-being;

- Personal growth;
- Reduced stress;
- Relief of chronic ailments;
- Better interpersonal relationships;
- Improved productivity;
- Enhanced environment understanding
- Spiritual development.

When you properly practice holistic living, you can:

- Improve body energy and physical strength;
- Alleviate illness and pain;
- Feel a sense of calm, comfort, rejuvenation and balance;
- Increase body longevity and overall good health.

Summary and Conclusion

Holistic nutrition and healthy life style means physically, mentally and socially well-being through the seven cycle that is individualized nutrition, plant-based medicine, restful sleep, joyful moment, compassionate self-care, practice of gratitude, and social support and avoiding some things like alcohol, junk food, stress, spicy food and stressful relationship.

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LEARN MUSHROOM CULTIVATION & MAKE MONEY IN 45 DAYS

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> “Mulching is the process or practice of covering the soil/ground to make more favourable conditions for plant growth, development and efficient crop production. Mulch technical term means ‘covering of soil’. When compared to other mulches plastic mulches are completely impermeable to water; it therefore prevents direct evaporation of moisture from the soil and thus limits the water losses and soil erosion over the surface.”

Mushrooms are well known throughout the world for their taste and other nutritional/medicinal properties. They are consumed since the early history. Greeks often consider mushrooms as an important food for strengthening the warriors. Romans often termed mushrooms as “Food of the Gods.” Even in China, mushrooms are often perceived as health foods, an “elixir of life.” More than 30000 of the mushrooms have been identified and among them 99% are edible ones with roughly 1% as poisonous. Yet many of the mushrooms are still undiscovered. There are different types of mushrooms being consumed throughout the world such as button mushrooms, oyster mushrooms, paddy straw mushrooms, etc.

Here, I'm going to tell you about how easily you can cultivate mushrooms at your home and start earning profits from it.

Introduction

Mushrooms are broadly classified under the *Kingdom Fungi* and most of the edible mushrooms are part of class *Agaricomycetes*. Botanically, Mushroom is a fleshy body bearing spores which typically produces on the top of the soil, wooden logs, straws, decomposing material, etc.

The mushroom's morphology is very simple as it have stem called *stipe*, a cap known as *Pileus* and the gills underside the cap. The similar morphology is also find in the *Ascomycota*. Unlike plants, they lack the chlorophyll pigment and hence are not photosynthetic.

General importance

Mushrooms are known for their delicacy and an ingredient of gourmet cuisine throughout the world. They are a great source of nutritional and functional value. Mushrooms themselves are very tasty and popular to eat with additional health benefits.

Health benefits of Mushrooms

1. All types of mushrooms are rich sources of proteins and fiber present in varying degrees in different types.
2. They also contain Vitamin B and an anti-oxidant Selenium which boosts immunity and repair cell and tissues of the body.
3. It is also a source of vitamin D as they are exposed to the UV light and improve its concentration
4. Mushrooms also helps in preventing the cancer risk as it contains folate enzyme which helps in DNA repair and building.
5. It also helps in preventing and controlling the diabetes.
6. It do maintains the heart health as fiber, protein and potassium together makes up cardiovascular health.
7. It helps in boosting immunity and a good source of vitamin C.

Types of Mushrooms

There are so many varieties of mushrooms and those which are very commonly consumed are as follow:

White button mushrooms *(Agaricus bisporus)*

White button mushrooms are the most widely cultivated and consumed members of family Agaricaceae. They are small or medium sized mushrooms with the diameter of about 2 – 7 cm. They are whitish in color with a round cap and slightly brown gills. They are cultivated round the year. These mushrooms are also known as Table mushrooms, common mushrooms or cultivated mushrooms. Nutritionally, they are good source of proteins, vitamin D, selenium, potassium, amino acids, folate and minerals like Zn, P and Mn. They are consumed as in raw or cooked form. Around 90% of the mushrooms we eat are of this variety only.

Oyster mushrooms *(Pleurotus ostreatus)*

This is often known as Oyster fungus. This mushroom is fan-shaped or having oyster-shaped cap. This fungus is generally grown over the decaying wood. This mushroom was first cultivated in the Germany for the world war warriors and later on, it is widely used in China, Korea and Japan as a delicacy food. This mushroom is cultivated commercially in the plastic bags filled with hay.

These mushrooms are available in different colors such as white, grey, pink, cream, yellow or light brown. It is also rich in several nutrients as white button mushroom, paddy straw mushroom, etc. It is rich in vitamin B complex and vitamin C along with many minerals such as Fe, Ca, Se, Na, P and K. Moreover, it contains about 10 times more Niacin as compared to the vegetables. This mushroom is one of the most versatile and easily cultivated mushroom on the earth.

Paddy straw mushroom *(Volvariella volvacea)*

Paddy straw mushroom was first cultivated in China and it is generally grown in South-east Asia (tropics and sub-tropics). It is also very preferable mushroom as it is good in taste, aroma and texture. Moreover, it is also very popular like white button mushrooms. In fact they are also grown under proper light and

well ventilated rooms. This is generally grown on paddy straw as one of its most common substrates. Their cultivation is also profitable as production is higher and more stable.

Cremini mushrooms

Cremini mushrooms are the same species as white button mushrooms. They are tastier than them. The only difference is that their cap is brownish in color.

Shiitake mushroom *(Lentinus edodes)*

Shiitake mushrooms are the edible natives of East Asia. It is mostly cultivated in Japan. This is very much preferred for their unique taste and flavor. Moreover, it contains chemical compound which helps in lowering the cholesterol level in the body. It grows widely on bark of trees like oak and chestnut.

Morel mushroom

Morels are the wild mushrooms and are also in wide demand in the market. They are not cultivated like other mushrooms. They are to be collected in the wild. They are the most delicious mushrooms. They are one of the most expensive mushrooms as compared to others because of their unique appearance and taste as well.

Mushroom cultivation

Key environmental factors considered for mushroom cultivation:

Temperature

The best temperature for growing mushrooms is 35-40 degree Celsius which is the best growing temperature for producing spores. If the temperature is too hot then the caps will be smaller and thus, reducing the economic quality of mushrooms. Caps can grow best at 30 degree Celsius temperature and nearly 35 degree Celsius is best for fiber and mycelium production.

Light

Light is essential for all living processes. Unlike plants, mushrooms don't require light essentially. In fact, mushrooms whiten in the dark space.

Oxygen

Oxygen is very important for the mushrooms. As it is required by them at every stage and most importantly during the bloom stage when caps are coming out. If oxygen will not be sufficient and CO2 is more than fiber will grow shorter and thus cap will stop growing and will result in abnormal mushrooms.

pH levels

The mushrooms grow best in the acidic to neutral conditions. The pH level for growing all types of mushrooms is between the ranges of 5-8. But it is very important to make sure that conditions shouldn't be too acidic because it can resist the bacteria to grow mushrooms.

Steps involved in Mushroom Cultivation

The mushroom cultivation involves six steps and they are enlisted as follow:

1. Preparation of compost
2. Get your spawn ready
3. Casing
4. Placing the substrate and spawn
5. Incubation
6. Fruiting
7. Harvest

Preparation of compost

The basement for the mushroom production is compost. The compost used for their cultivation can be made naturally or synthetically. You may also learn to make compost at home.

Making compost naturally

The composting must be done in the open. For making up the natural compost the ingredients required are horse dung, poultry manure, Wheat straw and gypsum. It is to make

sure that the manure collected must be fresh and isn't mixed with the dung of other animals. The straw must be also finely chopped. Mix all the ingredients and the mixture must not be exposed to the rains. Spray some water over it and turn it after sometime. With the fermentation going on, the compost heap will start to release ammonium nitrate. This is the sign that the heap has opened and is ready as substrate.

Synthetic compost

The ingredients used for synthetic compost are wheat straw, bran, urea, calcium ammonium nitrate and gypsum. Mix all of these ingredients and sprinkled the water on them. The very next step is to blend all of them with straw and mound them into a pile. The ready compost must be dark brown in color.

Get your Spawn ready

Spawn is a seed of the mushroom and the process of seeding for mushroom cultivation is spawning. The spawn can be your own also and you can also buy them from the certified national laboratories at the nominal prices. Spawning can be done in two ways:

1. By scattering it over the compost
2. By mixing the spawn into the compost before placing them in tray.

Casing

Casing is the shielding step in this. During casing formalin is sprayed over the substrate to make sure that the pathogens like nematodes, insects, pests etc are killed. It is to be sure that this stage requires lots of fresh air and the mushroom unit must be well ventilated during this time. The whole process is to be done in the temperature of 25 degree Celsius for and 2 hours and then lowered to 18 degree celsius.

Placing the substrate and spawn

There are many ways of placing the substrate and it also depends on the variety of mushroom which is to be cultivated (except morels which are to be collected wildly).

For the cultivation of button mushrooms, you have to simply take the trays or wooden boxes. Firstly, fill the base with a thin layer of soil and then fill it with the substrate (compost) and do take care about the moisture of the compost as it shouldn't be too dry or too wet. The size of the tray should be as per the convenience with the depth not more than 20 cm. The trays must be filled up to the surface and spawning can be done also according to their convenience.

For the paddy straw mushroom and oyster mushroom, the plastic bags should be filled with the compost and spawning can be done by mixing them. These bags are tied and small cuts are to be made for respiration and as growing points for them.

Incubation

When it comes to incubation try to place the trays and plastic bags in the dark room. Try to keep the place with an optimum temperature of 35 degree celsius and do make sure that the windows or other sources of light remain closed. After 10-15 days of casing, you will start observing tiny pin heads coming out.

Fruiting

When the tiny pinheads start to rise then it is time to increase relative humidity in the unit. The increased humidity helps in making the mushrooms fluffy. During this time, the temperature also needs to be slightly higher i.e., around 38 degree Celsius. Moreover, it also requires light during this period. The mushrooms start their capping within 5 – 8 days just after pinning.

Harvest

The moment when caps are prominent with a diameter of 6-8 cm is the perfect time to harvest the mushrooms (button or paddy straw). To do so, you have to simple hold the cap and twist the stem off against the growing substrate.

How to earn through mushroom cultivation?

The mushrooms are high in demand in almost every market and have the potential to grow throughout the year. They are one of the best sources of income as far as Indian farmers are concerned and same goes for the others as well. Even button mushrooms in India are sold at Rs. 300/fort.

Asia is the largest market of mushrooms and mushroom cultivation is the fifth largest sector agricultural sector. Globally, China is the largest producer of the mushrooms with a total yield of 38.42 million tonnes in 2017, accounting for total 75% global output. Increasing vegan population and nutrition rich mushrooms demand is increasing day by day along with its consumption.

This above information shows how widely mushroom is in demand and how its production can be an amazing source of earning money. Following are the enlisted reasons why mushroom cultivation is an effective source of making money:

- Mushrooms require small space to grow as anyone can start their business from home.
- Mushrooms are produced organically as organic food is high in demand.
- Mushrooms are a symbol of elegance that fetch good prices in the market.
- Mushrooms require low investment.
- Mushrooms can be grown throughout the year.
- Mushrooms are labor intensive thus making it easy to manage.

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ETHYLENE ESTIMATION AND DETECTION IN FRUIT CROPS

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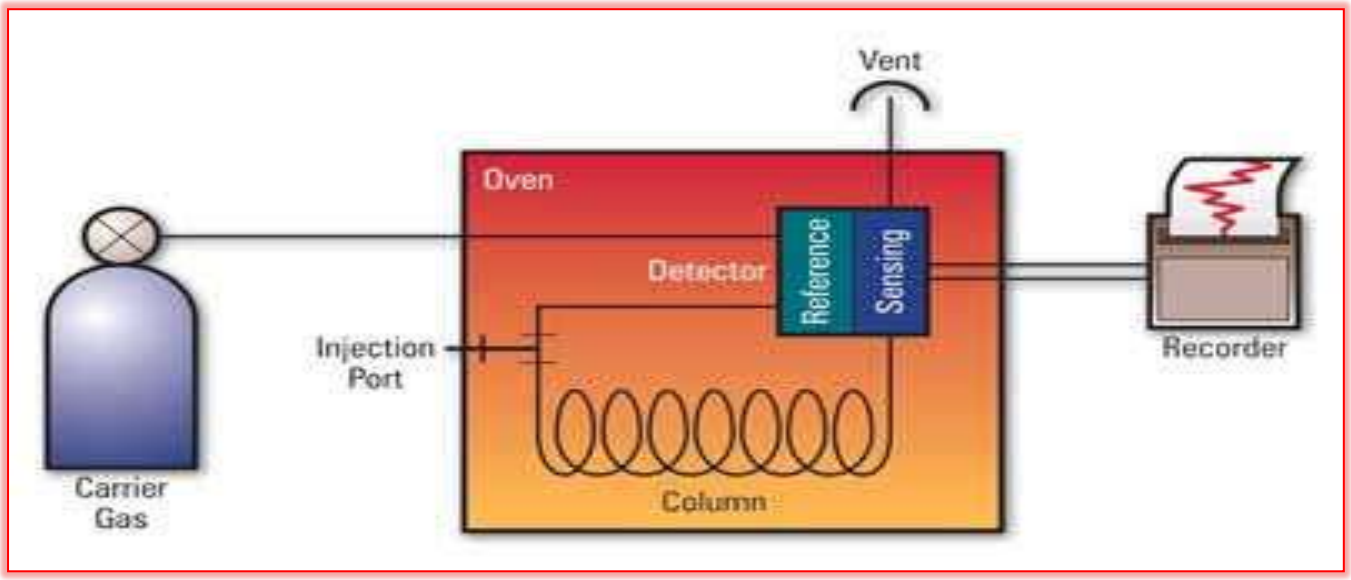
"At various storage conditions of fruits, it is very essential to monitor the ethylene level. Till now there was no handy small instrument available for use in supply chain. Thus, to maintain post-harvest stock of fruit producers as well as suppliers, innovative portable devices are recently developed."

Introduction

Ethylene refers to the hydrocarbons that can act as phytohormone involved in growth promotion, ripening of fruit, epinasty, senescence and breaking of dormancy. Ethylene present in both climacteric and non-climacteric fruits and has an influence on the shelf life of fruit during their transportation. During transportation, an unintentional exposure of ethylene gas results in a loss of fruit. Therefore at various storage conditions of fruits, it is very essential to monitor the ethylene level. Till now there was no handy small instrument available for use in supply chain. Thus, to maintain post-harvest stock of fruit producers as well as suppliers, innovative portable devices are recently developed.

Various types of ethylene estimation and detection methods are described as follows:

1. Gas chromatography (GC) detection



Gas chromatography systems are widely used to measure the ethylene produced by plants. Generally used for detection of lower ppm range.

Advantages of GC detection

- Requirement of small sample
- High selectivity
- Accessible at separating complex mixtures and compounds
- Fast analysis (minute time scale)
- Easy to operate (fully automated)
- Portable GCs available for measurement of field

Disadvantages of the GC detection

- Limited sensitivity
- Requirement of pre-concentration step for better sensitivity and optimized plant conditions.
- High costs.

2. Electrochemical sensing

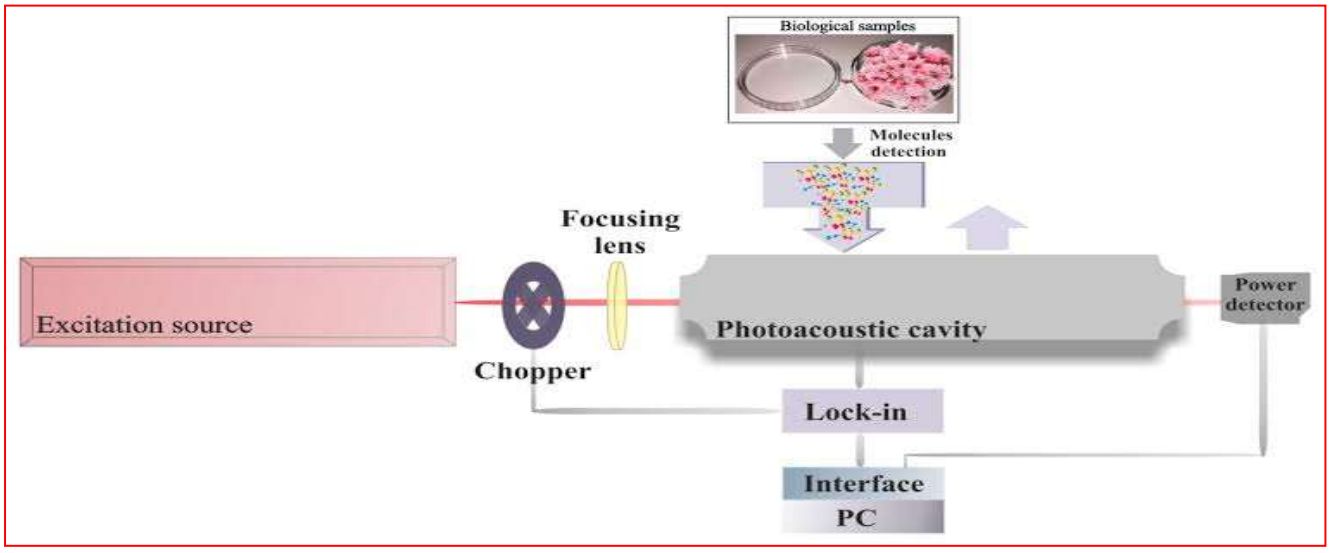
Sensing principle of electrochemical sensor of consist of two-step process-

- Ethylene from gas phase is dissolved into electrolyte
- Then, the dissolved ethylene undergoes an oxidation reaction at a noble metal electrode at required suitable potential.

Here, at the electrode-electrolyte interface the measured oxidation current is directly proportional to concentration of dissolved ethylene. Concentration of ethylene in the electrolyte is on its turn directly proportional to the concentration in the gas phase.

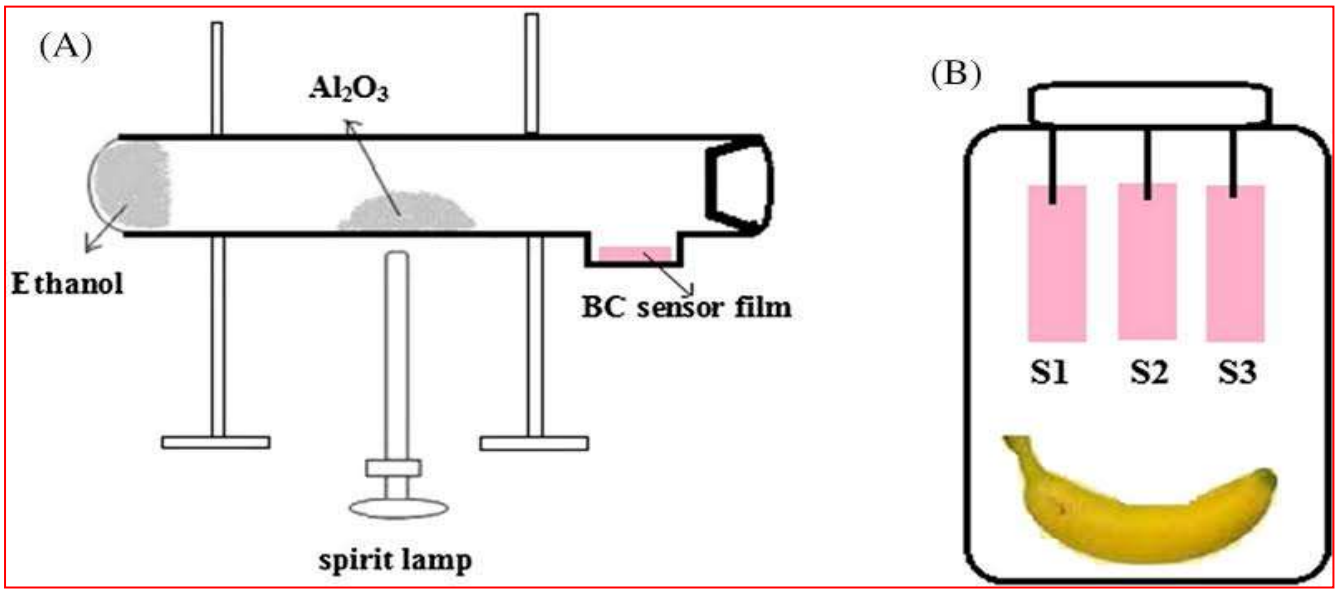
3. Photo acoustic spectroscopy detector

This system imparts the highest sensitivity values to ethylene gas. A laser beam (CO_2 laser) is polarized and chopped into a specific frequency. A specific gas compound absorbs the light at a specific wavelength- similar to NDIR spectroscopy depending on its chemical structure. Because of absorption, the gas in the measurement chamber is periodically heated according to the copping frequency. Pressure changes due to change



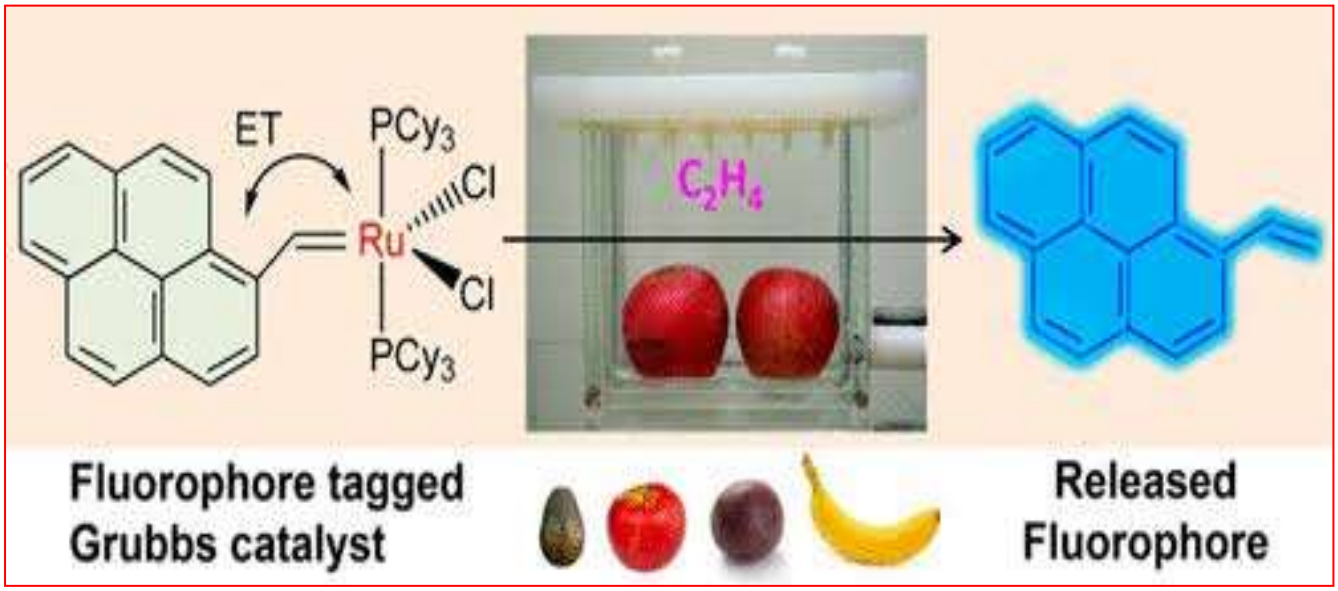
in temperature which can be measured with a microphone. Amplitude rises with the concentration of the specific gas component in the photoacoustic system.

4. Optical sensing



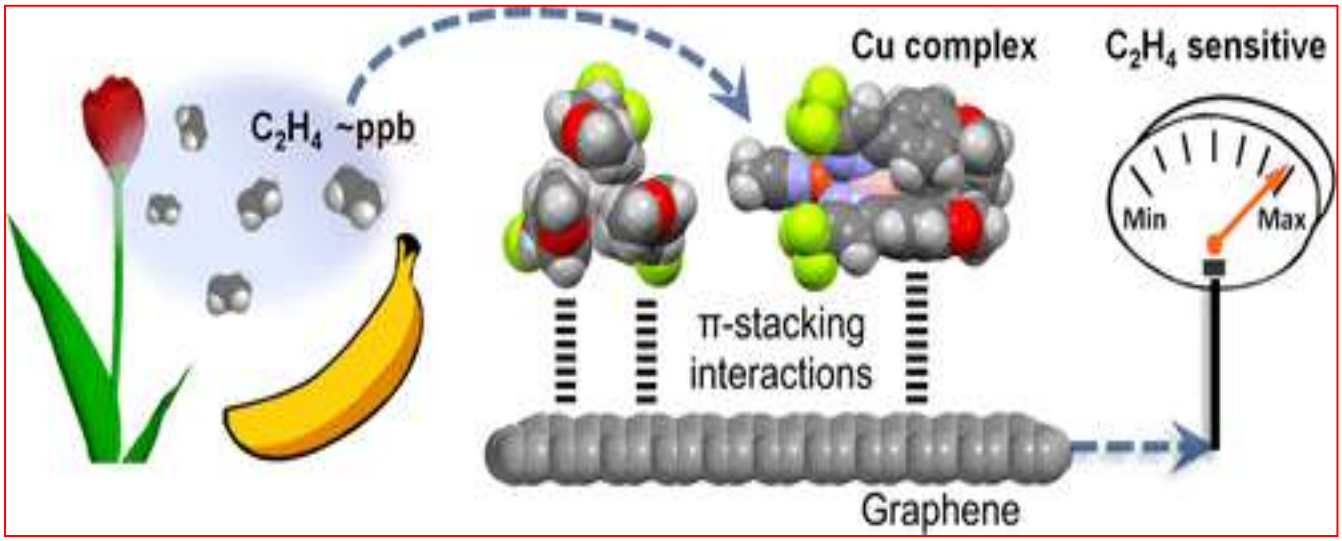
Molecular ethylene concentration can be quantified by knowing the absorption strength of ethylene at a specific IR light frequency. An optical sensor includes an appropriate light source (IR lamp or laser) that passes through an absorption cell containing required ethylene sample and reaches an optical detector that measures the light intensity.

5. Grubbs catalysts ethylene detector



Fluorescent probes developed by National University of Singapore provide suitable way to visually detect the presence of ethylene gas released during fruit ripening through a simple fluorescence microscope. Probes are developed from a class of transition metal carbine complexes known as Grubbs catalysts. It can detect ethylene up to level of 0.9 ppm in air.

6. Nanotechnology ethylene detector



Nanotechnology is an innovative and promising technology for affordable detection of ethylene. Based on the ethylene binding site, Carbon nanotubes 'doped' with copper used for detection of ethylene. When ethylene binds, the electrical properties of the nanotubes change.

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DEVELOP AND GROW KITCHEN GARDEN AT HOME

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"Kitchen garden near the house in empty space, where grown nutritious fruits herbs and vegetables. Kitchen garden provides fresh fruits and vegetables for the people healthy diet. They can also make your kitchen look vibrant. In kitchen garden Include plants that you plan to use in your cooking. Root and tuber rich in carbohydrate, legumes rich in protein, fruits and vegetables rich in vitamins and minerals and herbs rich in antioxidants. Kitchen garden Save the money and also help in some disease and disorder like malnutrition, anaemia, and constipation. Kitchen garden improves the environment."

Introduction

A kitchen garden is where grown nutritious fruits herbs and vegetables in empty space around the house. A kitchen garden contains plants that are grown to be eaten. Kitchen garden near the house is for quick and easy access to fresh herbs, fruits and vegetables for cooking. Kitchen garden apart from being healthy and sustainable, they can also make your

kitchen look vibrant. Kitchen garden provide fresh fruits and vegetables for the people healthy diet.

Healthy diet means pulses, cereals fruit and vegetables. Kitchen garden reduces the ratio of some disease and disorder like malnutrition, anaemia, and constipation. Kitchen garden fruits and vegetables more nutritious more than market food items. Because we grow organic fruits and vegetables with the help of natural compost use in our kitchen garden and in market food items grow through some medicine, pesticides and fertilizer. Kitchen garden helps in save your money.

Kitchen garden is very helpful for the poor people because they cannot afford market fruits and vegetables. Market fruits and vegetables are very costly compare to kitchen garden. It is helps us to solve our food problem, it provides basic nutrient in our diet. Kitchen garden is also one of the sources of earning money.

How to Develop a Kitchen Garden

- A kitchen garden should be in a sunny spot with a water source nearby and easy to access.
- Raised garden beds are an easy way to start your garden, since they are smaller and do not involve tilling. Raised beds can be made from cut wood or purchased as a kit from your local home improvement or garden store. Soil is added to the bed and should be replenished as needed.
- Amend the soil as necessary by adding compost or topsoil. Use a hand till to mix the dirt. If you're using a raised box or containers, the soil should be replaced or replenished to maximize the nutrients available for the plants.
- Take your climate and the growing season in your area into consideration when choosing vegetables.
- Include plants that you plan to use in your cooking. Kitchen garden ideas include tomatoes, chilies, snap peas, pumpkin, bottle gourds, beans, spices (coriander, turmeric,) garlic, cucumbers, lettuce and herbs.
- Perennial fruit trees and flowers can be used as border plants and will return each year.
- Consider the mature height and spread required for the different plants. Remember to leave room to access your plants for harvesting.
- Decide which plants may need a trellis and find the right spot for it.
- Determine how you will use plants and hardscape edging to define your garden space and design any pathways for your kitchen garden.

- Pay attention to plant spacing and timing, which will vary by plant. Plant the vegetables or flowers by digging holes with a plant spade that are wider than the root ball and just as deep. Fill dirt back into the hole around the plants and pat the soil down. Add mulch to protect the plants and keep moisture in.

  - Water the new plants immediately. Continue watering regularly, but do not over water.
- Harvest times will vary depending on the vegetables, the timing of plantings.

What shall we grow in kitchen garden?

1. **Roots and tubers (**potato, sweet potato) are the good sources of carbohydrate. It is grown in kitchen garden.
2. **Legumes** (chickpeas, soybeans) are a rich source of protein. Some also have vitamin E, fat and some minerals.
3. **Fruits and** vegetables (mango, banana, carrot, green leafy vegetables, pumpkin, beans,) rich in vitamins and minerals.
4. **Medicinal** plants (basil, ginger, aloe vera, curry leaves) rich in antioxidant, vitamins and minerals. These are very helpful in the treatment of common disease.

How to make the work easier in the Kitchen Garden

- Domestic waste water collection ash, water, hair, etc.
- Composting resources from the house to the land
- Seeds from the garden to house and from house to garden
- Sweepings from the house and courtyard
- Waste water used for irrigation in the kitchen garden
- Use of compost
- Liquid manure also used to control pests and disease
- Fodder from the land and live fence, and compost returned to the land
- Mulch material from the live fence and edges
- Vegetables etc. from the kitchen garden to the house

Benefits

- It helps in addressing malnutrition and micro nutrient deficiencies by consumption of fresh fruits and vegetables.
- Kitchen garden also improve environment.
- Organic garbage such as kitchen scraps can be processed into compost in such containers.
- Gardening is a natural a natural stress reliever.
- Save the money from purchasing grocery.

Conclusion

A kitchen garden is where grown nutritious fruits herbs and vegetables in empty space around the house. When make a kitchen garden some point to be consider in mind such as spot, soil, water sources and choose of the plant. It helps in addressing malnutrition and micro nutrient deficiencies by consumption of fresh fruits and vegetables. Kitchen garden also improve environment.

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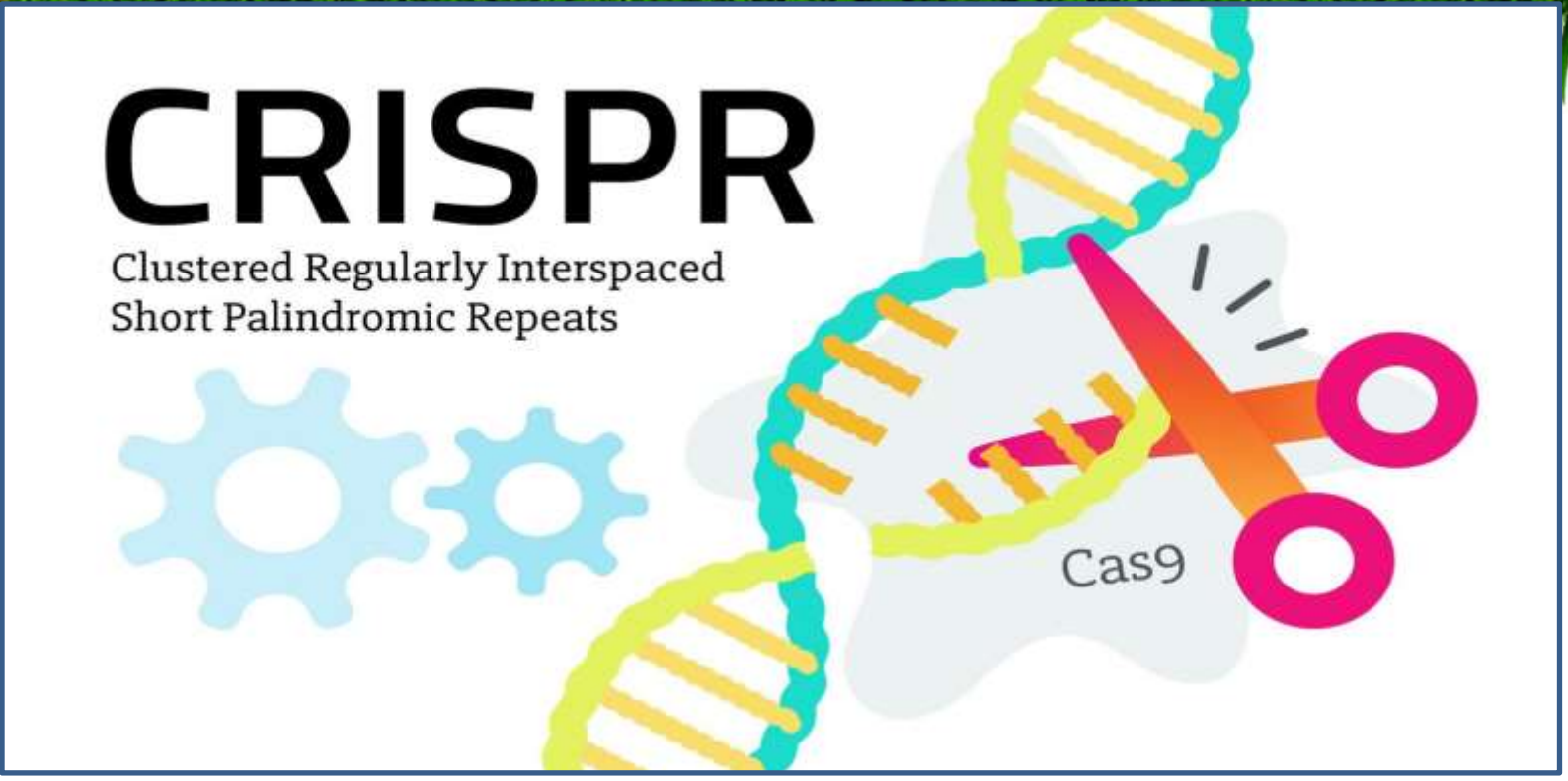

NEW WAY IN CROP IMPROVEMENT, GENOMIC SELECTION AND GENOME EDITING

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> "The coming years are likely to see continued innovations in molecular marker technology to make it more precise, productive and cost effective in order to investigate the underlying biology of various traits of interest. CRISPR technology has revolutionized the plant breeding and genetics and researchers are focusing on editing the genomes of all economically important plants."

Introduction

With the advancements in the field of genetic engineering, many techniques have been evolved to modify a single locus of a target organism. This dream comes true with the development of CRISPR (clustered regularly interspaced short palindromic repeat), a gene-editing technology. Genome editing has revolutionized plant breeding and has been applied successfully in different economically important crops. This technique facilitates the direct improvement of less favourable alleles into more favourable alleles. For the production of improved crop varieties, it is necessary to utilize genome selection and genome editing

collectively. Genome editing shortens the time when backcrossing is done between elite varieties and exotic germplasm. This exotic germplasm serves as the encyclopedia for the ancient alleles that are referenced for the development of modern varieties having resistance against biotic and abiotic stress.

For the recombination of alleles that are already adapted, GS is then applied. Genome editing (CRISPR). CRISPR is a genome-editing technique applied successfully in various plants. Cas9 is a recent advancement in the genome-editing technology and is becoming the technique of choice due to its many advantages, like its being easy to use, genome-editing versatility and ability to cleave methylated loci.

CRISPR RNAs and Cas protein are the two most important parts in the CRISPR technique. CRISPR RNA (crRNA) and trans-encoded CRISPR RNA (tracrRNA) are two short RNAs that can cleave a particular target site with the help of Cas9 endonuclease (the most explored Cas protein). sgRNA, known as single guide RNA, results when crRNA and tracrRNA are fused artificially. When sgRNA is combined with Cas protein, this leads to the formation of RNA-guided endonuclease that mediates the cleavage at a particular sequence in the genome.

Types of CRISPR

On the basis of this Cas protein, the CRISPR–Cas system is grouped into three types; I, II and III. Cas1 and Cas2 are two different proteins which are commonly present in all three types. Type I is present in both archaea and bacteria, while type II is only present in bacteria; however, type III is most commonly present in archaea but also in some bacteria. Genome editing has been performed successfully in model plants like Nicotiana tabacum, Arabidopsis and some economically important crops like maize and wheat.

Use of CRISPR

Mechanism Acquisition, expression and interference are the three steps which are used by the CRISPR-Cas system to identify and target the pathogen genetic material. Identification and consolidation of foreign DNA is performed within the CASPR locus as a spacer during acquisition. During the acquisition of DNA fragments, a Protospacer having a short stretch (2–5) of conserved nucleotides (PAMs) is used as the identification motif. The AT (adenine–thymine) leader side of the CRISPR array, a 30-bp single copy of spacer is inserted and duplicated.

During the expression step, a long pre-crRNA is transcribed from the CRISPR locus, while tracrRNA and Cas proteins (Cas1, Cas2, Cas9 and Cas4/Casn2) are applied for its processing into crRNAs. The Cas protein complex is guided towards the particular target

area of foreign DNA by crRNA for cleavage during the interference step, thus facilitating the immunity against the attack of pathogens.

Conclusion

CRISPR technology has revolutionized the plant breeding and genetics and researchers are focusing on editing the genomes of all economically important plants. The coming years are likely to see continued innovations in molecular marker technology to make it more precise, productive and cost effective in order to investigate the underlying biology of various traits of interest. The global population continues to rise, as does the likelihood of reduced yields of major food crops due to the changing climate, thus making the development of genetically improved, crops a research priority. The convergence of low-cost genome sequencing with improved computational power and high-throughput molecular phenotyping technologies has accelerated the identification of genes underlying important agronomic traits relevant to food production and quality. Deployment of these products from the laboratory to the field remains hindered by biological and regulatory bottlenecks that require further development.

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