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CONTENTS

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VOLUME 3 ISSUE 5 MAY, 2023

SOIL CONTAMINATION AND ITS PRECLUSION THROUGH MICROORGANISMS

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ABSTRACT

Uncontrolled usage of chemical fertilizers will eventually cause the soil to lose its natural fertility, turning it into a wasteland and generating soil pollution. Pesticides, insecticides, herbicides, etc., operate in the similar manner. Microorganisms act as "natural soil engineers," crucial in soil formation and ecology. Microorganisms can be employed to degrade dangerous chemicals; they break down dead and decaying plant and animal materials into simpler components that other plants and animals then consume. They control the flow of nutrients to plants, support nitrogen fixation, and ultimately encourage the detoxification of naturally occurring inorganic and organic pollutants in soil and finally help to clean up the environment.

INTRODUCTION

The concentration of any metal or chemical in the soil or atmosphere exceeds normal, it is called pollution. Most land pollution is spreading from industrial units. In this context, chemical fertilizers and sugar factories, textile manufacturing units, graphite, thermal power plants, cement factories, soap and oil factories, metal manufacturing plants, and other factories release chemicals and gases in large quantities that affect animals, organisms, plants, soil, etc. The use of unbalanced chemical fertilizers and other agricultural chemicals (insecticides, weedicides, etc.) and the release of chemicals and other heavy metals under various industrial activities are causing serious adverse effects on the health of the soil and environment. Growing crops, vegetables, fruits, etc. in contaminated soil, the plants absorb more heavy metals than at the normal level. These harmful pollutants enter the human body through the food chain. Soil pollution affects soil organisms and soil organic matter.

MAJOR CAUSES OF SOIL POLLUTANTS

Soil pollution can have various causes, including:

1. *INDUSTRIAL ACTIVITIES:* Chemical spills, dumping of hazardous waste, and inappropriate disposal of industrial waste can contaminate soil.
2. *AGRICULTURAL PRACTICES:* Using pesticides, herbicides, and fertilizers can lead to soil pollution. These chemicals can accumulate in the soil over time, harming human health and the environment.
3. *LANDFILLS:* Improper disposal of household and municipal waste in landfills can release toxic substances into the soil.
4. *MINING:* Mining activities can disturb the soil and release heavy metals and other pollutants.
5. *CONSTRUCTION ACTIVITIES:* Construction activities, such as demolition and excavation, can release chemicals and pollutants into the soil.
6. *TRANSPORTATION:* Vehicle emissions from cars and trucks can lead to the deposition of pollutants onto the soil.
7. *OIL SPILLS:* Oil spills can contaminate soil, making it unsuitable for plant growth and other uses.

Overall, soil pollution can have significant environmental and health impacts and requires measures to prevent and remediate contaminated sites.

A view of contaminated field

ROLE OF MICROORGANISMS IN THE REMOVAL OF SOIL CONTAMINATION

Microorganisms play a crucial role in the removal of soil contaminants through a process known as bioremediation. Bioremediation uses microorganisms to break down and degrade pollutants in soil, water,

and other environments. Microorganisms, such as bacteria and fungi, can transform contaminants into less harmful forms or even completely mineralize them into non-toxic substances. They do this by using the pollutants as a source of energy and carbon, breaking down the chemical structure of the contaminant through a range of biochemical pathways.

Table 1: Major Soil pollutants with their sources and toxic effect on human health

S.NO.	Major soil pollutant	Source	Toxic effects on human health
1.	Lead	Paint, food grains, vehicle smoke, agricultural chemicals, etc.	Effects on the nervous system, memory and general development
2.	Mercury	Food grains, processing, storage and medical sources of plants, vegetables and other food grains	• Burning, pain, side effects on brain and kidney • high blood pressure • Loss of hair, teeth, nails, etc.
3.	Arsenic	Coal mines, power industry, agrochemical etc.	Cancers related to the kidney, gall bladder, tongue, etc., Poor digestion, diarrhoea, etc.,
4.	Other metals (Manganese, Cadmium, Copper, Zinc, Nickel, etc.)	Food grains, chemical fertilizers, industrial waste etc.	Different effects of different metals
5.	Polyaromatic Hydrocarbons	From coal mines, vehicle exhaust, accumulation in plants and vegetables, burning of crop waste, wood etc.	• Effects on the skin • Eye irritation • Adverse effects on kidney and liver • Cancer in the skin, tongue, gall bladder etc. • Skin-related diseases etc.

The use of microorganisms in bioremediation can be natural or enhanced. In natural bioremediation, indigenous microorganisms present in the soil are stimulated to degrade the contaminants. In enhanced bioremediation, specific microorganisms are introduced into the contaminated soil to accelerate the degradation process.

Microorganisms have been successfully used in the bioremediation of various soil contaminants, including petroleum hydrocarbons, heavy metals, pesticides, and chlorinated solvents. However, the effectiveness of bioremediation depends on several factors, such as the type and concentration of the contaminant, the microbial community present in the soil, and environmental factors, such as temperature, pH, and nutrient availability.

MANAGEMENT OF SOIL MICROORGANISMS FOR REMOVAL OF SOIL CONTAMINATION

There are several strategies for managing soil microorganisms to enhance the removal of soil contaminants through bioremediation. Here are some common approaches:

1. *NUTRIENT MANAGEMENT:* Microorganisms require nutrients to thrive and carry out bioremediation. Adding nutrients such as nitrogen, phosphorus, and carbon to the soil can enhance the growth and activity of microorganisms. This can be done by adding organic amendments, such as compost, manure, or inorganic fertilizers.
2. *BIOAUGMENTATION:* Bioaugmentation involves the addition of specific microbial strains that are known to degrade the target contaminant. This approach can be effective when the indigenous microbial community is not well-suited to degrade the contaminant.
3. *BIOSTIMULATION:* Biostimulation involves the addition of substances that stimulate the growth and activity of indigenous microorganisms without adding specific strains. Common biostimulants include oxygen, electron donors, and surfactants that help to solubilize contaminants.
4. *PHYTOREMEDIATION:* Phytoremediation is the use of plants to enhance bioremediation by stimulating the growth and activity of microorganisms in the root zone. Plants can release organic compounds through their roots that can serve as a food source for microorganisms or absorb and translocate contaminants, making them available for microbial degradation.
5. *MONITORING:* Monitoring is an important aspect of bioremediation management to assess the approach's effectiveness and adjustment as needed. Monitoring can involve measuring contaminant concentrations, microbial populations, and soil properties such as pH and nutrient availability.

Overall, managing soil microorganisms for bioremediation requires carefully assessing the site conditions and selecting an appropriate approach based on the soil's contaminant and microbial community.

CONCLUSION

Uncontrolled usage of chemical fertilizers will eventually cause the soil to lose its natural fertility, turning it into a wasteland and generating soil pollution. Pesticides, insecticides, herbicides, etc., operate in the similar manner. Microorganisms act as "natural soil engineers," crucial in soil formation and ecology. Microorganisms can be employed to degrade dangerous chemicals; they break down dead and decaying plant and animal materials into simpler components that other plants and animals then consume. They control the flow of nutrients to plants, support nitrogen fixation, and ultimately encourage the detoxification of naturally occurring inorganic and organic pollutants in soil and finally help to clean up the environment.

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VOLUME 3 ISSUE 5 MAY, 2023

SMART FARMING WITH SOIL MOISTURE SENSORS: SIMPLIFYING PRECISION AGRICULTURE

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ABSTRACT

Precision agriculture uses soil moisture sensors to optimize watering practices and crop yield. While various types of soil moisture monitoring sensors are available, modern satellite sensors are particularly valuable because they can remotely track ground moisture levels without needing installation. This type of sensor provides data that can inform decisions in many areas of precision agriculture and related industries. With the information provided by satellite sensors, farmers can make informed decisions about when to irrigate, how much water to use, and where to focus their efforts to improve crop yield. Overall, using satellite sensors for soil moisture monitoring is an important tool for enhancing the efficiency and productivity of modern agriculture.

INTRODUCTION

A soil moisture sensor is a device that measures the amount of moisture in the soil. Integrating this tool in the irrigation system allows for more precise watering scheduling than is possible with historical data or weather forecasts. Conventional approaches to irrigation have limitations that farmers must consider. Relying on historical data alone can be risky as it doesn't account for unexpected weather changes. On the other hand, planning irrigation based on projected crop evapotranspiration requires complex calculations unique to each field's conditions.

Modern soil moisture measurement sensors provide more precise and timely data. These sensors can display results in near real-time, allowing farmers to adjust their watering schedule effortlessly for optimal crop development. Farmers can avoid over or under-watering by monitoring soil moisture levels, which can significantly impact crop yields. Overwatering can lead to water wastage and lower crop yields, while under-watering can harm crops, resulting in reduced yields or even crop failure. Farmers can optimize their irrigation practices and promote sustainable agriculture by using soil moisture sensors. Soil moisture sensor is an essential tool for modern agriculture, allowing for more precise and efficient watering

scheduling. These sensors provide farmers with real-time data, enabling them to make informed decisions about their irrigation practices and optimize crop yields.

Types of Soil Moisture Sensors

Soil moisture sensors are an essential component of smart farming, and they continue to evolve to become more user-friendly. Today's smart soil moisture sensors can transmit data wirelessly, be deployed at varying depths, and upload readings directly to a GIS database, eliminating the need for manual data collection. Portable soil moisture sensors are also available, which can collect data from any area and depth compared to stationary sensors. soil moisture sensors have undergone significant advancements, and their different types allow for greater flexibility and precision in measuring soil moisture levels. The integration of these sensors into smart farming practices can help farmers optimize irrigation practices, reduce water waste, and promote sustainable agriculture.

There are two types of soil moisture sensors based on underlying technology:

- **Ground sensors** are installed below the ground to monitor the root zone conditions.
- **Satellite sensors** estimate the situation from space, do not interfere with field activities, save costs, and do not require labour-consuming installations.

GROUND SENSORS

VOLUMETRIC SOIL MOISTURE SENSOR

A volumetric soil moisture sensor is a device that measures the amount of water in the soil, expressed as a percentage of the soil's volume. These sensors are designed to provide accurate and reliable data on the moisture content of the soil, which is a critical factor in plant growth and health.

Volumetric soil moisture sensors work by using time-domain reflectometry (TDR) or capacitance technology. TDR sensors send a high-frequency pulse through the soil, and the time it takes for the pulse to bounce back is used to determine the moisture content. Capacitance sensors use two electrodes to measure the electrical conductivity of the soil, which is proportional to the moisture content. One of the main advantages of volumetric soil moisture sensors is their ability to measure moisture content at different depths within the soil. This information is critical for farmers and agriculturalists to make informed decisions about irrigation, fertilization, and other aspects of plant management. Additionally, volumetric soil moisture sensors can provide continuous monitoring, allowing for real-time adjustments to be made in response to changing soil conditions.

NEUTRON PROBE

A neutron probe is a type of soil moisture sensor that measures soil moisture levels by detecting the amount of hydrogen in the soil. The probe works by emitting a beam of neutrons into the soil, and the neutrons interact with the hydrogen atoms in the soil. The number of neutrons that are slowed down by the hydrogen atoms is measured, and this information is used to calculate the soil moisture content.

Neutron probes are considered one of the most accurate methods of measuring soil moisture levels. They can provide precise data about moisture content at different depths within the soil, making them an essential tool for farmers and agriculturalists who need to optimize irrigation practices and ensure the health and productivity of crops.

While neutron probes are highly accurate, they are expensive and require specialized training. In addition, the use of radioactive isotopes in the probe requires strict safety protocols and regulations.

Despite these drawbacks, neutron probes remain valuable in precision agriculture, particularly for research purposes where high accuracy is necessary. By providing precise and detailed information about soil moisture levels, neutron probes can help farmers make informed decisions about irrigation and other crop management practices, leading to increased yields and more sustainable agricultural practices.

ELECTROMAGNETIC SENSORS

Electromagnetic sensors have become an increasingly popular alternative to neutron probes for measuring soil moisture levels since the late 1980s. Various types of electromagnetic sensors are available, but two of the most common types are capacitance or frequency-domain refractometry (FDR) sensors and time-domain reflectometry (TDR) sensors.

Capacitance or FDR sensors work by generating an electromagnetic signal that is sent into the soil. The signal is then reflected back to the sensor, and the frequency shift between the outgoing and reflected waves is analyzed to determine soil moisture content.

TDR sensors, on the other hand, use voltage on parallel rods to create pulses that are reflected back to the device for analysis. The soil moisture content can be calculated by measuring the time it takes for the pulse to return to the device.

Another type of electromagnetic sensor is transmissometry sensors in the time domain (TDT). These sensors operate on the same principle as TDRs but use a closed circuit with the rods connected in a loop. As a result, the speed of the returned pulse will be lower in damp ground than in dry ground, allowing for soil moisture levels to be measured.

Electromagnetic sensors offer several advantages over neutron probes, including lower costs, easier operation, and the ability to measure soil moisture levels at different depths. While they may not be as accurate as neutron probes, they are still valuable in precision agriculture and can help farmers optimize irrigation practices and improve crop yields.

SOIL WATER TENSION SENSORS

Soil water tension sensors, also known as tensiometers, are another type of instrument used to measure soil moisture levels. These sensors measure the tension or suction force required to extract water from the soil and are widely used in precision agriculture to optimize irrigation practices and improve crop yields.

Tensiometers consist of a hollow ceramic tip, which is inserted into the soil, and a vacuum gauge or pressure transducer, which measures the tension or suction force required to extract water from the soil. As the soil dries out, the tension or suction force required to extract water increases, and the tensiometer provides a corresponding reading.

One of the advantages of soil water tension sensors is their ability to measure the available water content of the soil, which is the amount of water that can be extracted from the soil at a certain tension level. This information can be used to optimize irrigation practices and ensure that crops are not over or under-watered. Another advantage of tensiometers is their low cost and ease of use. They require minimal maintenance and can be left in the soil for extended periods without the need for recalibration.

However, one potential disadvantage of soil water tension sensors is that they may not be suitable for all soil types. For example, soils with high clay content or high levels of organic matter may cause the sensor to become clogged, affecting its accuracy. Soil water tension sensors are a valuable tool in precision agriculture and can help farmers make more informed decisions about irrigation practices to improve crop yields while minimizing water usage.

SATELLITE SOIL MOISTURE SENSORS

Satellite-based soil moisture sensors have become an indispensable tool for farmers and researchers who need to monitor and manage soil moisture levels promptly and accurately. These sensors can analyze infrared (IR) emissions from the Earth's surface, allowing them to provide highly precise measurements of soil moisture content.

One of the key advantages of satellite remote soil moisture sensors is their ability to operate at a large scale. Unlike traditional soil moisture sensors, which need to be physically installed in the ground, satellite sensors can survey expansive regions of land from above. This makes them ideal for monitoring soil moisture levels in remote areas or regions with difficult terrain where installing sensors would be too time-consuming or difficult.

Satellite remote soil moisture sensors are also highly accurate, providing real-time data on soil moisture levels. This data can be used in conjunction with satellite photography to create detailed field maps showing moisture distribution across different land zones. Farmers can use this information to identify areas of their fields that may be experiencing water stress and respond appropriately to ensure optimal crop growth.

In addition to monitoring soil moisture levels, satellite remote sensors can provide information on other factors affecting crop growth, such as temperature, precipitation, and vegetation health. This information can be used to make informed decisions about irrigation schedules, crop selection, and other important farming practices.

Overall, satellite remote soil moisture sensors are valuable for anyone involved in agriculture, environmental monitoring, or land management. They provide accurate and timely data on soil moisture levels and other important factors that can help optimize crop growth and ensure the sustainable use of natural resources.

MONITORING SOIL MOISTURE FROM ABOVE: PRINCIPLES OF SATELLITE-BASED SENSORS FOR PRECISION AGRICULTURE

The basic principle behind satellite-based soil moisture estimation is that the amount of moisture in the soil affects the dielectric constant of the soil. The dielectric constant is a measure of a material's ability to store electrical energy in an electric field. The higher the moisture content, the higher the dielectric constant.

When a microwave signal is transmitted from a satellite to the Earth's surface, it interacts with the soil and is partially absorbed and partially reflected back to the satellite. The amount of reflection depends on the dielectric constant of the soil, which in turn depends on the soil moisture content.

Microwave radiometers or SAR sensors on board the satellite measure the strength of the reflected signal, which can be used to estimate the soil moisture content. This estimation is based on empirical relationships between the microwave signal and the soil moisture content that have been developed through field measurements and modelling.

To obtain accurate soil moisture estimates, satellite-based soil moisture estimation algorithms also take into account other factors that can affect signal strength, such as vegetation cover, topography, and surface roughness. In addition, these algorithms use machine learning techniques to analyze satellite data and separate the signal from noise and other factors.

Satellite-based soil moisture estimation tool monitor and manage soil moisture levels over large areas, which can help farmers make more informed decisions about irrigation, crop selection, and water resource management. The concept is based on the relationship between the dielectric constant of the soil and the strength of the microwave signal reflected from the soil, which can be used to estimate soil moisture content.

PRECISION IRRIGATION AND OTHER APPLICATIONS OF SOIL MOISTURE SENSORS IN PRECISION FARMING

Throughout the growing season, the conditions of the land undergo various changes that can significantly affect crop growth and yield. In the past, farmers would have to scout their fields and collect soil samples to analyze the soil's water and ground conditions. This process could take several weeks as samples must be sent to laboratories for analysis. However, with modern soil moisture sensors, farmers can now quickly respond to changes in field conditions.

Soil moisture sensors allow farmers to monitor specific areas of the field and adapt their irrigation scheduling strategies based on evapotranspiration loss and plant response to water stress. This approach has been shown to be the most straightforward and effective method for optimizing irrigation practices. By incorporating soil moisture sensor data, weather information, and crop history, growers and landowners can obtain valuable insights to enhance their precision agriculture practices.

One of the most crucial applications of soil moisture sensors in agriculture is tracking moisture levels near plant roots to reduce wasteful water use. This leads to increased crop yields, reduced water consumption, protection of local waters from depletion, and lower energy and fertilizer costs. All these benefits result in higher farmer profits.

Soil moisture sensors also play a crucial role in other areas of precision agriculture, such as greenhouse monitoring and control, fertigation management, analyses of water balance, classification of watersheds, predicting crop disease spread, plant (phyto) ecology, soil solarization, and assessing soil health, among others. Soil moisture sensors are a valuable tool for modern agriculture, enabling farmers to obtain accurate and real-time information on soil moisture levels. This information can be used to optimize irrigation practices, reduce water wastage, and improve

crop yields while minimizing environmental impact. Farmers can achieve more precise and efficient farming practices by utilizing soil moisture sensors, leading to greater profitability and sustainability.

REMOTE SENSING-BASED CROP MONITORING ENHANCES PRECISE SOIL MOISTURE ESTIMATION

Remote sensing-based crop monitoring can be a useful tool for precise soil moisture estimation as it allows for the collection of data on crop growth and development, as well as environmental conditions, over large areas and with high temporal resolution.

Through remote sensing techniques, such as satellite imagery, it is possible to obtain information on the vegetation index (VI) of crops, which is a measure of the vegetation's health and growth. The VI can then be used to estimate the crop's water use and its water stress, which can be linked to soil moisture levels.

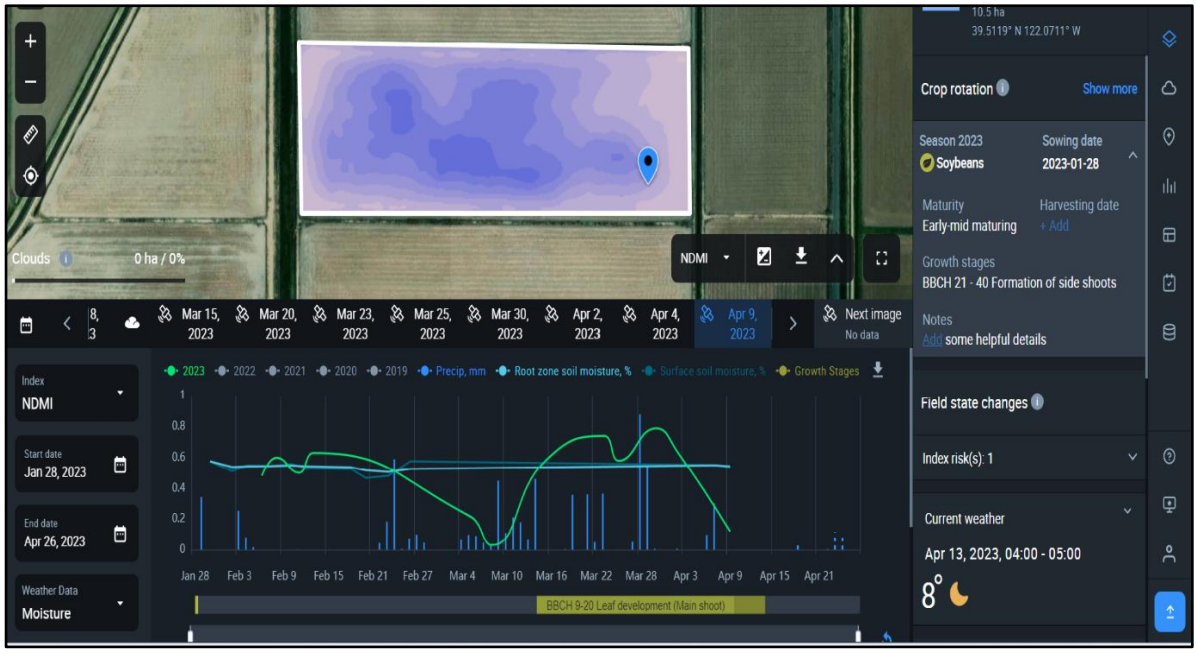

Figure 1. Graphs of seasonal surface and root zone soil moisture in remote sensing-based crop monitoring.

Remote sensing can also provide data on weather and climate conditions that can influence soil moisture levels. This data can include rainfall, temperature, and humidity, which can be used to estimate soil moisture through various models and algorithms. by combining data on crop growth and development with environmental conditions, remote sensing-based crop monitoring can provide precise soil moisture estimation, allowing for more accurate management decisions regarding irrigation, fertilizer application, and other agricultural practices.

Remote sensing-based crop monitoring platforms, such as **CropX**, **FieldView**, **EOS Crop Monitoring**, **AgriTask**, **TerrAvion** can estimate soil moisture levels at two different depths, which are both crucial for decision-making in agriculture. These depths are the soil surface (0-5 cm or 0-2 inches) and the root zone/rhizome (up to 70 cm or 27.5 inches).

One of the platform's main advantages is its ability to mine satellite data for patterns and trends, providing valuable insights into crop yields, precipitation totals, and vegetation indices. Furthermore, this information is compiled into a single graph, giving users a comprehensive view of the data in one place.

Crop Monitoring displays the data in the following sequence: vegetation, root zone moisture, and soil surface moisture, allowing users to easily analyze and understand the relationship between vegetation growth and soil moisture levels (**Figure 1**).

CONCLUSION

In conclusion, integrating soil moisture sensors with satellite imagery has revolutionized precision agriculture. The ability to obtain real-time data on soil moisture levels through sensors and the availability of high-resolution satellite imagery has informed farmers' decision-making. In addition, the use of satellites such as soil moisture and ocean salinity (SMOS), soil moisture active passive (SMAP), and geostationary operational environmental satellite (GOES) has provided a global perspective on soil moisture levels, which has greatly enhanced the management of agricultural practices. The combination of ground-based and satellite-based data has allowed for a comprehensive picture of crop health and growth, enabling farmers to make optimal management decisions for irrigation, fertilization, and other practices. As technology continues to advance, more sophisticated sensors and satellite missions are expected to emerge, further improving the capability to monitor and manage soil moisture levels for increased crop yields.

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CHALLENGES IN INDIAN POULTRY INDUSTRY

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ABSTRACT

The poultry industry in India is ever-expanding and contributes significantly to food security and the nation's economy. However, this industry is facing continuous challenges that hamper the significant growth of this sector. Some of these challenges include mortality due to infectious, nutritional, and managemental issues; the lack of proper government policies and support; the lesser availability and poor quality of feed; and the non-adherence to strict biosecurity measures. To meet consumer demand for poultry products and maintain sustainable agriculture, veterinarians, farmers, and all the other partners in the poultry production chain need to be more active in the current situation and the strategic future of the industry.

INTRODUCTION TO THE INDIAN POULTRY INDUSTRY

The Indian poultry industry refers to the domestication, breeding, and commercial production of poultryproducts, including meat and eggs. Poultry farming, introduced in India during the 1960s, has significantly contributed to the country's agricultural economy. Most poultry farms in India are small-scale family businesses that operate at a local level. The industry has witnessed significant growthin the past few decades, with India becoming one of the world's largest producers of poultry products. However, despite its growth, the Indian poultry industry faces several challenges that have limitedits potential for further expansion. This essay will explore some of the key challenges facing the Indian poultry industry today.

HIGH MORTALITY RATES: THE PRIMARY CHALLENGE

High mortality rates among poultry birds pose the primary challenge to the Indian poultry industry. India's poultry industry has been booming, ranking the country the fifth largest producer of poultry products globally. However, bird mortality remains a significant issue, hampering the industry's growth and sustainability. Two of the primary reasons behind the high mortality rate are diseases and poor management practices. Poultry birds in India are highly susceptible to various diseases, including avian influenza and Newcastle disease, leading to massive losses in the industry. Moreover, the lack of infrastructure and

technology and insufficient training among poultry farmers lead to inappropriate management, further aggravating the mortality rates. These challenges require a concerted effort fromboth government and private institutions to address the health and welfare of poultry birds, support theimplementation of proper management practices, and improve the overall condition of the industry.

LACK OF PROPER GOVERNMENT POLICIES AND SUPPORT

Another challenge in the Indian poultry industry is the lack of proper government policies and support. While the government has implemented some policies regarding animal welfare and food safety, they have not been consistent or comprehensive enough to support the growth and development of the poultryindustry. In addition, a lack of funding, research and development, and infrastructure support has hindered the industry's progress. This lack of support has forced many small and medium-sized poultry farmers to operate with outdated equipment and technology, increasing the risk of disease outbreaks and reducing their overall efficiency. Without proper government policies and support, the Indian poultry industry will struggle to compete with other countries in terms of productivity and quality.

COMPETITION FROM SUBSTITUTE PRODUCTS

Competition from substitute products is another significant challenge faced by the Indian poultry industry.The increasing popularity of vegetarianism and veganism and concerns over antibiotics in poultry farming have increased the demand for plant-based protein alternatives. As a result, products like tofu, pea protein, and seitan are becoming increasingly popular in India, and the poultry industry needs to recognize this shift in consumer preference. Additionally, there is a growing demand for meatalternatives like plant-based burgers and sausages, which offer a similar taste and texture to meat and areconsidered a healthier and more environmentally friendly option. The poultry industry must be responsiveto these changing consumer demands and explore ways to adapt and diversify its product offerings to remain competitive.

ISSUES WITH FEED AVAILABILITY AND QUALITY

One of the major challenges faced by the Indian poultry industry is the issue of feed availability and quality. The sector largely depends on external sources for procuring feed ingredients such as maize, soybean, and fishmeal. This makes the industry vulnerable to price fluctuations in the international market and supply chain disruptions. In addition, there are concerns regarding the quality offeed, especially in terms of aflatoxin contamination. The lack of proper storage facilities and inadequatetesting procedures lead to high levels of contamination, thereby impacting the health and productivity ofthe birds. Furthermore, the high prevalence of adulteration in the feed market exacerbates the problem andposes a great risk to the industry's sustainability. Therefore, there is an urgent need for the government and private stakeholders to

invest in feed processing and storage infrastructure, promote research for indigenous feed ingredients, and establish stringent enforcement mechanisms to ensure quality control.

OUTBREAKS OF AVIAN INFLUENZA: A PERSISTENT CONCERN

Outbreaks of avian influenza have been a persistent concern for the Indian poultry industry. The H5N1 virus was first detected in India in 2006, and since then, numerous outbreaks have been reported in various parts of the country. These outbreaks have resulted in the culling of millions of birds, causing significant economic losses to the industry. Moreover, avian influenza also threatens human health, as it can be transmitted to humans through close contact with infected birds. Therefore, the Indian government has implemented various measures to control the spread of avian influenza, such as monitoring and surveillance of bird populations, vaccination of birds, and biosecurity measures in poultryfarms. However, despite these efforts, the outbreak of avian influenza remains a challenge for the Indianpoultry industry, and continuous vigilance and preparedness are necessary to mitigate its impact on bothanimal and human health.

DIFFICULTIES IN MAINTAINING PROPER BIOSECURITY MEASURES

Another major challenge faced by the Indian poultry industry is the difficulty in maintaining proper biosecurity measures. Infectious diseases can spread quickly in poultry farms, and proper biosecurity protocols play a critical role in preventing disease outbreaks. However, many small-scale farms lack the necessary resources and knowledge to implement effective biosecurity measures, and infrastructure and resources are often inadequate. Furthermore, the illegal transport of poultry and informal trade practices also pose a significant risk for spreading diseases. Vaccination programs are essential in mitigating the risks

of disease outbreaks, but there are issues with the availability and affordability of vaccines, making them inaccessible to many farmers. These challenges highlight the importance of developing robust biosecurity measures in the Indian poultry industry to prevent the spread of disease and ensure thesafety of both poultry and consumers.

THE NEED FOR INNOVATIVE SOLUTIONS: FUTURE OUTLOOK

With the rising demand for poultry products, high feed prices, and fluctuating market prices, it is crucial to find innovative solutions to address these challenges. Using novel feed ingredients, modern equipment, and advanced management practices can help mitigatethe negative effects of these factors on the poultry industry. Furthermore, diversification into value-added products such as ready-to-eat meals and processed chicken products can create additional revenue and reduce dependence on live bird sales.

CONCLUSION

The Indian poultry industry must strive towards innovation and technological advancements to ensure a sustainable future outlook. Therefore, veterinarians, farmers, and all other partners engaged in the chain of the poultry industry should increase their cooperation. By embracing innovation and exploring new opportunities, the Indian poultry industry can continue to grow and remain competitive in the global market.

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EGG FRUIT: AN UNTAPPED EXOTIC FRUIT

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ABSTRACT

Canistel fruit is one of the neglected fruits in terms of processing and commercialization. Canistel fruit is a rich source of β-carotene and niacin. It also contains good amount of calcium, iron, protein, fibre and vitamin C. The climacteric and perishable nature of the fruit makes post-harvest management and transportation difficult, leading to its restriction in native for traditional uses. Encouraging the production of this fruit provides the scope for pharmaceutical and nutraceutical utilization. Therefore, the nutritional and therapeutic importance and the development of processing methods need to be done for maximum utilization of canistel fruit in different sectors such as dairy, confectionaries, bakery and medicine.

INTRODUCTION

Pouteria campechiana Baehni, also known as Canistel or Yellow sapote, belongs to the Sapotaceae family. It is native to Mexico and Central America. The word sapote is derived from the Nahuatl language 'tzapotl' or 'tezontzapotl', a general term applied to all fruit that is soft in texture and sweet in taste. It's a tropical tree having the potential as a commercial crop in tropical and subtropical regions. It is consumed highly in Mexico, Central and South American parts because of its pleasant taste. This plant can also be found in Kenya, Tanzania, Uganda, Egypt, Sri Lanka, India, Thailand, Cambodia, Vietnam, Malaysia, and Indonesia. It is most commonly compared to the texture of a hard-boiled egg and hence the common name Egg fruit. Despite being palatable when eaten fresh or after processing, the fruit is not frequently consumed and is still underutilized. It grows in Maharashtra throughout the Western Ghats, Kerala, limited parts of Tamil Nadu and Karnataka. Egg fruit season in India is June through July and extends up to December. It requires hot, tropical lowlands with moderate to high rainfall, also suited to seasonal dry spells and diverse soil types.

Trees are lactiferous, can reach a height of 12 m, and are propagated by seed or grafting. Though the size and shape of this fruit can vary greatly from one tree to another, the most favourable trees produce large, sweet, yellow fruits with an oval shape. Fruit production begins 3–4 years after grafting and 5–7 years after seed. Fruits are picked three to four days before they are fully ripe when 5 to 8 cm long and 3 to

5 cm in diameter. The unripe fruit is green, while the ripe fruit's skin is yellow-orange and quite delicate. The eggfruit contains one to six large, brown seeds. Because of its productivity, adaptability, and nutrient content, the species has the potential for commercial production. In addition, due to its fast-growing nature, eggfruit trees are ideal candidates for container culture.

Egg fruit tree with fruits

Ripe Egg fruit

On the other hand, processing any fruit is the widely used technique to make it available for human consumption. Fruits are subjected to various processes and treatments to develop products that can be preserved and exported beyond the geographical and seasonal barriers. Some fruits are wild, semi-domesticated or adopted locally, which are richer in nutrients, minerals and antioxidants compared to common commercial fruit crops. These types of fruits are traditionally used for centuries but less commercialized when more productive crops are cultivated. One of those fruits is Canistel or Egg fruit which has a hard-boiled egg yolk-like texture and sweet taste similar to boiled sweet potato (Kanak and Bahar, 2018).

NUTRITIONAL VALUE

Canistel fruit is a rich source of β-carotene and niacin. It also contains a good amount of calcium, iron, protein, fibre and vitamin C.

Including egg fruit in the diet can lower the risk of diabetes and regulates blood sugar level. It also helps reduce LDL (low-density lipoprotein i.e. bad cholesterol) and detoxifies the body. Studies have shown that egg fruit could be the best treatment for osteoarthritis as niacin

Nutritional value per 100g of fresh pulp	
Principle	**Nutritive value**
Protein	1.16%
Moisture	52.96%
Fibre	2.12%
Fat	4.97%
Carbohydrates	40.19%
Vitamin C	6 mg
Ash	0.91%
Calories	210 KCal

Source:(Sethuraman et al., 2020)

present in it helps in muscle strengthening and joint mobility. The fruit is a great source of carotenoids; it is an effective food for healthy eyes and vitamin C for boosting the immune system. Dietary fibres present in fruit increase digestive health.

Research has shown some metabolites such as alkaloids, glycosides, tannins, terpenoids, steroids, phlorotannins, amino acids, lipids, fats and acidic compounds in canistel fruit which exhibit a wide range of biological activities such as anti-HIV, antitumor, anti-inflammatory, antimicrobial and hepatoprotective. For example, some studies showed the antimicrobial activity of canistel fruit against *E.coli* and *P. aeruginosa*, the fungi *C. albicans* and *T. mentagrophytes* (Mehraj et al., 2015).

CULINARY USES OF CANISTEL FRUIT

Consumption of fresh fruit is beneficial to health but less preferred due to the texture of the fruit pulp, which is not juicy like many other fruits. Egg fruit is generally used to prepare milkshakes, puddings, pie, custard, puree, jams, and marmalades and as a flavouring agent in ice cream.

PROCESSED PRODUCTS FROM EGG FRUIT

Egg fruit is most commonly utilized for traditional preparations. Egg fruit processing is minimal commercially though they are good sources of many nutrients. Several research and trials have been carried out to study the processing behaviour of canistel fruit. The study showed that canistel fruit flour can be the good alternative to all-purpose flour in cookies (Paragados, 2014). Snack noodles prepared from canistel flour (90%) along with the modified cassava flour (10%) and guar gum (1%) were selected as highly accepted in terms of colour and sensory attributes (Retna Pertiwi et al., 2022). But the processing of fruit flour comes up with various challenges, such as eliminating bitterness and wax content and maintaining colour, moisture, carbohydrate, fibre and other nutrients intact throughout the process (Pertiwi et al., 2020). Carotenoids were extracted from canistel fruit with antioxidant activity that can be used as a natural pigment in food products. The extractability and the yield were affected by the extracting solvent, cooking temperature and pH (Huynh & Nguyen, 2022).

CONCLUSION

Canistel fruit is one of the neglected fruits in terms of processing and commercialization. The climacteric and perishable nature of the fruit makes post-harvest management and transportation difficult, leading to its restriction in native for traditional uses. On the other hand, encouraging the production of this fruit provides the scope for pharmaceutical and nutraceutical utilization. Therefore, the nutritional and therapeutic importance and the development of processing methods need to be done for maximum utilization of canistel fruit in different sectors such as dairy, confectionaries, bakery and medicine.

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PERCEPTIONS OF FARMERS CONCERNING SOIL AND WATER CONSERVATION PRACTICES – A CASE STUDY

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ABSTRACT

Farmers' perceptions have a crucial role in their decision-making. As a result, it is necessary to understand farmers' attitudes toward soil and water conservation and the socio-economic factors that influence them. This study evaluated farmers' perception of Soil and water conservation measures adoption in Anthiyur village of Erode district, Tamil Nadu, India, in 2018. The results revealed that about 87% of farmers were aware of soil erosion problems. Furthermore, almost all farmers acknowledged the presence of soil conservation measures, and 72% participated in conservation activities voluntarily. Hence, it is recommended a watershed development programme may be initiated in the area to provide continuous training and advice farmers to follow up on their land.

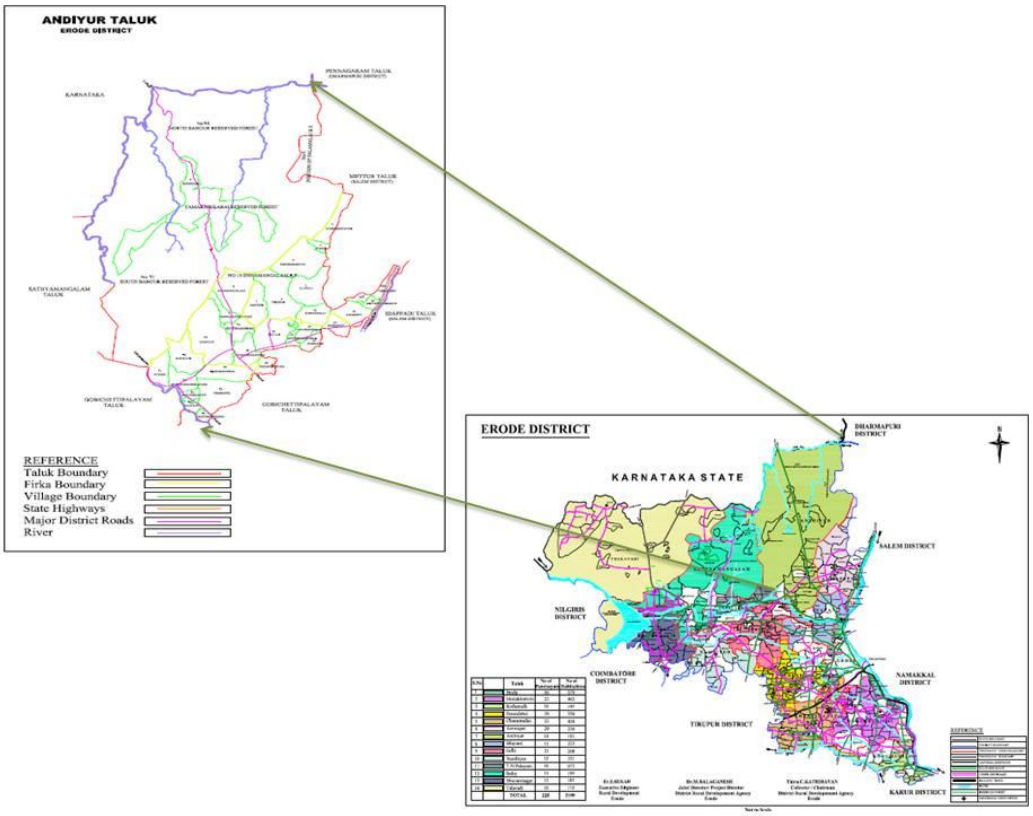
INTRODUCTION

Agriculture is the main part of most economies in the world most of the population depends on agriculture. But nowadays, the field is becoming a non-profitable and full of problems, especially land degradation due to soil erosion. Farmer's perception of soil erosion and alleviating this problem is a key social factor that plays a great role in their decision-making on land management practices for controlling soil losses. It affects soil conservation practices' selection and continued use (Pulido and Bocco, 2014). Hence, better understanding the factors that influence the adoption of SWC technologies has become an important concern which has stemmed from the high rate of land degradation. Therefore, the objective of this study was to assess farmers' perception of soil erosion and adoption of soil and water conservation technologies in Anthiyur village of Erode district, Tamil Nadu, India

METHODOLOGY

STUDY AREA

The study area (Anthiyur taluk) is located at 11.58°N 77.60°E it has an average elevation of 251 metres (823 ft). It is located in the extreme north of Tamil Nadu with a boundary of Karnataka. The temperature is moderate throughout the year except during summer. The study area is benefited by Northeast and Southwest monsoon seasons since it receives rainfall during both these seasons and scanty rainfall during winter and summer seasons with a mean annual rainfall of 830 mm (PWD)



(Source: Erode nic.in)

Fig.1. Location of the study area

This study conducted a survey on soil and water conservation to collect the details about farmers to conserve soil and water. A prepared questionnaire was used to collect the data. All parts of the questionnaire used open-ended questions. The survey instrument was developed based on previous research on this topic (Alemu et al., 2019). Items were designed to assess perceptions regarding issues in soil and water conservation and the usefulness of various sources of information. Respondents were encouraged to give written comments on the questionnaire. The questionnaire includes the questions such as the details about the farmer the land details, steps taken by them to conserve water, the cultivation methods and techniques

adopted in the cultivation, land tillage practices, fertilizers and nutrient management, based on the answers we provide rank to the farmers.

RESULT AND DISCUSSION

The farmers in the study area have been used to practice both indigenous and introduced soil and water conservation measures to conserve and maintain their farmland. Conservation measures like organic mulching, bunding, and multipurpose biological measures viz., vetiver grass (Vetiverial zizanioides) are practised. Out of the conservation measures, 13% of farmers practice advanced measures and tillage practices (cultivator, rotavator, disc plough). In water conservation and other parameters, 30% of farmers practice advanced techniques, 63% of farmers practice good techniques and 7% of farmers are in moderate level

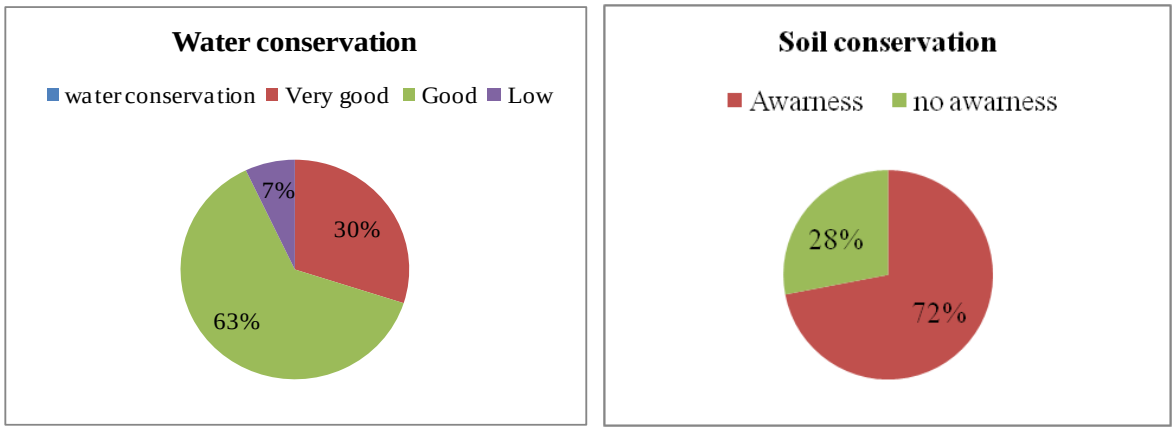


Fig 2. Soil and water conservation measures in the study area

CONCLUSION

The study assessed farmers' perception of adopting soil and water conservation technologies in Anthiyur village of Erode district. From the study, it was observed that many farmers are aware of soil and water conservation technologies. Hence, it is recommended a watershed development programme may be initiated in the area to provide continuous training and advice farmers to follow up on their land

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