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NATURAL FARMING

PATH TO SUSTAINABLE AGRICULTURE

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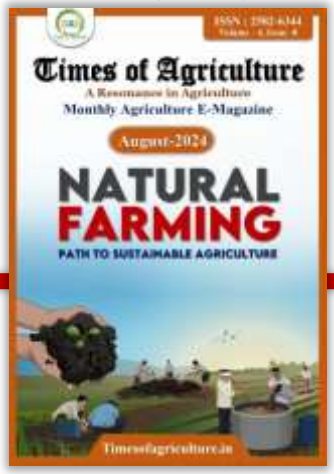

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From the Editor's Desk

Dear Readers,

You will greatly enjoy this August issue of **Times of Agriculture Magazine**. As you know, the Honorable Finance Minister has placed special emphasis on **natural farming** in her budget. Natural farming could be a better option for the future. The Prime Minister also wishes to spread this new technique to every citizen. Natural farming is not only crucial from an environmental perspective but also from the standpoint of soil health and overall well-being. We have overused our natural resources, and now we need to move towards techniques where we can focus on **zero-budget natural farming** without any external inputs.

This year, the Finance Minister has made a special proposal in her budget to connect **1 crore farmers** with natural farming and provide support for their certification and branding. In this issue, we have discussed natural farming in detail. This issue will provide you with comprehensive information on what natural farming are, its benefits, principles, how it differs from organic farming, its components, and we have also published some special success stories.

Along with natural farming, we have included new agriculture updates and various innovative articles in this issue. We hope, as always, that you will enjoy this issue. Please do send us your suggestions, as it inspire us to work with even greater energy. Thank you.

Thank you very much, and enjoy reading!

Editor-In-Chief

CONTENT

AGRICULTURE UPDATES

PM released 109 climate-resilient and bio-fortified varieties of crops

Prime Minister Shri Narendra Modi released 109 high yielding, climate resilient and biofortified varieties of crops at India Agricultural Research Institute, New Delhi. The 109 varieties of 61 crops released by the Prime Minister included 34 field crops and 27 horticultural crops. Among the field crops, seeds of various cereals including millets forage crops, oilseeds, pulses, sugarcane, cotton, fibre and other potential crops were released. Among the horticultural crops, different varieties of fruits, vegetable crops, plantation crops, tuber crops, spices, flowers and medicinal crops were released.

The new varieties encompass a wide range of crops, including cereals (rice, wheat, maize), millets (barley, sorghum, pearl millet, finger millet), pulses (chickpea, pigeon pea, lentil, field pea, faba bean, mung bean), oilseeds (safflower, soybean, groundnut, sesame), fibre (cotton, jute), forage (pearl millet, berseem, oats, maize, sorghum), sugar crops (sugarcane), potential crops (buckwheat, amaranth, winged bean, adzuki bean, pillipesara, kalingda, perilla), fruits (mango, pomegrnate, guava, bael, pummelo, musk melon, water melon), vegetables (potato, tomato, sem, bottle gourd, okra), flowers (crossandra, gladiolus, marigold, tuberose,), plantation crops (coconut, coca, cashew), spices (ajwain, fennel, mango ginger, nutmeg, small cardamom) and medicinal plants (ashwagandha, mandukparni, velevt bean).

India's first 24/7 'Grain ATM' starts dispensing in Odisha

The United Nations World Food Programme (WFP) and the Odisha Government have launched India's first around-the-clock grain dispensing machine, or 'Grain ATM,' in the state capital Bhubaneshwar. With this machine, also known as Annapurti (Hindi for "fulfiller of food"), Odisha becomes the first state to provide access to public distribution system beneficiaries 24 hours a day. The machine was inaugurated by Krushna Chandra Patra, Minister of Food Supplies, Consumer Welfare, Science and Technology of the Odisha Government, and Nozomi Hashimoto, Deputy Country Director for WFP in India, at a launch event on 9 August. This is a significant initiative in partnership with the United Nations World Food Programme to achieve nutritional security in the state, which is focused on food security. The ATMs will be set up across the state to provide food grains to beneficiaries with 24/7 access under the National Food Security Act.

The Annapurti provides universal access: anyone with a public distribution system ration card valid in India, regardless of their state or union territory, can access their entitlement. It can dispense up to 50 kilograms of grain in five minutes, reducing waiting time by 70 per cent. Once biometric authentication is completed, it provides consistent access to the full ration. Annapurti is energy-efficient and can be connected to solar panels for automatic refilling. The technology behind the Annapurti, developed by WFP India.

India registers 8,875 farmer producer organisations under Central Sector Scheme

The Government of India is implementing the Central Sector Scheme (CSS) for the ***"Formation and Promotion of 10,000 Farmer Producer Organisations (FPOs)"*** scheme to form and promote 10,000 new FPOs. As on date 30.06.2024, 8875 FPOs have been registered across the country. The cumulative paid-up capital for these 8,875 FPOs stands at Rs 630.3 crore. Under the scheme, a cumulative amount of Rs 210.1 crore has been released to eligible FPOs as a matching equity grant, demonstrating the government's commitment to bolstering financial support for farmer collectives.

The CSS for the "Formation and Promotion of 10,000 Farmer Producer Organisations (FPOs)" adopts a cluster-based approach for produce or produce mix. Additionally, it emphasizes the "One District One Product" strategy, which aims to develop product specialization. This approach encourages FPOs to focus on processing, branding, marketing, and exporting specific agricultural products declared for their respective districts. This strategic focus is intended to enhance value realization for farmers and promote sustainable agricultural practices. To further support these FPOs, the scheme includes provisions for a credit guarantee fund. Under this provision, loans worth Rs. 50.4 crore have been issued to FPOs, providing them with the necessary financial backing to expand their operations and enhance productivity. As of June 30, 2024, a significant number of shareholder farmers, totalling 19,68,868, have been

Union Minister launched 'ASEAN-India Fellowship' for Higher Education in Agriculture

The ASEAN-India Fellowship for Higher Education in Agriculture and Allied Science was launched by Union Minister of Agriculture and Farmers' Welfare and Rural Development Shri Shivraj Singh Chouhan in the presence of Union Ministers of State for Agriculture and Farmers' Welfare, Shri Bhagirath Choudhary and Shri Ram Nath Thakur in ICAR, PUSA, New Delhi.

Shri Chouhan applauded that the ICAR has been at the forefront of shaping and ensuring the quality of agricultural education in India. It sets the rules, policies, and standards to ensure that agrarian education thrives across the country and contributes to sustainable development in this sector. Currently, around 135 international students are pursuing their degrees at various agricultural universities. India has maintained a strong partnership with ASEAN member countries since the establishment of ASEAN. ASEAN is the cornerstone of India's 'Act East Policy' and the 'Indo-Pacific Vision' built upon it. India fully supports ASEAN unity, ASEAN centrality, and ASEAN's outlook on the Indo-Pacific.

The Agriculture Minister stated that the ASEAN-India fellowship aims to support postgraduate studies in various emerging fields of agriculture and allied sciences. Participating Indian faculty members will be facilitated with introductory visits to ASEAN member countries to aid ASEAN capacity-building which will promote the development of a pool of expert human resources in ASEAN for the growth of agriculture and allied sciences, he added. He emphasised that the long-term degree courses in India can help researchers from both regions stay connected for a long time and better understand agriculture-related issues in ASEAN countries and India.

RBI extended MISS for agriculture loans through KCC for FY 25

The Reserve Bank of India has extended the Modified Interest Subvention Scheme (MISS) for short-term loans fir agriculture and allied activities availed through Kisan Credit Card this financial year. This means farmers can now avail of loans up to Rs 3 lakh at concessional interest rates. Under the scheme, farmers will get loans at a concessional interest rate of 7%. An additional interest subvention of 3% per annum is provided to farmers who repay loans on time.

RBI has announced that farmers who are able to repay their loans promptly will be eligible for an additional interest subvention of 3%. This will effectively lower the interest rate to 4% per annum for those who make timely repayments within one year. "This implies that the farmers repaying promptly as above would get short-term crop loans and or short-term loans for allied activities including animal husbandry, dairy, fisheries, bee keeping, etc. @ 4% per annum during the financial year 2024-25.

The RBI added the rate of interest subvention to lending institutions will be 1. 5% for 2024-25. "The limit for crop loan component will take priority for interest subvention and prompt repayment incentive benefits and the residual amount will be considered towards allied activities including animal husbandry, dairy, fisheries, bee keeping, etc. For smooth facilitation of benefits to farmers through the Modified Interest Subvention Scheme, the requirement for Aadhaar linkage will persist as mandatory for accessing the specified short-term loans during the fiscal year 2024-25.

India Retains 8th Position in Global Agriculture Exports in 2023: WTO

India's agricultural exports, while experiencing a slight decline from $55 billion in 2022 to $51 billion in 2023, still secured the country's eighth position among the world's largest exporters. This stability is noteworthy considering the general trend of decreased agricultural exports among the top ten exporting nations.

Among the top ten agricultural exporters, only Brazil, the European Union, and Thailand saw an increase in their exports in 2023. The EU maintained its top position in 2023 by exporting agriculture produce valued at $836 billion compared to $799 billion in 2022. The US, too, continued at the second spot despite a drop in agriculture exports in 2023 to $198 billion as opposed to $222 billion in the previous year. Brazil's agriculture exports increased to $157 billion in 2023 from $148 billion in 2022 while it retained the third spot. China was the 4th largest agriculture exporter in 2023 with shipments valued at $95 billion which was marginally below exports worth $96 billion in 2022.

The decline in India's agricultural exports can be attributed to several geopolitical factors, including the Red Sea crisis and the ongoing Russia-Ukraine war. India also imposed bans on the export of key agricultural products such as wheat (May 2022), non-basmati rice (July 2023), and sugar (October 2023), which contributed to the decline. The top ten agricultural exporters collectively represented a 71.9% share of world exports in 2023.

Govt. launches mobile App to collect information on pest attack in crops

The Union Government on August 15, 2024 launched the AI-based National Pest Surveillance System (NPSS) mobile app that will help farmers to connect with agriculture scientists and experts on controlling pests using their phone. Launching the programme, Agriculture Minister Shivraj Singh Chouhan said the aim of NPSS is to reduce the dependence of farmers on pesticide retailers and inculcate a scientific approach among them towards pest management. NPSS will analyse the latest data on pests using AI tools to help farmers and experts in pest control and management. Technology should reach the fields and NPSS is one such effort. “If we know the pest attack immediately and at the beginning of the attack, it will help in curing. This system will help in identifying the pests and controlling it. The benefit of the technology must go to farmers adding that the Ministry will make efforts to strengthen the connection between scientists and farmers. The Centre envisages connecting scientists with the fields using the platform. Farmers can take photos of the infested crops or the insect using the NPSS platform and these will reach scientists and experts.

Using the correct quantity of correct pesticide at the correct time is the challenge and this system helps the farmers to address this challenge. The Ministry said NPSS will help about 14 crore farmers in the country. The Minister also said that the government will soon launch 'Kisan Ki Baat', a monthly radio programme aimed at bringing scientific knowledge to farmers. This program will be on radio and will feature agricultural scientists, department officials, and the minister himself, providing crucial information on best practices and scientific advancements.

COVER STORY

NATURAL FARMING

PATH TO SUSTAINABLE AGRICULTURE

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Natural farming recently garnered significant attention when it was highlighted in the Union Budget, where it was announced that, in the next two years, one crore farmers will be initiated into natural farming supported by certification and branding. Its implementation will be through scientific institutions and willing gram panchayats and also, 10,000 need-based bio-input resource centres will be established. The government's decision to promote natural farming aligns with its broader agenda of sustainable development and rural revitalization. Allocations in the budget for training, research and financial incentives signal a strong commitment to scaling up natural farming practices across the country. This policy shift underscores the growing recognition of natural farming as a viable solution to many of the environmental and economic challenges faced by Indian agriculture today. Recently, on 11th August, 2024, Prime Minister of India Shri Narendra Modi has released 109 high-yielding, climate-resilient and biofortified varieties of crops at India Agricultural Research Institute, New Delhi and highlighted that significant milestones are on the horizon as farmers are increasingly adopting natural farming. His speech on 78th Independence Day has also stressed on the need to transform agriculture sector and also mentioned that the government has launched programmes to encourage natural farming, and budget allocations too have been increased to promote such farm practices.

Principles of Natural Farming

Natural farming is based on the principle of working in harmony with nature, rather than attempting to control it. Central to this approach is the recycling of on-farm biomass, with an emphasis on mulching and the use of cow dung-urine formulations to enrich the soil. Natural farming prioritizes soil aeration, which supports the health of soil microorganisms, and strictly excludes synthetic chemical inputs. This method also integrates crops, trees, and livestock into a diversified farming system, which enhances biodiversity and creates a more resilient farm ecosystem. With no external inputs and focus on on-farm resource optimization, natural farming seeks to create a self-sustaining and environmentally friendly agricultural model.

Benefits of Natural Farming

The benefits of natural farming are extensive and multifaceted. By eliminating the use of chemical fertilizers and pesticides, natural farming helps restore soil health and increases its organic matter content. This leads to improved water retention, reduced erosion, and enhanced nutrient cycling, all of which contribute to higher and more stable yields over time. Additionally, the cost savings from reduced input purchases make natural farming economically attractive to smallholder farmers. Beyond the farm, natural farming promotes rural development by creating job opportunities and revitalizing local communities. The produce from natural farming is often more nutritious and freer from chemical residues, meeting the growing consumer demand for safe and healthy food.

In natural farming, it is assumed that the soil inherently contains the nutrients necessary for plant growth. By allowing natural microbial cycles to function as they do in undisturbed ecosystems, the soil can naturally meet the nutritional needs of plants. The primary responsibility is to continuously replenish the soil with organic matter, sourced from the farm itself, ensuring the sustainability of this nutrient-rich environment. For the successful natural farming four pillars are proposed.

Natural Farming vs. Organic Farming

While both natural and organic farming share a commitment to sustainability and the rejection of synthetic chemicals, there are important distinctions between the two. Organic farming, though environmentally friendly, allows for the use of certain approved organic inputs and more intensive management practices. In contrast, natural farming takes a more hands-off approach, minimizing human intervention and relying more heavily on natural processes and on-farm resources. This makes natural farming more stringent in its adherence to ecological principles, often resulting in a farming system that is more self-sustaining and less dependent on external inputs.

Natural Farming	Organic Farming
Operates entirely within the natural ecosystem, without any external inputs	Incorporates natural and organic materials like composts and organically approved pesticides
Soil fertility is sustained through natural methods such as mulching and fostering the activity of beneficial microbes	Soil health is improved through the application of organic compost, manure, and green manure
Pest control is managed through natural predators and beneficial insects	Employs organic, non-chemical pesticides and promotes beneficial insect populations for pest management.
Relies on natural processes, mulching and manual weeding	Combines manual weeding, mulching, and occasionally natural herbicides to control weeds
Seeds are typically untreated or treated with natural fermentative preparations.	Seeds may be soaked in organic solutions or used untreated, provided they are non-GMO
Characterized by minimal cultivation costs, particularly in "zero budget" approaches	Can involve higher expenses due to organic inputs, certification fees, and additional labor
No standardized certification process worldwide	Adheres to strict certification standards that are often governed by national or international regulations
Generally, less labor-intensive, with fewer interventions required	Often more labor-intensive due to specific organic practices and careful management.
Embodies the philosophy of “Work in harmony with nature”	Focuses on avoiding synthetic chemicals while actively managing the overall health of the farm

Challenges and Limitations

Despite its numerous benefits, natural farming encounters several significant challenges. Transitioning from conventional farming methods to natural farming can be arduous, requiring a fundamental shift in both mindset and farming practices. This transition often results in initial reductions in crop yields as the soil gradually recovers from years of chemical use, which poses a financial risk for farmers accustomed to higher productivity levels. Additionally, natural farming relies heavily on a steady supply of natural inputs, such as organic matter and indigenous seeds. The shortage of these essential resources can hinder the effectiveness of natural farming practices and limit their scalability. Farmers may also face obstacles related to acquiring the necessary technical knowledge, accessing markets and obtaining financial support to implement and sustain these practices. Addressing these challenges is essential for the successful scaling of natural farming. Overcoming these barriers requires targeted support, including increased access to education, improved infrastructure for organic input supply, and financial incentives to mitigate the risks associated with the transition. Ensuring these elements are in place will help unlock the full potential of natural farming and support its growth as a sustainable agricultural practice.

Author's thoughts for future Natural Farming

The future of natural farming looks bright as more farmers, consumers and policymakers recognize its value. With increasing government support, advances in research, and growing demand for sustainable produce, natural farming is set to play a key role in the future of Indian agriculture. As the world contends with the challenges of climate change, natural farming offers a regenerative and resilient path forward. By embracing the principles of natural farming and supporting its adoption, India can lead the way in sustainable agriculture, ensuring a prosperous and healthy future for generations to come.

Automation and Remote Sensing

Automation, when applied judiciously, can reduce the labor burden of natural farming while preserving its ecological focus. Remote sensing technologies, such as drones and satellite imagery, can provide early warnings of potential issues like pest outbreaks or water stress, enabling timely interventions that align with natural farming practices.

Blockchain for Transparency and Traceability

Blockchain technology can enhance transparency and traceability in the supply chain of natural farm products. By recording every step of the production process on a blockchain, consumers can verify the authenticity and sustainability of the produce they purchase, building trust and allowing natural farming products to command a premium price. This not only benefits farmers economically but also reinforce the integrity of the farming system.

Conclusion

The integration of modern technologies into natural farming, when done thoughtfully, can enhance its efficiency and sustainability without compromising its core principles. By leveraging precision agriculture, AI, automation and blockchain, natural farming can be made more resilient, productive and scalable, ensuring its viability for future generations. The key is to maintain a balance, using technology to complement and enhance natural processes, rather than to dominate or replace them. In this way, natural farming can continue to evolve as a truly regenerative and sustainable agricultural practice.

COMPONENTS OF NATURAL FARMING

Natural Farming is a chemical-free farming system rooted in Indian tradition enriched with modern understanding of ecology, resource recycling and on-farm resource optimization. It is considered as agro-ecology based diversified farming system which integrates crops, trees and livestock with functional biodiversity. It is largely based on on-farm biomass recycling with major stress on biomass mulching, use of on-farm cow dung-urine formulations; maintaining soil aeration and exclusion of all synthetic chemical inputs. Natural farming is expected to reduce dependency on purchased inputs. It is considered as a cost- effective farming practice with scope for increasing employment and rural development.

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Components of natural farming

A. Beejamrit

Beejamrit is an ancient, sustainable agriculture technique. It is used for seeds, seedlings or any planting material. It is effective in protecting young roots from fungus. Beejamrit is a fermented microbial solution, with loads of plant-beneficial microbes, and is applied as seed treatment. It is expected that the beneficial microbes would colonize the roots and leaves of the germinating seeds and help in the healthy growth of the plants.

Inputs needed: 5 kg cow dung, 5 litre cow urine, 50 gram lime, 1kg bund soil, 20 litre water (for 100 kg seed)

Application as a seed treatment: Add beejamrit to the seeds of any crop; coat them, mixing by hand; dry them well and use them for sowing. For leguminous seeds, which may have thin seed coats, , just dip them quickly and let them dry.

B. Jivamrit

Jivamrit acts as a biostimulant by promoting the activity of microorganisms in the soil and also the activity of phyllospheric microorganisms when spayed on foliage.. It acts like a primer for microbial activity, and also increases the population of native earthworms.

Inputs needed: 10 kg of fresh cow dung, 5-10 litre cow urine, 50 gram lime, 2 kg jaggery, 2 kg pulses' flour 1 kg uncontaminated soil and 200 litres water
Application of Jivamrit: This mixture should be applied every fortnight. It should be either sprayed directly on the crops or mixed with irrigation water. In the case of fruit plants, it should be applied on individual plants. The mixture can be stored for up to 15 days.

C. Mulching

Mulching is defined as covering of soil surface using both live crops and straw (dead plant biomass) to conserve moisture, lower soil temperature around plant roots, prevent soil erosion, reduce runoff and reduce weed growth. There are two types of mulches:

1. **Crop Residue Mulch:** This comprises any dried vegetation, farm stubble, such as dried biomass waste etc. It is used to cover the soil against severe sunlight, cold, rain etc. Residue mulching also saves seeds from birds, insects, and animals.
2. **Live Mulch:** Live mulching is practised by developing multi-cropping/inter cropping patterns of short durational crops in the rows of a main crop. It is suggested that the pattern should be of monocotyledons and dicotyledons in the same field, in order to provide all the essential nutrients. Monocots, like wheat and rice, supply nutrients such as potash, phosphate and sulphur, while dicots such as pulses are nitrogen-fixing plants. Such practices reduce the demand of a particular type of plant nutrient.

D. Whapsa

Whapasa means the mixture of 50% air and 50% water vapour in the cavity between two soil particles. It is the soil's microclimate on which soil organisms and roots depend for most of their moisture and some of their nutrients. It increases water availability, enhances water-use efficiency and builds resilience against drought.

COMPONENTS OF

NATURAL FARMING

Beejamrit

The process includes treatment of seed using cow dung, urine and lime based formulations.

Jivamrit

The process enhances the fertility of soil using cow urine, dung, flour of pulses and jaggery concotion.

Whapasa

The process involves activating earthworms in the soil in order to create water vapor condensation.

Mulching

The process involves creating micro climate using different mulches with trees, crop biomass to conserve soil moisture.

Plant Protection

The process involves spraying of biological concoctions which prevents pest, disease and weed problems and protects the plant and improves their soil fertility.

E. Plant Protection

1. **Neemastra:** Neemastra is used to prevent or cure diseases, and kill insects or larvae that eat plant foliage and suck plant sap. This also helps in controlling the reproduction of harmful insects. Neemastra is very easy to prepare and is an effective pest repellant and bioinsecticide for Natural Farming.
2. **Brahmastra:** This is a natural insecticide prepared from leaves which have specific alkaloids to repel pests. It controls all sucking pests and hidden caterpillars that are present in pods and fruits.
3. **Agniastra:** It is used to control all sucking pests and caterpillars. 200 litre cow urine mix with 2 kg neem leaves paste, 500 gram tobacco powder, 500 gram green chilli paste, 250 gram garlic paste and 200 grams turmeric powder . Stir the solution in clockwise direction and cover it with a lid and allow it for boiling till we get foam. Remove from fire and keep the vessel under shade, away from direct sunlight for cooling up to 48 hours during this fermentation period stir the components twice a day. It can be stored for 3 months.
4. **Dashparni extract:** Dashaparni ark acts as substitute for Neemastra, Bramhastra, and Agniastra. It is used to control all types of pests and used depending on the level of infestation.

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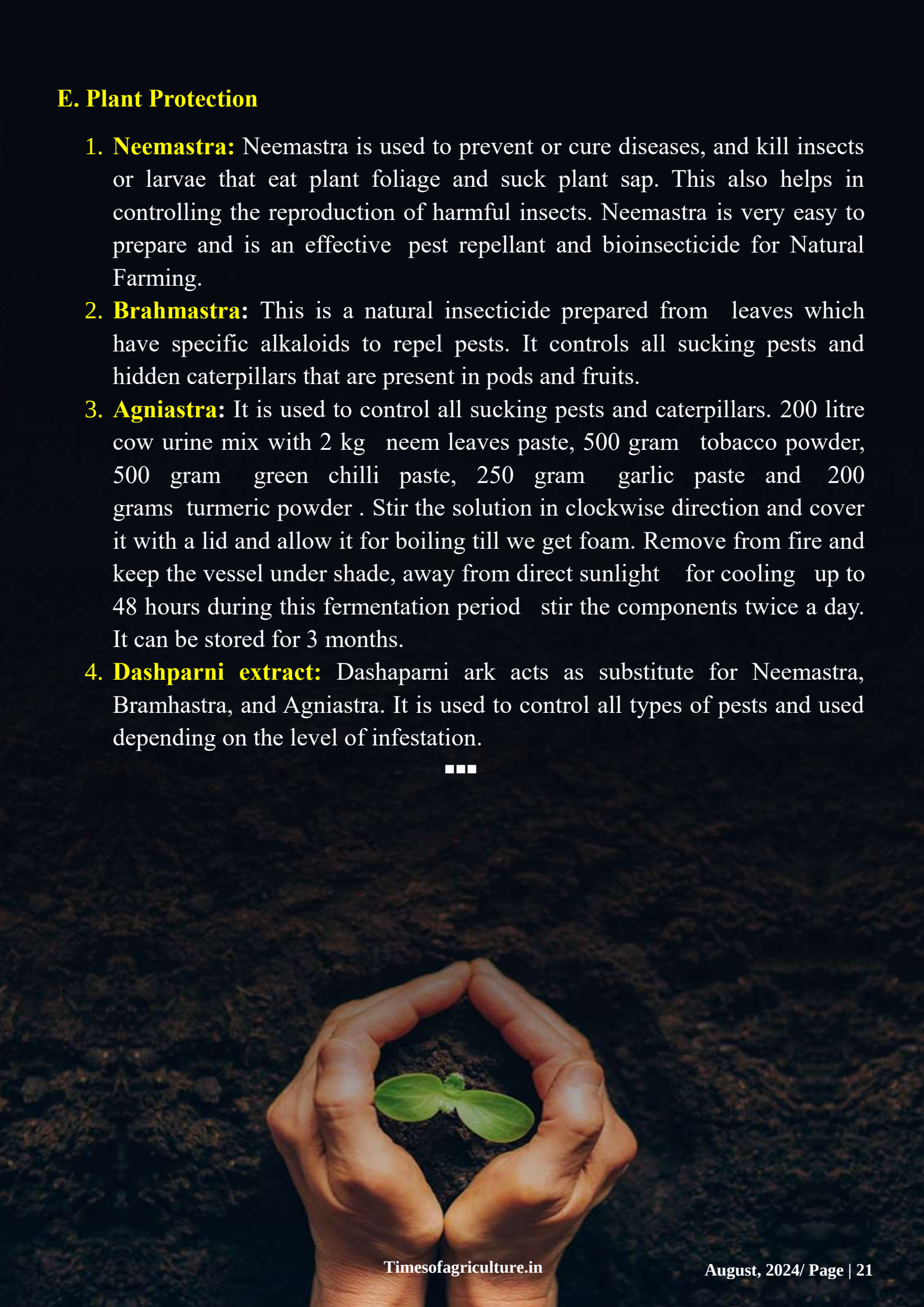

Previous Issues

Website Statistics (July 2024)

190K	72K	1.8M
Monthly Pageview	Monthly Visitor	Monthly Impression

Social Stats

6.5K	5.2K	7.1K	1.7K	2K

NATURAL FARMING

SUCCESS STORIES

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Masanobu Fukuoka (1913–2008) developed an ecological farming method known as "the Fukuoka Method," "the natural way of farming," or "do-nothing farming." The phrase was first used by Japanese farmer and philosopher Fukuoka in his 1975 book *The One-Straw Revolution*. The following are the popular success stories of farmers in India who got a tremendous return by natural farming process.

Story of Adaribariki Seethamma from Andhra Pradesh

From Pedalabudu village in Araku Mandal, in the Visakhapatnam district of Andhra Pradesh, comes Adaribariki Seethamma, a lead natural farmer. In May of 2019, prior to the onset of the monsoon season, meticulous pre-monsoon dry sowing practices were meticulously executed. A total of 200 kg of nutrient-rich *Ghanajivamrit* was meticulously applied to nourish the soil, promoting healthy crop growth. These diligent efforts were accompanied by minimal soil disturbance to support the ecosystem. An array of diverse crops, including groundnuts, leafy vegetables, red and white rajma, maize, tomato, red gramme, ragi, and various millets, were sown on the specified date, May 15th. Each seed underwent special treatment with *beejamrit* before being methodically sown in rows, except for the groundnuts, which were separately planted. The soil was carefully mulched with dry grass before being covered, providing essential protection and moisture retention for the seeds to germinate successfully. To safeguard the crops from potential threats, thorn-fencing was strategically put in place to deter cattle and other animals. Regular applications of *Dravajivamrit* were diligently carried out every two weeks throughout the crop cycle, ensuring optimal nutrient supply and plant health. Additionally, *Neemastra* was skillfully sprayed on the crops to effectively repel mosquitoes and pests, safeguarding the plants from damage and flower loss. Close monitoring and meticulous observation were maintained at every stage of the cultivation process to ensure the crop's well-being and growth. Continuous cultivation efforts prevailed throughout all seasons, with no land remaining uncultivated as the efficient PMDS method was steadfastly implemented for sustainable agricultural practices.

She sold food items for consumption at a minimum cost of Rs 2300 and made a total income of Rs 28,000 from 0.30 acres of land. She

collected leafy vegetables practically every day, and she never made less than Rs 500 per day. Her farm income also increased as a result of a steady rise in Rajma's yield.

Story of Ganga from Himachal Pradesh

Ganga, a devoted teacher who encountered health issues due to the unavailability of chemical-free produce, embarked on a journey of experimentation with various farming methods back in 2013. Initially met with resistance from her family, she persevered and achieved fruitful results through natural farming techniques, such as yielding bountiful crops like French beans, coriander, and radish, eventually expanding her practices to include apple cultivation. Her passion for natural farming was ignited by her online research and formal training under Subhash Palekar's guidance in Kufri in 2018. Presently, Ganga is diligently practicing natural farming on a diverse range of crops such as peas, carrot, cucumber, and more, with resounding success. To further support her endeavors, Ganga's husband made the significant decision to take early retirement in 2019 to focus on their flourishing natural farming venture collectively. Through her experiences, Ganga discovered the efficacy of products like Jivamrita and Khatti Lassi in managing fungal diseases, as well as Saptdhyankur for enhancing the appearance of apples. Their recent farm produce sales of peas valued at `10,000 and coriander at `4,000 in the local market are a testament to the beneficial outcomes of their sustainable farming practices. She passionately advocates for the transformative impact of PK3Y on agricultural practices and the empowerment of women in the farming community, even fostering connections with fellow women farmers through a dedicated WhatsApp group.

Delving into the specifics of Ganga's farming model reveals a meticulous approach across her 10 bigha land holding, with 6 bigha dedicated solely to natural farming. Noteworthy apple varieties in her cultivation include Royal Delicious, Red Golden, Geromine, and Gail Gala, alongside a diverse array of crops like radish, French beans, potato, peas, carrot, and bottle gourd. A stark comparison between chemical and natural farming investments and returns highlights the sustainability and financial viability of Ganga's chosen eco-friendly agricultural practices.

Story of Adinath Annappa Kinikar from Maharashtra

Adinath Annappa Kinikar, a dedicated farmer hailing from Karveer Taluk in Kolhapur District, Maharashtra, practices a sustainable agricultural approach characterized by natural farming and multi-cropping techniques. On his expansive 6-acre plot of land, he actively engages in the production of vermi compost, which serves as a vital component in enriching the soil and enhancing crop yields. To cater to his farming needs, Adinath locally prepares various organic solutions such as vermin wash, Jivamrit, Dashparni Ark, Gir-Gokrupa Amrutam, and deploys Pheromone traps to regulate pests naturally. In addition to these innovative farming practices, Adinath also raises desi cows to produce organic agri-inputs, further accentuating the sustainability of his farming system. The diverse range of crops cultivated on his land includes sugarcane, soybean, intercropped moong, rice, gram, groundnut, and sorghum, enabling a harmonious coexistence of crops to maximize productivity and soil health. As a testament to his agricultural prowess.

Adinath's meticulous approach towards crop diversity and sustainable practices has yielded impressive results, with a significant net income of Rs 2,36,500 being generated from the cultivated crops. The fruit crops and trees, including sapota, lemon, mango, banana, coconut, papaya, custard apple, guava, and drumstick, have proven to be particularly profitable, contributing Rs 2,73,000 to his income. Furthermore, the cultivation of vegetable crops like brinjal, tomato, cabbage, cauliflower, chili, and coriander has also been fruitful, with a substantial income of Rs 73,000 being realized. The integration of cow rearing and vermicompost production has further bolstered. Adinath's economic success, resulting in a net income of Rs 1,08,000. His exemplary methods serve as a beacon of inspiration for sustainable agriculture enthusiasts and underline the immense potential for productivity and profitability inherent in eco-friendly farming techniques. The profound impact of Adinath's agricultural endeavors reverberates not only through his bountiful harvests but also through the sustainable ethos he embodies, highlighting the power of conscientious farming practices in fostering a prosperous and harmonious agricultural landscape. By nurturing the land with care, embracing biodiversity, and leveraging nature's bounties, Adinath has set a shining example of how sustainable agriculture can pave the way towards a greener, more resilient farming future.

Story of Mr. Renny Jacob from Karnataka

Mr. Jacob, a visionary farmer with a keen eye for opportunities, decided to venture into the cultivation of rambutan in a region known for its ideal conditions for crops such as arecanut, pepper, rubber, and banana. Embracing this new endeavor, he took the bold step of planting rambutan on 2 acres of land, marking the beginning of a fruitful journey. Driven by his passion for agricultural innovation, Mr. Jacob sought guidance from experts at CHES, Chettalli, where he engaged with scientists to gain insights into the performance and production technologies of rambutan. This valuable interaction not only boosted his confidence but also paved the way for strategic management practices that would later lead to his farm achieving remarkable success. Hailing from Puttur,

Karnataka, Mr. Jacob's dedication to his craft and commitment to excellence have not gone unnoticed. His rambutan orchard has become a beacon of inspiration for fellow growers in the region, drawing admiration for his progressive approach to farming. By maximizing the sale of rambutan fruits through his farm outlets, Mr. Jacob has not only secured better profits but has also set a benchmark for sustainable agricultural practices. Meanwhile, in a different part of the country, Renny Jacob, a chartered accountant turned planter, made a significant shift from rubber cultivation to rambutan in Kanjirappally, Kottayam. This strategic move proved to be a game-changer as he now yields an impressive 12 tonnes of rambutan annually, fetching a market value exceeding Rs 16 lakh. His foresight in diversifying into exotic fruits like rambutan has not only shielded him from the volatility of rubber prices but has also opened up new avenues for agricultural growth in the region.

With the demand for exotic fruits rising among consumers, the cultivation of rambutan and other unique produce has gained traction on the western coast, particularly in Kerala and Karnataka. The success stories of farmers like Mr. Jacob and Mr. Renny Jacob underscore the profitability and potential of these non-traditional crops, offering a lucrative alternative to conventional agricultural practices. As more farmers turn to crops like rambutan for sustainable income, the agricultural landscape is witnessing a shift towards diversified and innovative farming methods that benefit both the farmers and consumers alike.

Story of Mr. R. Ramesh from Tamil Nadu

The Sree Vaigai Passion Fruit Association was founded in the Theni district of Tamil Nadu by Mr. R. Ramesh, an agro-input dealer, and his friends. There are 5,000 acres of grape gardens in the district. A few years back, grape cultivation was severely impacted by the powdery mildew disease. Farmers discovered that they were in a serious crisis. Sensibly, a few of them began cultivating bottle gourds and bitter gourds on their pandals. Unfortunately, the farmers' good returns were marred by misfortune. A glut in the market meant that competition was fierce. Now, Ramesh's group is bringing passion fruit farming on pandals to a wider audience.

"He is investigating market prospects in Madurai and Chennai and has planted passion fruit on 150 acres in various locations. In HD Kote, close to Mysore, Mr. Sebastian has a two-acre orchard that is bearing fruit. On an acre that Joseph leased for ~1 lakh in Karkala, he has planted vines. These farmers want to go to Kerala and sell their fruit. A crop that's good for farmers is passion fruit. Both the domestic and export markets are ready for it. Farmers can establish a small processing facility for relatively little money. The very first year the vines bear fruit. They don't require replanting for roughly four years, and it doesn't cost much. The fruits fall on their own, even though the commercial growers can't wait for that to happen organically. Thus, farmers can harvest without hiring labour. The pulp is kept fresh for ten days under the protection of a thick rind. Unsold stock can therefore be processed. There is also transportation offered. In the upcoming years, the majority of inexperienced passion fruit growers are eager to increase their output. Passion fruit cultivation on Mr. Joseph Louis Kavalam's 5-acre property has made his life "sweeter." Kavalam is a retired soldier from Kottayam, Kerala.

He first began growing passion fruits in between rubber plants as an intercrop. But as soon as he realised it was succeeding, he went to the plantation company and purchased thousands of passion fruit seedlings, planting them. In just five months, his efforts yielded "fruit," even with simple organic fertilisers. Every day, he receives over 200 kg of fruits, which are sold in the market for Rs 80 per kg. These fruits' pulp is used to make juice products with added value. According to Joseph, there is a high demand for the fruits and juice because they are grown organically. Except from needing to be properly watered in the summer, passion fruit doesn't require much care. Additionally, he has installed about fifty beehive boxes on the farm to help with the easy pollination of the passion fruit blossoms. The honey he receives is more money.

Conclusion

Replacing chemical inputs with natural inputs in certain ecosystem may promote better and well distributed root system and the ability to interact with beneficial soil microorganisms; contributing to soil, crop and seed health, good product quality, better yield levels and yield stability. Thus, natural farming in specific identified areas can help India to move towards achieving many SDGs by mitigating hunger, conserving natural resources and ensuring food and nutritional security in a sustainable manner (NITI Ayog, 2022). However, not many studies and information are available on this very important aspect of safe food production system which conserves and promotes all round sustainability of ecosystem and wellbeing of humanity.

■■■

REMOTE SENSING AND GIS IN AGRICULTURE

About Author

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Remote sensing and GIS (Geographic Information System) are transforming the agricultural sector by providing valuable insights and data-driven decision-making tools. Remote sensing technologies, such as satellite and aerial imagery, enable farmers and agricultural managers to monitor crop health, growth, and development, predict yields, and detect early signs of stress, pests, and diseases. This information is then integrated with GIS, which provides spatial analysis, mapping, and data integration capabilities, allowing for a more comprehensive understanding of agricultural systems.

The integration of remote sensing and GIS enables precision agriculture, where farmers can optimize crop management, reduce chemical usage, and improve resource allocation. For instance, remote sensing can identify areas with specific crop stress, allowing farmers to target their interventions, reducing waste and environmental impact. GIS mapping can also help identify suitable land for different crops, reducing land degradation and improving agricultural productivity.

Agricultural research and extension services also benefit from the integration of remote sensing and GIS. Researchers can analyze remote sensing data to identify trends and patterns, informing studies on agricultural productivity and sustainability. Extension services can use GIS maps to provide personalized advice to farmers, taking into account their specific conditions and needs.

Policy makers also rely on remote sensing and GIS to inform decisions on agricultural productivity and sustainability. By analyzing remote sensing data and GIS maps, policy makers can identify areas of high agricultural potential, optimize resource allocation, and develop targeted interventions to improve agricultural productivity and reduce environmental impact.

Despite the benefits, there are challenges and limitations to the use of remote sensing and GIS in agriculture. Data quality and accuracy, interoperability and standardization, integration with existing systems and practices, accessibility and affordability for smallholder farmers, and addressing privacy and security concerns are some of the key challenges.

To address these challenges, future directions include integrating AI and machine learning for predictive analytics, developing IoT-enabled precision farming systems, expanding satellite and aerial imagery capabilities, enhancing data sharing and collaboration platforms, and addressing emerging challenges like climate change and sustainability.

In conclusion, the integration of remote sensing and GIS is revolutionizing agriculture by providing data-driven insights and decision-making tools. By leveraging these technologies, agriculture can become more efficient, productive, and sustainable, ensuring food security and

environmental stewardship for future generations.

Remote sensing has revolutionized the field of agriculture by providing valuable insights and data-driven decision-making tools. Here are some applications of remote sensing in agriculture:

1. **Crop monitoring:** Remote sensing enables farmers to monitor crop health, growth, and development. This helps in identifying issues like pests, diseases, and nutrient deficiencies.
2. **Yield prediction:** By analyzing remote sensing data, farmers can predict crop yields, enabling them to make informed decisions about harvesting and marketing.
3. **Soil moisture monitoring:** Remote sensing helps monitor soil moisture levels, enabling farmers to optimize irrigation and reduce water waste.
4. **Precision farming:** Remote sensing enables precision farming by providing detailed information about soil types, crop varieties, and weather conditions.
5. **Crop classification:** Remote sensing helps classify crops, enabling farmers to identify areas with specific crops and optimize management practices.
6. **Pest and Disease Management:** Remote sensing helps detect pests and diseases, enabling farmers to take targeted action and reduce chemical usage.
7. **Irrigation management:** Remote sensing helps optimize irrigation systems, reducing water waste and improving crop water productivity.
8. **Weather forecasting:** Remote sensing provides accurate weather forecasts, enabling farmers to plan planting, harvesting, and other activities accordingly.
9. **Land use planning:** Remote sensing helps identify suitable land for different crops, reducing land degradation and improving agricultural productivity.
10. **Climate change mitigation:** Remote sensing helps monitor the impact of climate change on agriculture, enabling farmers to adapt and develop resilient farming practices.
11. **Supply chain optimization:** Remote sensing helps optimize supply chains by providing real-time information about crop availability, quality, and location.
12. **Insurance and Risk Management:** Remote sensing helps insurance companies assess crop damage and provide fair compensation to farmers.
13. **Extension services:** Remote sensing enables extension services to provide personalized advice to farmers based on their specific needs and conditions.
14. **Research and Development:** Remote sensing helps researchers develop new technologies and practices, improving agricultural productivity and sustainability.
15. **Policy making:** Remote sensing informs policy decisions by providing data-driven insights on agricultural productivity, sustainability, and environmental impact.

Remote sensing technologies used in agriculture include:

- Multispectral and hyperspectral imaging.
- Radar and LiDAR.
- Satellite and aerial imagery.
- UAVs and drones.

Benefits of remote sensing in agriculture include:

- Improved crop yields and productivity.
- Enhanced decision-making and resource allocation.
- Reduced chemical usage and environmental impact.
- Increased efficiency and cost savings.
- Better risk management and adaptation to climate change.

Challenges and limitations of remote sensing in agriculture include:

- Data quality and accuracy.
- Interoperability and standardization.
- Integration with existing systems and practices.
- Accessibility and affordability for smallholder farmers.
- Addressing privacy and security concerns.

Future directions for remote sensing in agriculture include:

- Integrating AI and machine learning for predictive analytics.
- Developing IoT-enabled precision farming systems.
- Expanding satellite and aerial imagery capabilities.
- Enhancing data sharing and collaboration platforms.
- Addressing emerging challenges like climate change and sustainability.

Integration of Remote Sensing and GIS:

- **Crop management:** Integrating remote sensing and GIS optimizes crop management.
- **Precision agriculture:** Combining remote sensing and GIS enables precision agriculture.
- **Agricultural research:** Integration supports research on agricultural productivity and sustainability.
- **Extension services:** Integration helps extension services provide personalized advice to farmers.
- **Policy making:** Integration informs policy decisions on agricultural productivity and sustainability.

■■■

THE FUTURE OF FARMING

LATEST TECHNOLOGIES IN DRIP IRRIGATION

About Author

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The increasing global demand for food, coupled with water scarcity and climate change, has necessitated the adoption of efficient irrigation methods in agriculture. Drip irrigation, known for its precision in delivering water directly to plant roots, is at the forefront of these advancements. Recent innovations in this field include smart irrigation systems that utilize sensors and data analytics to optimize water usage based on real-time conditions. Pressure compensating emitters ensure uniform water distribution, while subsurface drip irrigation (SDI) minimizes evaporation and weed growth by burying the drip lines underground. The integration of Internet of Things (IoT) technology allows farmers to monitor soil moisture and environmental factors remotely, enhancing decision-making processes. Additionally, solar-powered drip irrigation systems reduce reliance on fossil fuels, making them sustainable options for remote areas. Advanced filtration technologies further improve system efficiency by preventing emitter clogging. Collectively, these technologies not only conserve water but also enhance crop yields, promoting sustainable agricultural practices. As the agricultural sector continues to embrace these innovations, drip irrigation is poised to play a crucial role in addressing the challenges of food security and resource management in the coming years.

Introduction

As the global population continues to rise and climate change poses increasing challenges to traditional farming practices, efficient water management has become more crucial than ever. Drip irrigation, a method that delivers water directly to the roots of plants, is gaining traction as one of the most effective solutions for conserving water while maximizing crop yields. This article explores the latest technologies in drip irrigation that are transforming agriculture and promoting sustainable farming practices.

Understanding drip irrigation

Drip irrigation is a method that involves delivering water directly to the base of plants through a network of tubing, pipes, and emitters. This targeted approach minimizes evaporation and runoff, making it an efficient alternative to conventional irrigation methods. According to the Food and Agriculture Organization (FAO), drip irrigation can reduce water usage by up to 50% compared to traditional flood irrigation systems (FAO, 2020).

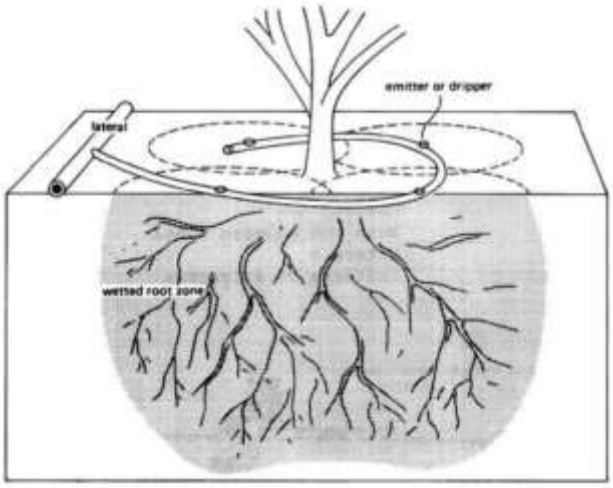

Fig. 1.0 wetting pattern under drip irrigation

Fig. 2.0 Sub-surface drip system

1. Smart irrigation systems

One of the most significant advancements in drip irrigation technology is the integration of smart irrigation systems. These systems utilize sensors, weather data, and soil moisture information to determine when and how much water is needed. By automating the irrigation process, farmers can optimize water usage and reduce waste.

Fig.1.0 Smart Irrigation Systems

For instance, companies like Rain Bird and Hunter Industries have developed smart controllers that connect to weather stations and soil moisture sensors. These devices adjust irrigation schedules based on real-time data, ensuring that crops receive the right amount of water at the right time (Rain Bird, n.d.; Hunter Industries, n.d.).

2. Pressure compensating emitters

Pressure compensating emitters are another innovative technology enhancing the efficiency of drip irrigation systems. Traditional emitters can deliver varying amounts of water depending on changes in pressure along the tubing, which can lead to uneven watering. Pressure compensating emitters maintain a consistent flow rate regardless of pressure fluctuations, ensuring uniform water distribution across the field. Research has shown that using pressure compensating emitters can improve crop yields by providing more consistent moisture levels. This technology is particularly beneficial in hilly terrains where pressure variations can be significant.

3. Subsurface Drip Irrigation (SDI)

Subsurface drip irrigation (SDI) is an advanced method where drip lines are buried beneath the soil surface. This approach reduces evaporation losses and minimizes weed growth while allowing for efficient nutrient application. SDI systems are particularly effective for high-value crops such as fruits and vegetables. According to a study published in the journal "Agricultural Water Management," SDI can increase water use efficiency by 20-30% compared to surface irrigation methods. The technology is gaining popularity among farmers looking to maximize their yields while conserving water resources.

4. Internet of Things (IoT) Integration

The Internet of Things (IoT) is making its way into agriculture, including drip irrigation systems. IoT-enabled sensors collect data on soil moisture, temperature, and humidity,

Fig. 3.0 Automation Systems

which can be accessed remotely via smartphones or computers. This real-time monitoring allows farmers to make informed decisions about irrigation schedules and water usage.

Companies like CropX and AgriWebb offer IoT solutions that integrate with existing drip irrigation systems, providing farmers with valuable insights into their operations (CropX, n.d.; AgriWebb, n.d.). By leveraging IoT technology, farmers can optimize their water management practices and improve overall efficiency.

5. Solar-Powered Drip Irrigation

As renewable energy sources gain traction in agriculture, solar-powered drip irrigation systems are becoming increasingly popular. These systems utilize solar panels to power pumps and con trollers, reducing reliance on fossil fuels and lowering operational costs.

A study conducted by the International Water Management Institute found that solar-powered drip irrigation systems can significantly reduce energy costs while improving water use efficiency (IWMI, 2019). This technology is particularly beneficial in remote areas where access to electricity is limited.

6. Advanced Filtration Systems

Water quality is a critical factor in the success of drip irrigation systems. Advanced filtration technologies are now available to ensure that water used in irrigation is free from contaminants that could clog emitters or harm crops. These filtration systems include sand filters, screen filters, and media filters designed to remove particles and impurities.

Fig.4.0 Solar Powered Drip Irrigation

By investing in high-quality filtration systems, farmers can prolong the lifespan of their drip irrigation infrastructure and maintain optimal performance.

Conclusion

The latest technologies in drip irrigation are revolutionizing water management in agriculture, enabling farmers to conserve resources while maximizing crop yields. From smart irrigation systems and pressure compensating emitters to IoT integration and solar-powered solutions, these innovations are paving the way for sustainable farming practices.

As water scarcity becomes an increasingly pressing issue worldwide, adopting advanced drip irrigation technologies will be essential for securing food production and ensuring the sustainability of agricultural practices in the years to come.

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IndGAP
A PATH TO SAFE AND SUSTAINABLE FOOD

About Author

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The globalisation of agricultural trade has enabled India, a country with enormous agricultural potential, to emerge as a major exporter of numerous agricultural products. Also, currently, there is an upsurge in e-commerce activities in India, using which many consumers are purchasing fresh fruits and vegetables directly from the farmers. While these trends benefit all farmers, they currently benefit only a small subset of the farming community, such as organic farmers and exporters. For all the other farmers also to avail the benefits of such trends in the markets, they must follow certain standards in production and provide a credible certificate ensuring the same. The government of India has one such certification scheme available which helps our farmers to attain certification by following certain standards during production.

IndGAP

IndGAP stands for India Good Agricultural Practices, a certification scheme offered by the Quality Council of India (QCI) for the farmers of the nation. Quality Council of India is an autonomous organisation working under the Ministry of Commerce and Industry since 1996. The certification prescribes certain practices that need to be followed by the farmers during their production process which ensures that the food which is produced is safe and sustainable. All the standards prescribed under the IndGAP certification are also aligned with the ISO 17065 standards for product/process certification, thereby making them valid internationally.

IndGAP Basic and IndGAP Premium

In India, small and marginal farmers constitute around 86% of the total farmers, who frequently lack sufficient land and resources to implement the recommended practices. Keeping this in mind, QCI is offering two different schemes, one catering to small and marginal farmers while the other for large farmers. IndGAP Basic is the certification scheme for small and marginal farmers. Importantly, the scheme also has a provision for tenant/lease land farmers. These landless farmers must have a documented agreement with the landowner stating that the latter has no power over the production process or products produced on the land. IndGAP Premium is a scheme aimed at large farmers.

Group certification

The scheme also has a provision for group certification and the certificate will be issued in the name of the group. All the registered Farmer Producer Organisations (FPOs) can avail the benefits of this certification scheme, opening avenues for them to access new markets. As small and marginal may often feel hindered by the certification charges and also lack essential knowledge and training on Good Agricultural Practices, FPOs can play a key role. As per the Economic Survey 2023-24, 8,195 FPOs are registered in India and the government is further working to increase their number and presence throughout the country. FPOs can play a significant role in increasing the number of farmers who have this certification by offering education and

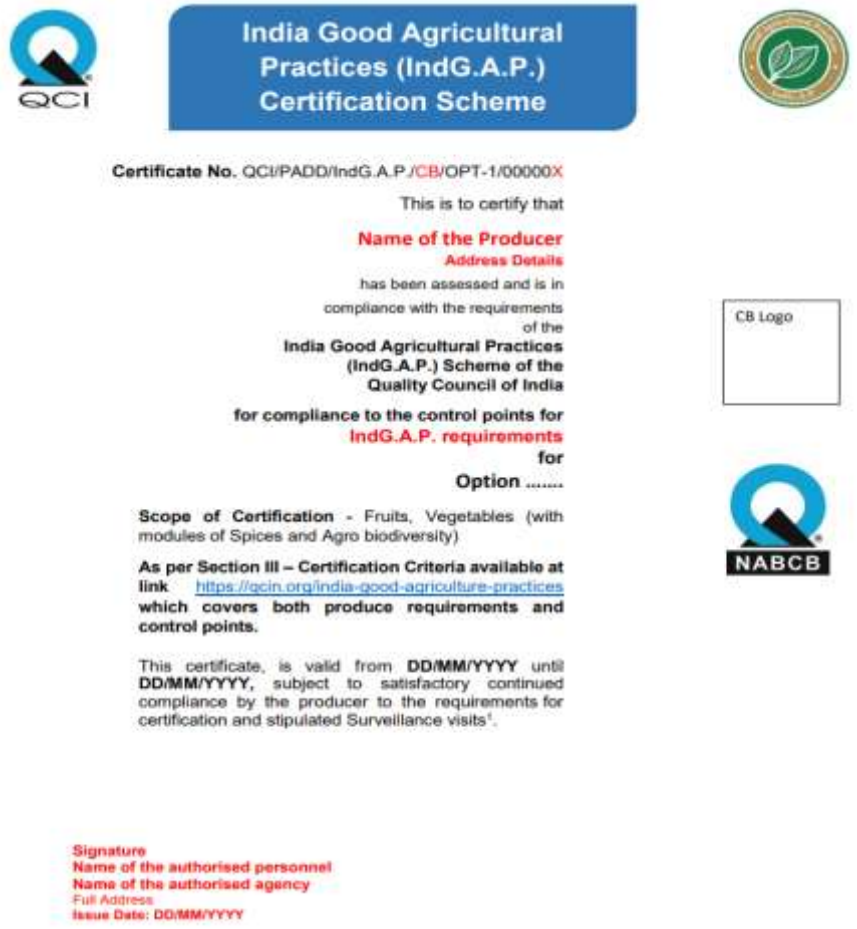

Image of IndGAP certificate template

training to all farmers in the group on the practices that must be followed to obtain this certification.

Overview of the certification process

A farmer or farmer group needs to register and apply for the certification to certification bodies (CB) which involves providing all the relevant information about the crop, location, area, etc. Following the application process, the CB will verify and inform the farmers within 7 days if any deficiencies are observed. If the information is found to be complete, the application will be accepted. Following that, farmers can seek a non-mandatory pre-assessment to assess their preparedness and the presence of required documents and records. Later, an initial evaluation by the CB will be done. Following that, both announced and unannounced audits (10% of the applicants) will be done in the later stages by the CB. Assessment will be done based on the Control Points and Compliance Criteria checklist, which is a list of all various practices that the farmers need to follow in the production process. There are 3 different compliance criteria which are under this scheme, namely, Major, Minor and Recommended. Farmers should comply 100 per cent with the Major criteria, 95 per cent of the Minor criteria, and no minimum compliance is required in case of Recommended criteria. Once the farmers are found to be complying with the practices, certification will be granted on the name of the farmer along with the name of the produce, validity date etc. The certificate will be valid only for 12 months with a provision for extension for a maximum period of 4 months given valid reasons as acceptable by the CB. The certification can be renewed at the end of each year given that the farmers are continuously following all the practices as required.

Advantages

Produce with the IndGAP certification guarantees that it is grown sustainably and safely, opening up new markets for the product, including retail stores and online retailers. Also, because the standards satisfy the demands of foreign importers, it makes our produce export-ready and comply with non-tariff trade barriers. Farmers can realize higher prices for their products, especially through group marketing by utilising the FPOs in the region. As the farmers are mandated to follow good agricultural practices, it ensures environmental and social sustainability. Overall, it also guarantees that the food produced is safe for consumption and free of any contamination which threatens human health.

Conclusion

IndGAP certification has a huge scope to cater to the needs of Indian farmers to realise their potential and avail the benefits of the current trends in the agricultural sector. Further, awareness is needed to the farmers regarding the availability of such a scheme and adequate training should be provided to the farmers to implement all the practices as necessary.

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CHALLENGES AND BARRIERS TO SUCCESS

FARMER PRODUCER ORGANISATION (FPO)

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India secure 2nd rank worldwide in farm production. Weak market network and credit has become one of the important challenge in taking up a new, improved technology. Small and marginal farmers still unable to recognise their capability to live a better life because they consider farming as their requirement not as a business. Therefore, FPO can be a right direction and support to empower them and increase their productivity and profit. Inadequate resources and approaches to technology can also reduce the scope of farmer producer organisation (FPO). Various FPOs fight back to keep up their operations because of issues like resource constraints, succession of leadership etc. Constant capacity-building programs and trainings are essential for FPO members. To recognise the best agricultural practices, its management and financial management. It has been witnessed that the FPOs can be implemented better when there is a strong capital structure, governance and management system, infrastructure development, financial and market accessibility etc. Often FPO concentrate on one crop which may leads to issues of crop failure. In India, Farmer Producer Organizations (FPO) become a sustainable solution to empower small and marginal farmers through assembling their resources and collective negotiating power. Despite their capability, a few barriers and challenges reduce FPOs' sustainability and success. FPO formation and registration process become a challenging and time consuming which includes complicated legal as well as regulatory requirements which disappoints farmers in forming FPOs. Rural farmers often lack information regarding the aim and benefits of forming FPOs. FPOs sometimes strive to establish sustainable and robust market connections for their agricultural products. In some parts of India, cultural and social norms may hamper formation and functioning.

What is FPO?

FPO stands for Farmer Producer Organization. FPO's members are Farmers. It offers support to the small and marginal farmers including processing, technical and marketing. The

concept of FPO was initiated as the farmers unable to market their products. FPO assists small and marginal farmers in enhancing the quality of produce along with good quality seeds, soil management and the application of less fertilisers, manure and irrigation. FPO helps farmers to sell the goods in proper market with improved modern technology. Generally, FPO is formed by the members' contribution and get registration under a trust, a non-profit organization or a corporation.

Challenges faced by FPOs

1. Farmers' mobilisation

Farmers' mobilisation is one of the most important challenge for FPOs. It's very difficult to motivate farmers to join in an FPO. Inadequate participation of farmers hampers the farmers' mobilisation.

2. Limited management skills

In FPO, Board of Director and Chief Executive Officer are elected by the farmers to run the organisation. They have inadequate experience and managerial skills to develop a business, leading to wrong decision making and mismanagement. Therefore, frequent training and capacity-building programmes have to provide for the proper running of the organisation.

3. Financial constraints

This is also a major constraints of FPO as they have little equity capital and cannot get investments and loans. Lack of financial support hinders FPO management and therefore requires a different funding approach.

4. Equity contribution

To form a FPO, contribution of Rs 1000/- is challenging for the farmers. FPO's CEO must give effort to influence farmers to trust FPO model.

5. Policy & regulatory challenges

Inadequate information and proper guidance hamper the utilisation of various government schemes.

6. Market access/ intermediary

FPO's important goal is to improve market access and reduce intermediaries. Intermediaries hinder the penetration of FPOs and as a result farmers get a small amount share of their produce.

7. Climate change and environmental sustainability

Due to lack of expertise and resources, FPOs find it challenging to adopt climate-resilient and agricultural practices to face effects of climate change.

8. Value addition and processing

Many FPOs still primarily involved in agricultural production, but do not have any value addition and processing facility, which leads to post-harvest losses and reduces farmers' income.

9. Geographical dispersion

Geographical dispersion of FPO's members is one of the challenges to coordinate among members and their management.

10. Infrastructure & logistics

A well infrastructure is required for FPO with scientific storage facility, good processing unit, transport and packaging facility. However, most of the FPOs don't have the logistics and infrastructure to store their agricultural produce, which results in post-harvest losses. Lack of transportation facility hinders the delivery of produce to the market and reduces the quality of the product.

Conclusion

FPOs could develop the agricultural sector by developing small and marginal farmers, enhancing their bartering power and by acquiring resources and markets. To evaluate the impact of FPO, a monitoring and evaluation system should be present so that transparency and accountability of FPO operations can be maintained among members and stakeholders. There must be a strong network and collaboration among FPOs so that they can disseminate their best knowledge, practices and resources. Collaboration with universities, research institutions and different extension services should be maintained so that FPOs can access the modern and improved agricultural innovation and research.

Dealing with the challenges FPOs may enhance the farmers' livelihoods by increasing crop yield and contribute to the country's economic development. In India, continuous efforts from different financial institutions, government, NGOs and most importantly farmers can establish an environment for FPOs to succeed.

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