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# Times of Agriculture

A Resonance in Agriculture

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March-2026

## Why International Trading Networks Are Critical to INDIA'S FOOD AND AGRI-SECURITY

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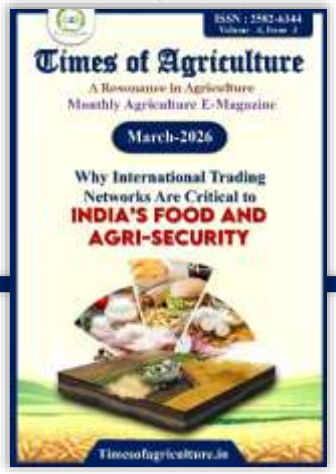


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## From the Editor's Desk

**Dear Readers,**

Greetings to all of you with the March issue of **Times of Agriculture** magazine. In this issue, we have given place in our magazine to various innovations related to agriculture and writers. As you all know, the main objective of our magazine is to present innovations related to agriculture to you in simple and easy language and to publish articles written by experts.

In this issue, in the cover story, we have given place to the article "**Agriculture Food Supply**." As you know, India is a food grain-rich country, but concerns regarding food security keep being expressed. We have become a self-reliant country, but in many parts of food supply we are still far behind. For example, we are still dependent on other countries for oil, and in our country, edible oil is used the most.

Similarly, other resources on which we are dependent on other countries, we also need to increase production to become self-reliant. Recently, to promote increasing technology, IFFCO has launched nano NPK fertilizer, which is a remarkable work. To reduce the expenditure of fertilizer subsidy, more and more production of liquid fertilizer will prove very beneficial for our country. Nano urea, nano DAP, and after that nano NP, such liquid fertilizers will free our country from traditional chemical fertilizers and will protect soil and environment.

Dear readers, we always hope that like every time, you will like this article. If you find any error in it, then you can inform us, and you can also send us your articles for the upcoming issue. Thank you very much to all of you.

Thank you.

Enjoy Reading!

**Editor-In-Chief**


# CONTENT

Times of Agriculture
A Resonance in Agriculture

# AGRICULTURE UPDATES

# IFFCO Introduces Indigenous Nano NPK Fertilisers

In a major step toward strengthening sustainable agriculture, the Indian Farmers Fertilizer Cooperative (IFFCO) has launched a new range of indigenously developed Nano NPK fertilizers. As one of the world's largest farmer-owned cooperatives, IFFCO continues to play a leading role in advancing agricultural innovation aimed at improving crop productivity while minimizing environmental impact. The introduction of these nano fertilizers aligns with India's broader push for self-reliance in critical agricultural inputs and reflects growing efforts to modernize farming practices through scientific advancements.

The newly introduced products include Nano NPK Liquid (8-8-10) and Nano NPK Granular (20-10-10), both of which have received approval under the Fertilizer Control Order, marking a significant regulatory milestone. These formulations are being recognized as global firsts, highlighting India's emerging leadership in fertilizer innovation. Designed for both foliar and basal application, the products ensure efficient and balanced nutrient delivery throughout various stages of crop growth. This dual-application capability enables farmers to use fertilizers more effectively, improving nutrient absorption and supporting healthier crop development. The advanced formulations are expected to enhance agricultural efficiency while maintaining soil health.

Furthermore, the launch of Nano NPK fertilizers is expected to significantly reduce dependence on conventional fertilizers, which are often resource-intensive and contribute to environmental degradation. By improving nutrient use efficiency, these products can help lower input costs for farmers, leading to better economic returns. At the same time, the initiative supports India's goal of reducing reliance on fertilizer imports, a critical factor in ensuring agricultural stability amid global supply chain uncertainties. Overall, IFFCO's latest innovation represents a crucial step toward building a more resilient, cost-effective, and environmentally sustainable farming ecosystem in the country.

# Smart Irrigation Tech Summit 2026 to Drive Sustainable Farming Solutions in Haryana

The "Smart Irrigation Tech Summit 2026" is set to take place from March 31 to April 1, 2026, in Tosham, marking a significant step toward promoting water-efficient and technology-driven agricultural practices in Haryana. The event comes at a crucial time as farmers in the state face mounting challenges such as declining groundwater levels, unpredictable climate patterns, and rising input costs. These issues have increasingly threatened the sustainability and productivity of agriculture, making the adoption of innovative irrigation solutions more important than ever. The summit aims to create a platform for stakeholders to discuss and address these pressing concerns through modern technological interventions.

Organised by the Micro Irrigation & Command Area Development Authority (MICADA), Government of Haryana, in collaboration with the Irrigation Association of India and the Irrigation Association of Haryana, the summit will focus on accelerating the adoption of advanced irrigation methods. Key highlights of the event include the promotion of micro-irrigation systems, automation, and precision agriculture technologies. Experts, policymakers, industry leaders, and farmers are expected to participate, facilitating knowledge exchange and collaboration. The summit will also showcase cutting-edge innovations such as Internet of Things (IoT)-enabled irrigation systems, artificial intelligence-based applications, fertigation techniques, and automated irrigation solutions designed to enhance water use efficiency and crop productivity.

A major objective of the summit is to bridge existing implementation gaps by improving awareness, coordination, and access to advanced irrigation technologies. It also seeks to strengthen partnerships between the public and private sectors, ensuring a more integrated approach to agricultural development. Furthermore, the initiative aligns with national priorities under the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) and supports broader goals of climate-resilient agriculture. By encouraging sustainable water management practices and technological adoption, the summit is expected to play a vital role in securing the future of farming in Haryana while contributing to long-term environmental and economic stability.

# Brazil Develops AI-Based Platform to Combat Soybean Rust

Scientists at Embrapa have developed an advanced cloud-based digital platform designed to help farmers diagnose and manage Asian soybean rust, one of the most damaging diseases affecting soybean crops globally. The innovation marks a significant step forward in the use of digital agriculture technologies to tackle crop diseases more efficiently. By leveraging modern tools such as artificial intelligence and data analytics, the platform aims to provide farmers with timely and accurate insights to protect yields and improve farm management practices.

The system integrates artificial intelligence, environmental sensor data, agronomic inputs, and digital image analysis to assess the risk of disease outbreaks. It gathers data from multiple sources, including environmental sensors, images of soybean leaves, and variables such as crop variety, plant spacing, and sowing schedules. This information is processed in the cloud and presented through an interactive online dashboard. Farmers can monitor climate conditions, track plant health over time, and receive technical recommendations for disease prevention and treatment. By enabling informed decision-making, the platform helps reduce unnecessary fungicide use while maintaining crop productivity.

Researchers involved in the project have designed the system to classify disease risk into three categories—low, medium, and high—based on a combination of environmental and agronomic factors linked to disease progression. The project was supervised by Paulo Cruvinel of Embrapa Instrumentation and supported by funding from the São Paulo Research Foundation. This innovation highlights the growing role of smart technologies in agriculture and underscores the importance of sustainable, data-driven solutions in addressing global crop health challenges.

# ICARDA launches global drive to breed low-methane, high-productivity sheep and goats

In a major step toward climate-resilient livestock farming, International Center for Agricultural Research in the Dry Areas, in collaboration with partners in Tunisia and Ethiopia, has launched a new project titled "Low-methane genetics expansion to small ruminants in Africa and Asia." The initiative is funded and supported by the Global Methane Hub and aims to accelerate the development of low-methane-emitting sheep and goats across low- and middle-income countries (LMICs). The project reflects growing global efforts to tackle agricultural emissions while ensuring sustainable livelihoods for farmers.

Small ruminants, including sheep and goats, make up nearly 55 percent of the world's domestic ruminant livestock and contribute about 9.6 percent of global livestock methane emissions. A large proportion of these animals are raised by smallholder farmers and pastoralists across regions such as Africa, Asia, and Latin America. Recognizing this, the project focuses on implementing targeted genetic strategies that can simultaneously reduce methane emissions and improve productivity, incomes, and resilience. By addressing both environmental and economic concerns, the initiative aims to create a balanced approach to sustainable livestock development in vulnerable regions.

The three-year project seeks to demonstrate that long-term and cumulative methane reduction can be achieved through genetic improvements without compromising animal performance or farmer livelihoods. While advanced breeding strategies for low methane emissions have already been adopted in cattle and sheep programs in developed countries, their application in LMICs remains limited. To bridge this gap, the initiative will integrate methane measurement into existing Community-Based Breeding Programs (CBBPs) for small ruminants in countries including Ethiopia, Tunisia, India, and Mongolia. By embedding this innovation into local breeding systems, the project aims to establish scalable and sustainable solutions for reducing emissions while strengthening rural economies.

# TNAU Secures Patent for Sugarcane Bud Cutter to Boost Efficiency and Reduce Costs

Tamil Nadu Agricultural University has been granted a 20-year patent by the Patent Office, Government of India, for an innovative sugarcane single bud sett cutter developed under the Sustainable Sugarcane Initiative (SSI). This development marks a significant advancement in mechanized farming, aimed at improving productivity and reducing input costs for sugarcane growers. The SSI method promotes the use of single-budded chips to cultivate uniform and high-yielding canes, and the newly patented machine is expected to further strengthen this approach by enhancing operational efficiency.

The machine addresses the limitations of conventional bud chippers and manual cutting methods, which are often labour-intensive and inconsistent. Powered by a 4-HP diesel engine, the cutter is designed to deliver fast and uniform cutting of sugarcane stalks into single-bud setts. It is built on a robust mild steel frame and equipped with advanced features such as a power transmission system, serrated cutting discs, protective covers, a cane holder for easy feeding, and a delivery chute. Additional components include a counter to track output, vibration control mounts, and wheels for easy mobility. The system operates at a blade speed of 2,200 rpm with 200 mm diameter cutting discs and allows adjustable sett sizes of 30 mm, 35 mm, and 40 mm.

Field trials have demonstrated the machine's strong performance and cost-effectiveness. It achieved a cutting capacity of around 1,700 buds per hour, significantly improving operational efficiency. The cost of bud cutting using the machine is estimated at ₹1,000 per hectare, compared to ₹6,250 with conventional methods, resulting in substantial savings for farmers. Developers report that the machine can reduce both time and cost by over 50 percent. Additionally, high germination rates—95 percent in protray nurseries and 90 percent under field conditions—highlight its effectiveness in ensuring better crop establishment. This innovation is expected to play a crucial role in modernizing sugarcane cultivation and enhancing farmer incomes.

# Government Launches Digital Fertilizer Subsidy System to Enhance Transparency and Efficiency

In a significant reform aligned with the vision of Digital India and the long-term goal of achieving a developed nation by 2047, the Department of Fertilizers has introduced a fully digital and integrated fertilizer subsidy claim process. Union Minister for Health & Family Welfare and Chemicals & Fertilizers, Jagat Prakash Nadda, inaugurated the new e-Bill system at Kartavya Bhawan. The launch marks a major step forward in promoting technology-driven governance and strengthening financial transparency within the fertilizer subsidy framework, which is a critical component of India's agricultural support system.

The newly introduced digital platform is designed to handle fertilizer subsidy claims worth nearly ₹2 lakh crore annually through a seamless end-to-end online process. This reform aims to eliminate manual interventions, reduce delays, and improve accuracy in claim settlements. Describing the initiative as a transformative step, Nadda emphasized that the integrated system would enhance transparency, efficiency, and accountability in public financial management. The move is also expected to benefit fertilizer companies by ensuring faster processing of claims, ultimately contributing to a more stable and reliable supply chain for farmers across the country.

The platform has been developed through the integration of the Department of Fertilizers' Integrated Financial Management System (iFMS) with the Public Financial Management System (PFMS) operated by the Controller General of Accounts under the Ministry of Finance. This technological convergence ensures real-time tracking, better coordination between departments, and improved monitoring of subsidy disbursement. By leveraging digital infrastructure, the government aims to streamline operations and strengthen governance mechanisms, reinforcing its commitment to building a transparent, efficient, and future-ready administrative system in line with national development goals.

COVER STORY

# Why International Trading Networks Are Critical to INDIA'S FOOD AND AGRI-SECURITY


About the Author

**Mr. Abhishek Wadekar**

**Founder Chairman**

**Tradelink International Pvt. Ltd.**


In the context of a highly interconnected global economy, international trading networks are the lifeline for food and agricultural security in India. Being one of the most populated countries in the world and a significant contributor to global food production, the food and agricultural security, sustainable growth, and price stability in the country, along with coping with climatic and geopolitical shocks, are increasingly dependent on the strength of international trading networks.

As a leading global commodities and fertilizer trade player, I have witnessed how international trading networks are the backbone of food and agricultural security, and the food and agri landscape in India benefits immensely from its diverse trading relationships that cover all continents, commodities, and market classes.

## 1. Enhancement in Food Availability and Pricing Stability

India has witnessed a significant rise in its agricultural output in recent decades. The food grain output in India has reached around 3,539.6 lakh metric tons in the financial year 2024-25, growing by around 6.5% over the previous financial year, primarily driven by growth in rice, wheat, and horticulture crops. The rice output in the country has been projected at around 1,490.7 lakh metric tons in the financial year 2024-25.

While the output level is a significant indicator of food security, there are instances where the overall output level is impacted by factors such as seasonal gluts or shortages, weather-related factors, and price volatility in the international market, thereby requiring cross-border trade to address food security issues in the country and protect its consumers from adverse price movements in food commodities such as edible oils, pulses, and maize, among others.

This has been witnessed in the recent past, where the international rice market has witnessed a sharp response to changes in exports, with the international price touching a 12-year high in response to changes in exports from major rice-producing countries.

## 2. Fueling Export-Led Growth and Farmer Prosperity

India's agricultural sector is an export-driven sector in a world where the demand for quality food products is increasing. In FY25, the agro exports of India have risen to an all-time high of around US$51.86 billion, compared to US$48.15 billion in FY24. This is a clear indication of the increasing competitiveness of Indian agro exports in the global arena.

India's emergence as a global agro exporter is a boost to the prosperity of farmers in the country. Commodities like marine products, spices, basmati and non-basmati rice, and processed food items are in increasing demand in markets across the Asian, African, European, and American continents. For example, in the year 2025, India exported over 21.5 million metric tons of rice, making it one of the top rice exporters in the world and further strengthening its position as a food provider to the world.

### 3. Access to Essential Inputs and Nutrients

Though India has managed to achieve self-sufficiency in many food items, it is still strategically dependent upon the international system in terms of accessing essential inputs and nutrients for the agricultural sector, especially fertilizers. Nutrients like potash (MOP), rock phosphate, and micro nutrients are mostly imported due to the lack of sufficient reserves in the country. Recent figures suggest that the import of fertilizers to India is likely to reach ~18 billion dollars in the FY25-26 period.

The robust and diversified system ensures the smooth availability of fertilizers, even during geopolitical crises, and hence prevents any scarcity that could affect the productivity of the crops. The long-term relationships with the Middle East, North African, and Southeast Asian nations also ensure the availability of the products at reasonable prices, protecting the Indian farmer from any price volatility.

### 4. Strengthening Resilience Against Global Shocks

The world food security system is the vital support system in a world facing the challenge of climate change, conflict, and economic volatility. Network economists and scientists have been stressing the need for a resilient world food system characterized by the diversity of trade partners and the redundancy of the supply chain, both of which contribute to the strength of India's food systems. A robust world food system is the support system that helps the Indian food system overcome localized disruptions and prevents the Indian food system from being impacted by adverse global shocks. Whether India is facing droughts, floods, or disruptions in the logistics of the food system, the ability to draw from alternative sources or to shift the direction of food exports based on the highest demand is the fundamental pillar of food security for any major agricultural economy.

### 5. Technology, Standards, and Market Innovation

Trade networks not only help in the trade of goods but also in the sharing of technologies, standards, and best practices. Trade in the international market forces Indian producers to adopt global standards in food safety, improve their refrigerated logistics, and adopt traceability, which in turn helps to improve the quality of their products.

The foreign direct investment (FDI) received by India in its food processing industry and agricultural services sector, valued at over $13 billion cumulatively up to the middle of 2025, is a clear example of the trade-related flow of technology that is helping the sector grow.

# CARBON FARMING

## A NATURE-BASED ALTERNATIVE FOR CLIMATE CHANGE

About Author

**Pragti Negi***
Dept. of Veg. Sci., College of Horticulture, V.C.S.G. Uttarakhand University of Hort. & Forestry, Bharsar, Uttarakhand

**Shivani Bisht**
Deptt. of Hort., School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand

The agriculture sector is the major contributor of carbon dioxide and other greenhouse gas emissions in the atmosphere. To curb these emissions, the concept of "Carbon Farming" has gained importance. It refers to the agricultural practices that focus on alleviating the levels of greenhouse gases and enhancing the carbon sequestration in soils and vegetation, thereby minimising the negative impacts of climate change. Such practices involve agroforestry, conservation tillage, incorporation of biochar and enhanced crop and livestock management. All these approaches capture the atmospheric $CO_2$ and store it in agricultural landscapes, eventually providing many benefits includes improved soil health and agricultural productivity, increased biodiversity and a higher resilience to climate change. The article below provides insights into carbon farming and how this approach will help the nation to achieve its interim net-zero target by 2030.

### Idea behind carbon farming

In the contemporary world, agriculture is considered one of the significant sources of carbon dioxide and other greenhouse gas emissions, but the scenario may take a turn if the global agriculture shifts towards carbon farming. If that situation arises, then, instead of being a major source of GHGs, agriculture can act as a sink.

At present, the agriculture sector stands at a crucial turning point. On the one hand, rising input costs, reduced soil fertility, and fluctuations in temperature and rainfall are posing challenges for farmers; on the other hand, the increasing population demands higher food production. To add to this, climate change has further worsened this problem, making conventional farming practices less stable and unsafe.

In such a situation, the carbon farming practice emerges as an effective solution that supports both crop productivity

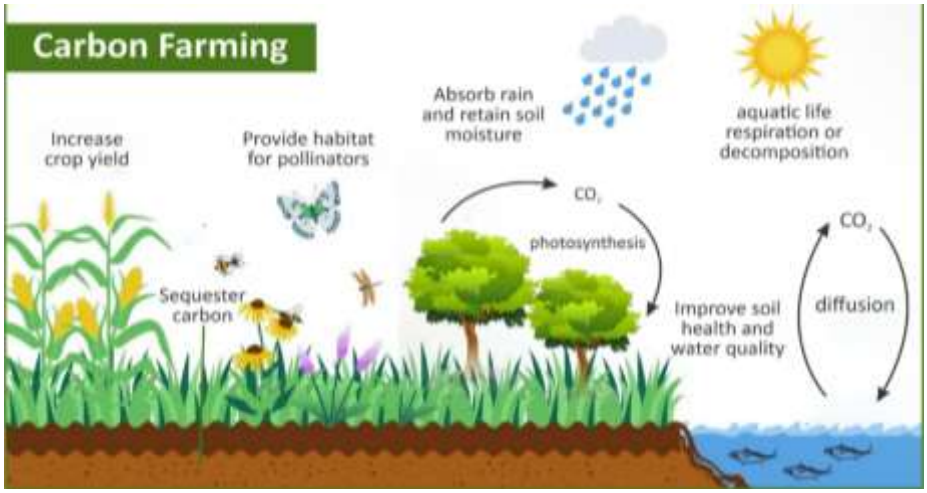



**Fig:** General overview of carbon farming

and environmental sustainability. Under this concept, soil health is enhanced, the capacity to withstand climate change is increased, and farmers earn additional income through carbon credits. The adoption rate of carbon farming in India is increasing rapidly, with the involvement of states like Punjab, Haryana, Kerala, Uttar Pradesh and Jharkhand. In 2022, Kerala became the first state to establish carbon-neutral farming methods across 13 farms.

## Key practices involved

Carbon-smart farming practices aim to store/ capture carbon, thereby reducing greenhouse gas emissions. Some of these conservation measures are given below

### Reduced/No-Till Agriculture

This core carbon farming practice aims to minimise soil disturbance so that carbon sequestration and soil organic matter are enhanced, and greenhouse gas emissions are reduced. These involve minimal soil disturbance, thereby preserving soil organic carbon. In addition to these, reduced or no-till practices encourage water conservation by enhancing water infiltration and minimising surface water flow. Therefore, these two approaches emerged as effective guardians for ecological sustainability.

**Fig:** A reduced/no-till agricultural land

### Forest management

This approach encompasses various strategies, like afforestation and reforestation, in addition to the diversification of species and peatland restoration. Forests play a vital role in alleviating climate change by capturing carbon dioxide, followed by storing it in soil and forest biomass. Forests do not merely occupy 40% of the area, but also serve as a natural solution to reduce atmospheric carbon dioxide. Various agroforestry systems like alley cropping, silvi-pasture, windbreaks and forest farming are the powerful tools that aids to store carbon, restoring soil health and eventually provide benefits to the farmers.

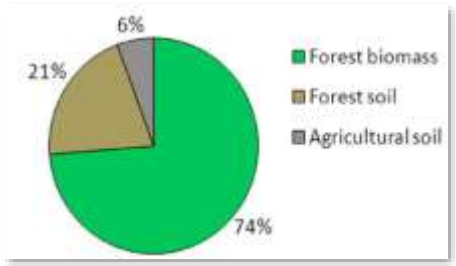



**Fig:** Importance of forests and soil as a carbon sink

### Green energy production

Globally, fossil fuel-based energy generation is the largest source of greenhouse gas emissions. The switch from non-renewable energy to renewable sources (wind, solar and biomass) helps to mitigate these emissions in the agricultural and economic sectors. Additionally, this displacement also creates carbon credits that lower the impact of the climate crisis. India already has an advanced green energy production system, which comprises 51% of total installed capacity (from renewable sources), which ranks India at 4th position, on a global scale.

### Optimised fertiliser application

Chemical fertilisers, when applied in fields, release greater amounts (up to 60-70%) of greenhouse gases, while the remaining amount (30-40%) is


**Fig:** Utilisation of renewable energy in carbon farming

released during the production process. Annually, a total of 2.6 gigatons of carbon is said to be emitted by the application of both manure and synthetic fertilisers. Therefore, it is important to emphasize both the aspects of production and application to reduce the impact of fertilisers on global warming. Farmers can follow organic farming practices (use of compost, organic manure, mulching, crop rotation) to improve soil fertility, enhance crop yield, and carbon sequestration.

### Agroforestry

The amalgamation of trees with crops or livestock is defined as "Agroforestry". This strategy originated in the late 1970s, with the idea that trees play a very productive and protective role in preserving agricultural interests. By utilising agroforestry operations, farmers can enhance their ability to cope with the impacts of climate change.

### Improved residue management

### Using cover crops and companion planting

These two are the foundational practices of carbon farming that reform the agricultural land from a carbon source into a carbon sink. Cover crops like rye, clover, legumes, and grasses improve the soil structure, reduce the leaching of nutrients and enhance microbial activity in soil, thereby contributing to carbon sequestration and limiting the amount of carbon dioxide in the atmosphere. Companion planting (planting two or more crops together), on the other hand, increases the crop diversity and supports each other's growth, hence establishing a more resilient farming system.

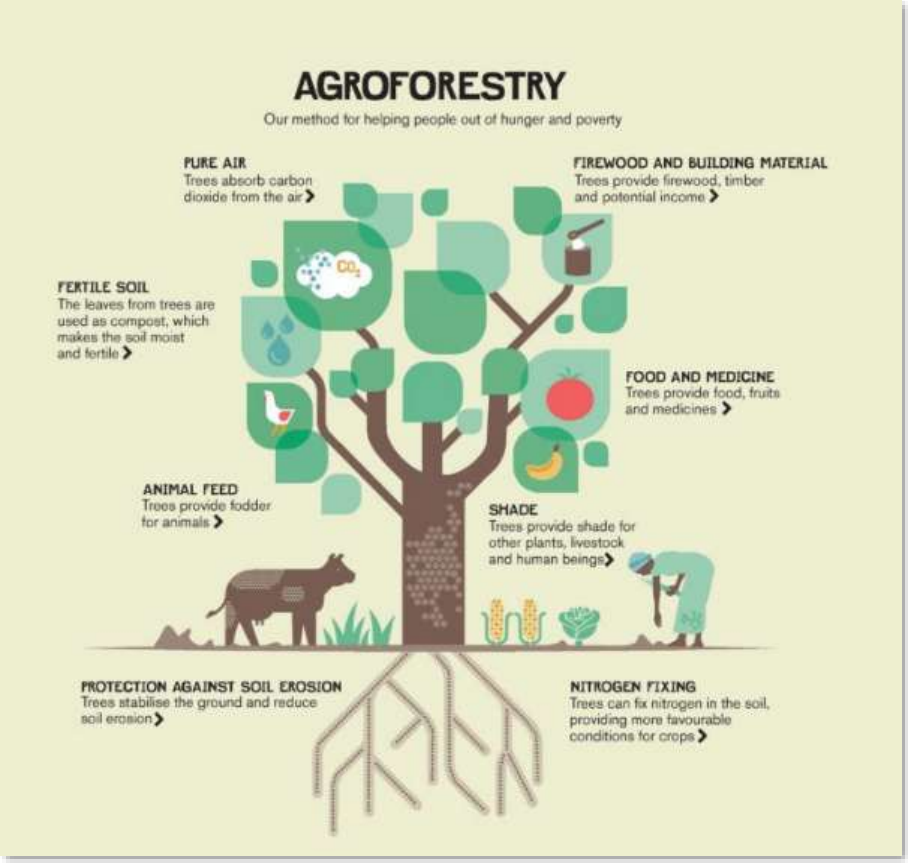



**Fig:** Role of agroforestry in carbon farming

## India's role in carbon farming

### Carbon Credit Framework for Agriculture in India

It is a well- structured, government-funded system that assigns a monetary value to greenhouse gas (GHG) emissions, thereby permitting entities to trade carbon credits. Thus, one carbon credit denotes permission to emit 1 ton of carbon dioxide. Basically, it is a system wherein, if a country emits more $CO_2$, it has to buy extra credits and sell additional credits when emissions are reduced. The position of Indian agriculture in carbon emissions makes this framework a critical step to meet the national climate goals adopted under the Paris Agreement and to encourage rural economic development. The core components of this framework are:

1. Low-carbon programs for agriculture.
2. Soil-carbon capture strategies.
3. Access to the carbon market and authentication standard.
4. Participation from corporation.
5. Collaboration with the government schemes.

### Major projects and companies for carbon credit in India

Currently, the nation is playing a big role in broadening the large-scale carbon sequestration and emission control projects. Big companies like Varaha, Climate Ag and Grow Indigo top the list to implement significant projects that cover hectares of land and

reduce a large amount of $CO_2$ emissions of approximately 4 million metric tons. These companies improve carbon sequestration efficiency by utilising collaboration, executing innovative farming techniques, and investing in technologies like satellite-based carbon measurement, developed by Sagri, Bengaluru. Mahanadi Compressed Biogas and Nurture Agtech are among others that expands the India's carbon farming landscape by emphasising methane and nitrous oxide reduction, which are overlooked in the carbon-centric frameworks. Hence, the presence of such participation provides a strong foundation for India's evolving carbon market. Below are some of the carbon farming initiatives adopted in India.

| Company name | Year of establish -ment | Location | Initiatives taken | Operational area (hectares) | Annual emission reductions (metric tons of $CO_2$) |
|---|---|---|---|---|---|
| **Varaha ClimateAg** | 2022 | New Delhi, India | It owns the largest emission reduction project in India. | 20,00,000 | 47,96,219 |
| **Boomitra Inc.** | 2016 | USA | Administers in India, Latin America, and East Africa. It has also collaborated with Kirishitan, India, to promote carbon farming in India. | 2,00,000 | 7,50,000 |
| **Mahanadi Compressed Biogas (CBG) Pvt. Ltd.** | 2022 | Chhattisgarh , India | It emphasizes reducing methane gas emissions via biogas initiatives. | -- | 64.457 |
| **Landmark Agri Exports Pvt. Ltd.** | 2020 | Bhopal, India | Through agricultural exports, it enhances carbon credit efforts. | 8,085 | 58,722 |
| **Sagri Bengaluru Pvt. Ltd.** | 2019 | Bengaluru, India | A Japan owned subsidiary, having expertise in satellite-based soil carbon measurement. | -- | -- |

## Some government initiatives for carbon management

India is actively engaged in advancing carbon farming to mitigate the effects of climate change with initiatives like the Carbon Credit Trading Scheme (CCTS), the Voluntary Carbon Market Framework for Agriculture, and the Green Credit Programme (GCP). The overview of it is given below-

1. **Carbon Credit Trading Scheme (CCTS)-** This scheme is set to launch officially in mid-2026 and provides a national framework that facilitates the trade of carbon credits across various sectors. It will focus on those sectors that emit more carbon dioxide and incentivize them to reduce emissions. As a result, it will establish a credible and transparent market.
2. **The Voluntary Carbon Market Framework for Agriculture-** This mechanism was launched by the Government of India in 2024 to provide benefits to small and medium-scale farmers by voluntarily buying and selling carbon credits to mitigate greenhouse gas emissions.
3. **The Green Credit Programme (GCP)-** Launched in October 2023 by the Government of India under the Environment Protection Act, 1986. It involves the voluntary-plantation activity across the nation, thereby gaining "Green Credits" and

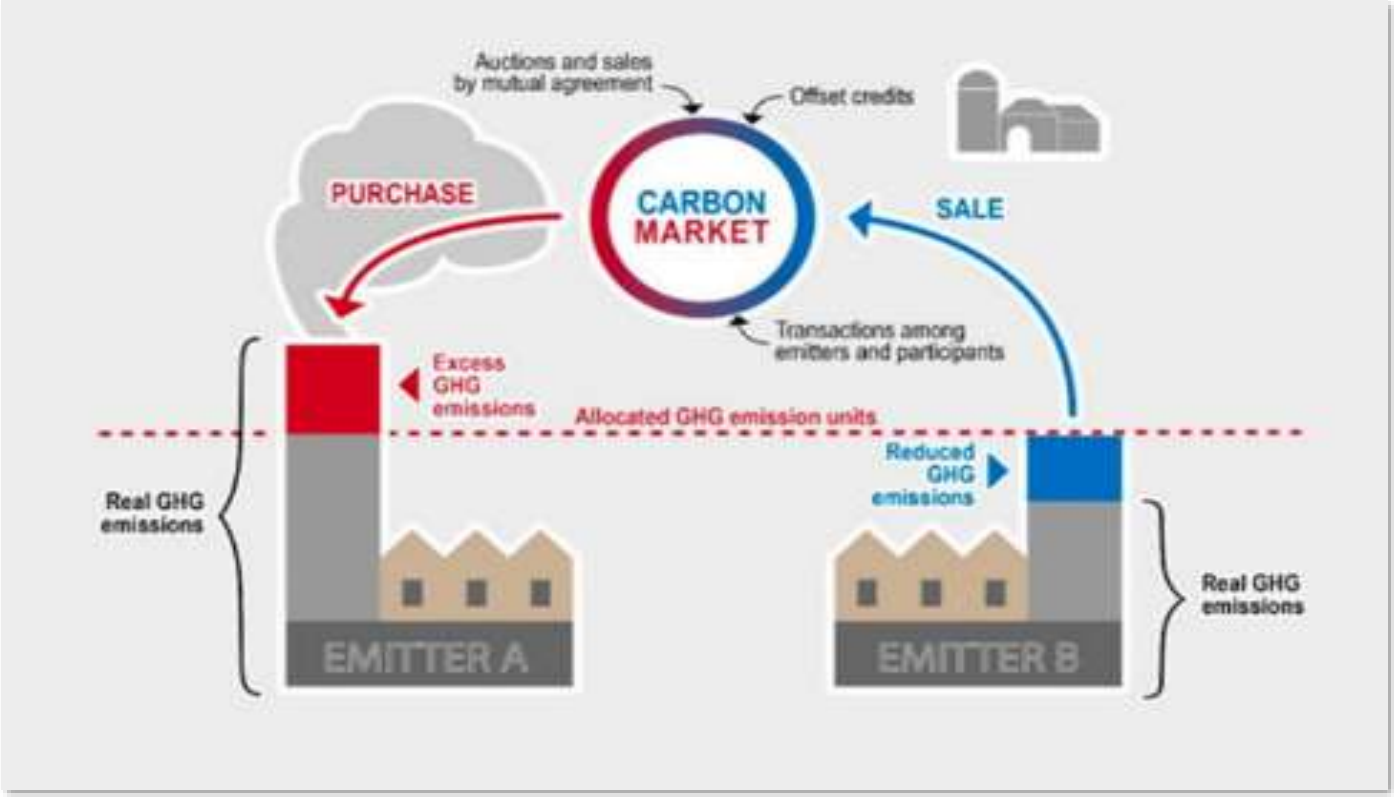
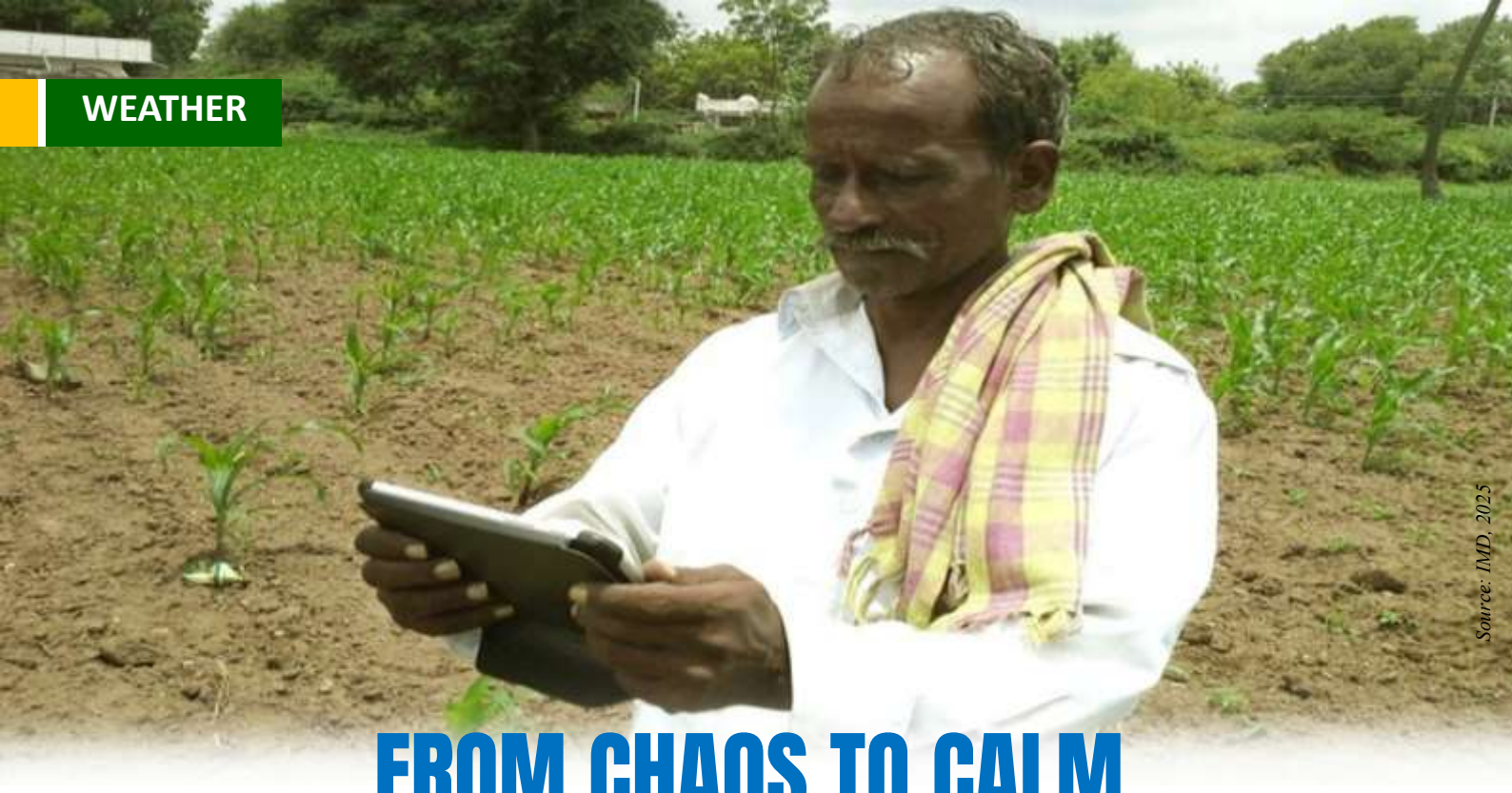



**Fig:** Carbon Market Framework

recording the degraded land which, in future, can be utilised for afforestation programmes.

India's transformation to carbon farming requires a holistic and collaborative approach to strengthen carbon sequestration and minimise greenhouse gas emissions. Although financial incentives such as carbon credits and subsidies are also available, the adoption rate among farmers remains low, primarily due to a lack of awareness and technical knowledge. This should be resolved through institutional support, government schemes, and research initiatives. Furthermore, the establishment of a carbon credit framework and adoption of various practices like no tillage, agroforestry, cover crops and companion planting signify that India has already taken a step towards a carbon-neutral future.



Source: IMD, 2025

# FROM CHAOS TO CALM
## ODISHA'S WEATHER FORECASTING TRIUMPH

About Author

**Satya Pragyan Kar***
**Ph.D. (Ag.) Scholar**
Deptt. of Agril. Meteorology, BAU, Kanke, Ranchi, Jharkhand
**Chitrotpala Dehury**
**M.Sc. (Ag.) Scholar**
Deptt. of Agronomy, BAU, Kanke, Ranchi, Jharkhand

Imagine a time when a cyclone could devastate an entire region with little warning, leaving thousands of dead and crops ruined. Odisha, a state on India's eastern coast, faced this nightmare during the 1999 Super Cyclone, which claimed over 10,000 lives and destroyed vast farmlands. Fast forward to 2025, and the story has changed dramatically. Thanks to the India Meteorological Department (IMD), Odisha has transformed from a crisis zone to a beacon of confidence, thanks to its revolutionary weather forecasting and early warning systems. This article explores how IMD's four-stage cyclone alert system has saved lives and crops, drawing from historical progress and recent successes, with voices from farmers who now rely on these forecasts.

### A historical turnaround

The 1999 Super Cyclone was a wake-up call for Odisha. With winds exceeding 260 km/h and a storm surge flooding 35 km inland, the lack of accurate forecasting led to catastrophic losses (IMD, 2025). Post-1999, IMD embarked on a modernization drive, integrating advanced technology like Doppler radars and super-computers. By 2007, under Dr. Mrutyunjay Mohapatra's leadership, IMD set ambitious goals to improve cyclone forecasting accuracy by 20% by 2015 and 40% by 2020—targets it surpassed (Mohapatra, 2021). The introduction of the four-stage color-coded warning system—green (all clear), yellow (be aware), orange (be prepared), and red (take action)—has become a lifeline for the state.

This system, refined over decades, now provides alerts up to seven days in advance, with red warnings issued 24 hours before landfall. The 2013 Cyclone Phailin, accurately predicted by IMD, saw over a million people evacuated, reducing deaths to just 45 compared to thousands in 1999 (IMD, 2025). Recent data from June 2025 shows IMD's Bharat Forecast System, launched this year, achieving 90% accuracy in predicting Cyclone Dana's path, minimizing crop damage in coastal districts (IMD, 2025).

### Saving lives and crops

Accurate weather forecasts are a game-changer for Odisha's 60% rural population dependent on agriculture. The 2024 monsoon season brought heavy

rains, but IMD's timely orange and red alerts allowed farmers to harvest early or protect crops with tarps. In Kendrapara, a district prone to flooding, rice yields dropped only 5% despite 200 mm of rain in 24 hours, thanks to these warnings (ODDMA, 2025).

Farmer testimonials highlight this impact. Rajendra Swain from Puri says, "In 2020, Cyclone Amphan destroyed my paddy, but this year, IMD's app alerted me three days before Dana. I moved my harvest indoors and saved 80% of my crop." Similarly, Laxmi Jena from Bhadrak adds, "The red alert gave us time to secure our livestock and vegetables. We lost nothing this time." These stories reflect how forecasts empower farmers to act, reducing economic losses estimated at ₹500 crore annually pre-1999 to ₹50 crore in 2024 (FAO, 2023).

The four-stage system's precision is backed by 37 Doppler radars (up from 15 in 2013) and the Meghdoot app, delivering hyperlocal updates in 12 languages. During Cyclone Dana (June 2025), IMD's early warnings enabled the Odisha Disaster Rapid Action Force (ODRAF) to deploy 150 teams, ensuring zero casualties—a stark contrast to the 1999 toll (ODDMA, 2025).

**Table 1: IMD Four-Stage Cyclone Alert Impact (2020-2025)**

| Alert Stage | Lead Time | Action Taken | Impact (Lives Saved/Crop Loss Reduction) |
|---|---|---|---|
| **Green** | 7 days | Monitoring | N/A |
| **Yellow** | 3-5 days | Awareness campaigns | 50% crop protection |
| **Orange** | 48 hours | Evacuation planning | 75% lives saved |
| **Red** | 24 hours | Full evacuation | 100% lives saved, 80% crop protection |

*Source: ODDMA, 2025; IMD, 2025*

## The science behind the success

IMD's forecasting relies on real-time data from 1,500 Automatic Weather Stations and satellite imagery, processed by the Bharat Forecast System. This system, dedicated on June 27, 2025, by Union Minister Dr. Jitendra Singh, offers 15-day outlooks with 85% accuracy for rainfall and cyclone tracks (IMD, 2025). The color-coded alerts are tailored to cyclone intensity: yellow for winds of 50-60 km/h, orange for 60-90 km/h, and red for above 90 km/h, aligning with WMO standards.

## hallenges and the road ahead

Despite progress, challenges remain. Remote areas like Malkangiri still lack real-time access to alerts, affecting 10% of farmers. IMD plans to add 25 more Doppler radars by 2027 and expand the Panchayat Mausam Sewa to all 6,800 panchayats by 2026 (IMD, 2025). Collaboration with private agencies, as seen in Kerala, could further enhance Odisha's system, ensuring no farmer is left behind.

## Conclusion

Odisha's weather forecasting revolution is a testament to human resilience and technological innovation. From the devastation of 1999 to the confidence of 2025, IMD's four-stage alert system has turned crisis into opportunity, saving lives and crops while empowering farmers. As climate change intensifies, scaling these efforts will secure Odisha's agricultural future, making it a model for India and beyond. Join this journey by staying updated via IMD's digital platforms and supporting local preparedness initiatives.

# PRIMING PROFITS

## SEED PRIMING AS THE NEXT BIG OPPORTUNITY FOR AGRIPRENEURS

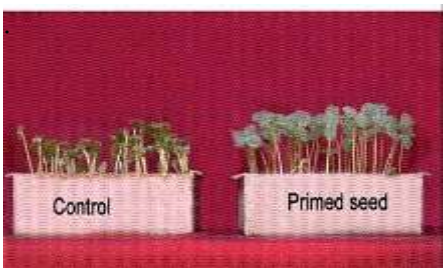
**About Author**

**Ruchika**
**M.Sc Seed Sci. and Tech.**
Deptt. of Seed Sci. and Tech.
Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.)

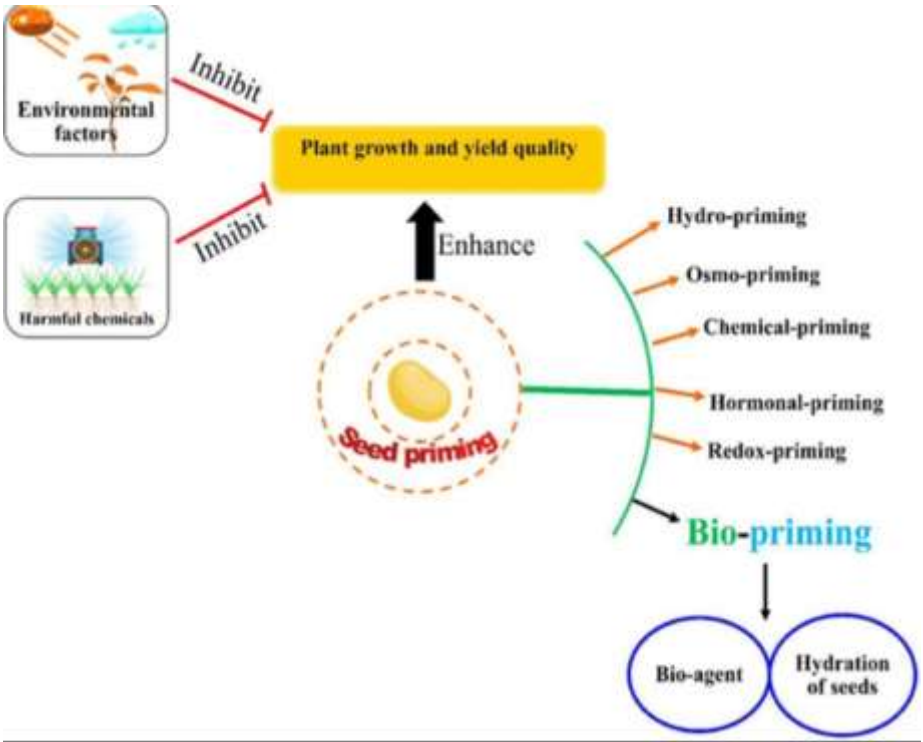
Seed priming is rapidly gaining attention as a simple yet powerful innovation that bridges scientific advancement with field-level impact. By partially hydrating seeds to activate early metabolic processes without initiating germination, priming enhances seed performance—resulting in faster, more uniform emergence, improved seedling vigor, and better tolerance to environmental stresses. Techniques such as hydropriming, osmopriming, and biopriming are increasingly being adopted due to their low cost, ease of application, and proven benefits across a wide range of crops.

For agripreneurs, seed priming opens up a dynamic and scalable business opportunity. From establishing localized seed treatment units to supplying priming agents and offering customized services to farmers, this technology aligns well with the growing demand for quality inputs and climate-resilient agriculture. Its suitability for smallholder systems makes it particularly relevant in countries like India, where improving seed quality can directly enhance productivity and farm income.

With strong research backing from institutions such as Indian Council of Agricultural Research, seed priming is evolving beyond a laboratory concept into a practical, profit-oriented solution. This article explores how seed priming can serve as both a productivity tool and an entrepreneurial pathway, positioning it as a key driver in the future of sustainable agriculture.




*The future of farming may not begin in the field—it may begin before the seed is even sown*




On a quiet morning in a village, Ramesh, a young agriculture graduate, carefully drains a batch of soaked seeds laid out for drying. To most, it's a simple task. To him, it's a business in motion. What started as a small experiment in seed priming has now turned into a steady source of income—and a model for rural agripreneurship.

**Seed priming,** a pre-sowing technique where seeds are partially hydrated to activate early metabolic processes, is gaining attention as a low-cost, high-impact innovation. By preparing seeds for faster and more uniform germination, priming improves seedling vigor, enhances stress tolerance, and ultimately boosts crop productivity.

For farmers dealing with erratic rainfall and unpredictable growing conditions, these benefits are critical. Studies have shown that seed priming can improve germination rates by 10–25% and increase yields by 5–20%, depending on the crop and conditions. In an era of climate uncertainty, such gains can make a significant difference.

## From science to startup

What makes seed priming especially attractive is its simplicity. Techniques like hydro-priming, osmo-priming, and bio-priming require minimal infrastructure. Yet, their impact on crop establishment is substantial.

Ramesh began with hydro-priming, using basic containers and locally available resources. Farmers quickly noticed improved germination and uniform crop stands. Encouraged by the response, he expanded into bio-priming, introducing beneficial microbes to enhance plant growth and soil health.

Within a season, demand grew. Farmers were willing to pay for treated seeds because the results were visible. What began as a small experiment evolved into a scalable enterprise.

## An emerging agribusiness opportunity

Seed priming is emerging as one of the most accessible agripreneurship models. It does not require large landholdings or expensive machinery—only technical knowledge and consistency. Entrepreneurs can explore:

- Service- based models (treating farmers' seeds),
- Product-ased models (selling primed seeds),

- Integrated models (priming + biofertilizers/biostimulants).

With an initial investment of ₹50,000–₹2 lakh, a small unit can be established, with profitability achievable within one or two seasons.

Technology is taking priming further-

- Modern innovations are pushing seed priming into the AgriTech space.
- Nano-priming enhances nutrient delivery.
- Precision systems control moisture and temperature.
- Digital advisory tools help optimize protocols.

This blend of traditional science and modern technology is what makes priming highly scalable.

## Why the timing is right

With increasing emphasis on sustainable agriculture, farmers are looking for low-cost, chemical-free solutions. Seed priming reduces dependency on agrochemicals, improves input efficiency, and supports better crop establishment—making it highly relevant in today's context.

## Challenges and the road ahead

Despite its benefits, adoption remains limited due to low awareness, lack of standardized protocols, and need for technical guidance. However, these challenges also create opportunities for training, extension services, and startup innovation.

### 📌 ICAR Insight Box

- Research and field demonstrations by the Indian Council of Agricultural Research and its institutes have consistently highlighted the benefits of seed priming:
- Priming enhances germination speed and uniformity across crops like wheat, rice, and vegetables
- Bio-priming with beneficial microbes improves nutrient uptake and disease resistance
- Studies from ICAR institutes such as Indian Agricultural Research Institute show improved seedling vigor and yield stability under stress conditions
- Priming is recommended as a climate-resilient, low-cost technology for smallholder farmers

These findings reinforce seed priming as both a scientifically validated practice and a field-ready innovation.

## A Small Step, A Big Impact

Back in the village, Ramesh walks through fields where uniform rows of healthy seedlings stand as proof of his work. For farmers, the benefits are visible. For him, the rewards are both financial and personal.

Seed priming may seem like a small intervention, but its impact is far-reaching. It improves crop performance, reduces risk, and opens new avenues for rural entrepreneurship.

In a time when agriculture needs solutions that are affordable, scalable, and sustainable, seed priming offers exactly that. For agripreneurs, it is not just a technique—it is an opportunity.

Because sometimes, the biggest profits in agriculture don't come from expanding fields—but from improving the very first step: the seed.

■■■

# CLIMATE-SMART AGRICULTURE

## CULTIVATING SOLUTIONS FOR LOWER EMISSIONS

**About Author**

**A.V. Anusha**
**Ph.D Scholar**
Department of Agronomy
**Rajeshwar Malavath**
**Professor**
Department of Soil Science & Agricultural Chemistry
**V. Ramulu**
**Director**
International Programmes
College of Agriculture, Rajendranagar, PJTAU
**T.L. Neelima**
**Senior Scientist**
RS& GIS unit, Centre for Digital Agriculture & Tech., Rajendranagar, PJTAU

Climate-Smart Agriculture (CSA) is a sustainable approach that addresses both food security and climate change. It aims to increase farm productivity, improve resilience to a changing climate, and reduce greenhouse gas emissions. While agriculture contributes to climate change through emissions from livestock, fertilizers, and soil practices, it is also affected by rising temperatures, irregular rainfall and extreme weather. Climate-smart agricultural practices include reduced tillage, crop diversification, efficient water use, agroforestry, and improved livestock management. These methods enhance soil health, increase carbon storage and reduce environmental impact. Additionally, Climate- smart agricultural practices help farmers lower costs, improve yields and increase income, while benefiting from government support and carbon credit opportunities.

### Introduction

Agriculture is essential for ensuring food security and supporting rural livelihoods, but it is also a major source of greenhouse gas (GHG) emissions. Key contributors include methane from livestock and rice fields, nitrous oxide from fertilizer use, and carbon dioxide from fuel consumption and soil disturbance. These emissions drive climate change, which negatively impacts agriculture through rising temperatures, unpredictable rainfall, droughts and extreme weather conditions. To overcome these issues, Climate-Smart Agriculture has been introduced as an effective approach that

combines sustainable farming practices with environmental protection. It focuses on three main goals: improving productivity, building resilience to climate change and reducing emissions. Practices such as reduced tillage, crop diversification, efficient water use and better livestock management help make farming more sustainable. These methods not only lower emissions but also improve soil health, enhance resource efficiency and increase farm income making CSA a practical solution for both environmental sustainability and economic development in agriculture.

## Climate-Smart Agricultural Practices

Climate-smart agricultural practices involve innovative and sustainable methods that help farmers adapt to climate change while reducing greenhouse gas emissions.

### a) Conservation and reduced tillage

Conservation tillage practices such as zero tillage and reduced tillage minimize soil disturbance, helping retain soil moisture and organic carbon. Zero tillage improves energy efficiency and reduces emissions.

### b) Organic and natural farming

Organic farming replaces chemical fertilizers and pesticides with natural inputs such as compost, biofertilizers, and organic manures. This reduces nitrous oxide emissions from soils, improves soil health, and protects water and air quality.

### c) Efficient water management

Water-saving irrigation techniques such as Alternate


Wetting and Drying (AWD) in rice cultivation reduce methane emissions compared to continuous flooding. AWD can maintain high grain yields besides improving water-use efficiency.

### d) Biochar production and carbon sequestration

Agricultural residues such as stalks and stubbles of the crop after harvest can be converted into biochar through pyrolysis. Biochar helps store carbon in soil and reduces atmospheric carbon dioxide levels.

### e) Agroforestry systems

Agroforestry integrates trees with crops or livestock systems. They provide higher carbon sequestration, improved soil fertility, and increased farm income, making them a sustainable farming approach in semi-arid regions.

### f) Livestock emission reduction strategies

Methane emissions from livestock can be reduced through improved feeding practices and feed additives. Technologies such as 3-NOP inhibitors, red seaweed supplements, and probiotics can significantly reduce methane production from ruminant animals.

### h) Precision Agriculture Technologies

Advanced tools such as Green Seeker, nutrient expert systems, variable rate technology and sensors help optimize fertilizer and water use. These technologies improve nutrient use efficiency and reduce emissions associated with fertiliser production and application.

## Advantages in terms of monetary and economic efficiency

Climate-smart agriculture not only benefits the environment but also improves farmers economic outcomes.

### Increased farm profitability

CSA practices increase farm profitability by improving crop productivity and reducing input costs.

### Improved resource efficiency

CSA practices reduce the use of fuel, fertilizers and water, lowering production costs. Zero tillage reduces machinery use and fuel consumption resulting in

significant cost savings for farmers.

### Higher Eco-Efficiency

Eco-efficiency refers to producing more agricultural output with fewer environmental impacts. Climate- smart agriculture improves eco-efficiency indicating better resource utilization and reduced greenhouse gas emissions per unit of production.

### Carbon Credits and Additional Income

Farmers adopting sustainable practices such as agroforestry, conservation tillage, and soil carbon management can benefit from carbon credit programs. These programs provide financial incentives for practices that increase carbon sequestration and reduce emissions.

### Government Incentives and Support

Several government schemes in India support climate-smart agriculture. Programs such as solar irrigation pump subsidies, drip irrigation support, organic farming assistance and biogas infrastructure grants help farmers adopt environmentally friendly practices while reducing production costs.

### Long-Term Economic Sustainability

CSA practices improve soil fertility, water availability and ecosystem health ensuring sustainable agricultural production over the long term. This reduces risks associated with climate variability and ensures stable farm incomes.

## Conclusion

Climate-smart agriculture (CSA) helps address climate change while maintaining farm productivity and sustainability. Practices like reduced tillage, crop diversification, efficient irrigation, agroforestry, and improved livestock management reduce greenhouse gas emissions, improve soil health, and enhance resource-use efficiency. Techniques such as alternate wetting and drying in rice, biochar use, and precision nutrient management further minimize environmental impacts while maintaining good yields.

CSA also benefits farmers economically by lowering input costs, increasing productivity, and providing additional income opportunities through carbon credits and government support. Overall, adopting these practices improves climate resilience, promotes sustainable farming, and enhances farmer livelihoods.

# Previous Issues


## Website Statistics (Fab. 2026)

| 142K | 25K | 3.7M |
|---|---|---|
| Monthly Pageview | Monthly Visitor | Monthly Impression |

## Social Stats

| 6.5K | 6.1K | 10.0K | 1.7K | 2.1K |
|---|---|---|---|---|

# Times of Agriculture

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