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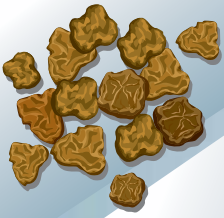
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# TIME FOR WATER RESILIENT AGRICULTURE

During the 2011 census, India entered the league of water deficient nations, which means the per capita availability of water fell below 1700 cubic meters per person. In years to come, this is to fall further. Many cities have started to wither under water crisis. Bengaluru currently faces a shortage of 500 million litres of water per day (MLD) against the actual requirement of 2,600 MLDs. It is time to make tough decisions.

Water is the lifeline for agriculture. A water abundant country, our agricultural practices have been traditionally inclined towards water intensive methods of irrigation, utilizing surface water resources. As per the Central Water Commission, 85.3% of the total water consumed was for agriculture in the year 2000. Free power and subsidized agriculture has engendered mindless extraction of groundwater leading to a drastic reduction in the groundwater levels. Despite the urgency of the situation, we are yet to approach it with an iron fist.

Our approach should be multipronged - counting on the judicious use of irrigation water, water harvesting and irrigation on user per need basis. Fortunately, with advances in precision agriculture, remote sensing and development of sensors, we have means to monitor the actual needs of the crop and deliver water accordingly. However, there still remains the larger question of how accessible these technologies are to small farmers. Ag water solutions that can increase yield and incomes of small holder farmers with reduced water usage are to be promoted. For that we need innovators.

The DCM Shriram AgWater Challenge thrown open by the DCM Shriram Foundation & The/Nudge Prize stands as an innovation catalyst for water-smart agriculture. This 16-month long competition with a Prize purse of INR 2.6 cr, is to ensure development of innovative solutions which are scalable for efficient and sustainable water use in agriculture, thereby creating resilient livelihoods for small and marginal farmers in the face of water stress. So far the challenge has shortlisted 16 organizations from a pool of 134 applicants! These sixteen AgWater Tech Innovators are actively addressing agricultural water challenges in India through a wide range of solutions.

It was exciting for Agriculture Today to collaborate with DCM Shriram Foundation and learn about these innovators, some of whom have been covered in this edition. Besides them, this edition also covers players who are actively trying to bring about a solution to the water crisis and addressing them quite effectively. It was heartening to know that the future is not bleak and there is still hope for humanity.



*Anjana*



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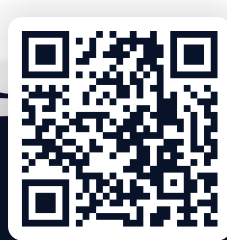


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# Ushering in Transformative Change

## Exploring Sustainable Water Management Practices in Agriculture

Water crisis is looming large globally. It is high time, Indian agriculture pursue sustainable water management practices and embrace innovative approaches. In an exclusive interview with Ms. Anjana Nair, Group Editor, Agriculture Today; Mr. Ajay S Shriram, Chairman & Sr Managing Director, DCM Shriram Ltd, discusses the water crisis and advocates solutions to address the same.



To address the water crisis in agriculture in India, the next action plan should focus on sustainable water management practices and diversification of water sources for agriculture.

### How well-endowed is India with water resources? Are we facing a water crisis in agriculture?

India possesses approximately 4% of the world's freshwater resources, despite having 18% of the global population. Therefore the nation is indeed faced with a severe water crisis, particularly with its impact on agriculture. It's widely acknowledged that a water crisis can hamper economic growth, livelihoods, human well-being, and ecological sustainability. Instances of lengthy queues for water tankers and parched crops due to insufficient rainfall are not uncommon.

Despite possessing surface water resources, India heavily relies on groundwater for everyday survival, a dependence attributed to the demands of the green revolution. With over 20 million wells, often operating with subsidized power, they have significantly contributed to the depletion of this invaluable resource. Among all sectors, agriculture and food security are most intricately linked to water. With the population and purchasing power on the rise, the country's annual food requirements will only escalate.

A detailed examination of crop cultivation across various states reveals that suboptimal planting practices exacerbate water stress. Water-intensive crops like sugarcane and paddy are predominantly cultivated in states like Maharashtra and Punjab. Despite the considerable water demand, Maharashtra alone contributes



22% of the nation's sugarcane output, while Bihar's share is merely 4%.

Similarly, in Punjab, groundwater sources supply 80% of the water used for irrigating paddy fields. Additionally, India's international trade in agricultural commodities is exacerbating water loss through the export of water-intensive crops. Water shortages not only affect agriculture but also pose challenges to industrial operations and urbanization, thus impeding India's aspirations for economic growth.

**70-80 % of irrigation in India is dependent on ground water and our water tables are receding. What should be our next action plan? Where can agriculture tap for more water?**

To address the water crisis in agriculture in India, the next action plan should focus on sustainable water management practices and diversification of water sources for agriculture.

It's noteworthy that water management falls within the purview of both the Centre and the States under Article 246 of the constitution, appearing in both List 1 and List 2. To address national-level challenges, establishing a National Water Council akin to the GST model would be pertinent. This council, comprising representation from Chief Ministers or at least Irrigation Ministers of each state, and coordinated by the Central Ministry of Water Resources, should focus on three key objectives.

Firstly, it should strive to achieve a political consensus to curb the unrestrained extraction of groundwater, including addressing the practice of providing free electricity for irrigation pumps. Secondly, it should ensure that water management institutions assess watersheds and river basins holistically, rather than focusing solely on geographic boundaries. Thirdly, the council should work towards realigning the country's cropping patterns to enhance agricultural sustainability, incentivizing water-intensive crops in surplus water areas and promoting less water-

*tête-à-tête with Anjana*

intensive crops in water-stressed regions. At the micro level, each State must address various aspects. Efficient delivery of water from small irrigation schemes necessitates involvement and support of end-users, with decentralized management through Farmer Producer Organizations (FPOs) or Water User Associations. Furthermore, promoting climate-resilient agriculture and indigenous seed varieties is crucial for mitigating the impact of climate change. Incentivizing micro-irrigation and gradually mandating its use for certain crops can significantly enhance water efficiency. Establishing institutional frameworks for managing water bodies and supporting water-use efficiency start-ups are also imperatives towards sustainable water management.

**There are many technologies like drip irrigation, IoT etc., that can**

**effectively improve water use efficiencies. How can a country like India which is dominated by small holder farmers look for a wider adoption of these technologies?**

To expedite the widespread adoption of water-efficient technologies like drip irrigation and IoT among smallholder farmers in India, a multifaceted approach can be implemented.

Firstly, financial support mechanisms such as subsidies or financial assistance can be instituted to make these technologies more accessible and cost-effective for smallholder farmers.

Secondly, conducting capacity-building initiatives like training programs and workshops can effectively educate farmers on the advantages and proper utilization of these technologies, thereby en-



hancing their understanding and willingness to embrace them.

Thirdly, the establishment of demonstration farms can serve as practical showcases where smallholder farmers can witness firsthand the effectiveness of water-efficient technologies, fostering trust and confidence in their utility.

Furthermore, fostering collaborative partnerships among diverse stakeholders including government agencies, research institutions, NGOs, and private sector entities can facilitate the exchange of knowledge regarding water-efficient technologies. By implementing these strategies and fostering an enabling environment, India can empower smallholder farmers to integrate water-efficient technologies. The learnings would help in increasing farmer's income as well provide a platform where knowledge will be shared freely for the benefit of all communities.

### **What policy level changes would you recommend to bring accountability and efficiency in water usage in agriculture?**

To bring accountability and efficiency in water usage in agriculture, several policy-level changes can be suggested.

**Shift to Volumetric Irrigation Water Fees:** Implementing a shift from fixed to volumetric irrigation water fees can promote accountability by charging farmers based on the volume of water they use, encouraging efficient water usage and discouraging wastage.

**Promotion of Crop Diversification:** Encouraging farmers to diversify from water-intensive crops like rice and wheat through policy incentives can help reduce overall water consumption and promote sustainable water usage practices.

**Reforming Agricultural Support Policies:** Reforming agricultural support policies to align with climate change adaptation goals can enhance the ability of farmers to reduce water usage in agriculture.

**Incentivizing Sustainable Practices:** Providing incentives for the adoption of sustainable agricultural practices like drip irrigation which can improve water effi-

## The DCM Shriram AgWater Challenge aims to unlock prosperity for 1 million Indian farmers by inducing scalable innovations within India's agricultural water ecosystem, particularly targeting cereals and cash crops

ciency and conservation.

**Monitoring and Reporting Mechanisms:** Establishing robust monitoring and reporting mechanisms to track water usage in agriculture, identify inefficiencies, and ensure compliance with water conservation measures can enhance accountability and transparency in water management.

### **What is the idea behind DCM Shriram AgWater Challenge?**

The DCM Shriram AgWater Challenge aims to unlock prosperity for 1 million Indian farmers by inducing scalable innovations within India's agricultural water ecosystem, particularly targeting cereals and cash crops. This initiative seeks to build productivity and prosperity for water-stressed smallholder farmers, thereby improving their economic outcomes.

The challenge, launched by the DCM Shriram Foundation in partnership with The/Nudge Prize, seeks to catalyze innovations at scale in water use efficiency for smallholder farmers. It addresses pressing issues such as unpredictable weather patterns, source sustainability, groundwater exploitation, legacy farm practices, fragmented tech-based innovations for smallholder farmers, and weak governance. These issues contribute to challenges in water availability, farm productivity, and ultimately, income generation.

The potential of the DCM Shriram AgWater Challenge lies in building a long-term approach by focusing on solutions that enhance smallholder farmer resilience and promote climate- and water-smart practices. There is an urgent need to identify and champion solutions that can alleviate water stress on agriculture and improve smallholder farm productiv-

ity at scale.

### **How was the response to the challenge?**

The response to the challenge has been highly encouraging. An eighteen member jury comprising of sector experts and other key stakeholders has been formed to assess the applications. The selection process will evaluate entries based on impact, readiness, and affordability, and will be done in three stages. This diverse set of participants includes AgTech and Social Impact Entrepreneurs who have showcased their solutions tailored specifically for water-intensive crops such as rice, wheat, sugarcane, and cotton. From a pool of 134 applicants, 16 organizations have been shortlisted to compete for a total prize fund of INR 2.6 crores, with INR 60 lakh allocated for the three finalists

These sixteen AgWater Tech Innovators are actively addressing agricultural water challenges in India through a wide range of solutions. Their efforts encompass data-driven and smart irrigation systems, IoT-powered embedded hardware, user-friendly Geo-AI platforms for precise water management, portable moisture measurement probes, and advanced imaging technology. Additionally, some innovators are pioneering an "Irrigation-as-a-Service" model aimed at providing affordable and equitable irrigation systems.

These innovative approaches hold immense potential to significantly enhance water utilization and boost the profitability of smallholder farmers. We are eagerly waiting for the final outcome, and are confident that it will drive transformative change in water use within Indian agriculture.





# DCM SHRIRAM AGWATER CHALLENGE

## SECURING WATER AND PROSPERITY FOR 1 MILLION FARMERS

**A**griculture and water are inextricably linked. It is an established fact that 70% of fresh water withdrawals in India goes into Agriculture. Around 60% of irrigation in India is dependent on groundwater. Unfortunately, India has reached an alarming position as regards to ground water availability. Overexploitation of groundwater and reduced availability of rainfall owing to climate change have started to impact agriculture. Therefore it has become more pertinent now for concerted efforts in the area of water conservation.

### DCM Shriram AgWater Challenge

DCM Shriram Foundation has been creating sustainable impact among rural communities of India. The organisation's emphasis on integrated rural development addresses community needs through all-round development for a measurable improvement in quality of life by focusing on livelihood, healthcare, sanitation, environment and education

Water in agriculture is an equally important aspect for promoting economic empowerment of farmers through enabling environment for water conservation and improve water-use efficiency in agriculture.

### Inspiring Scalable Innovations

The DCM Shriram AgWater Challenge, as an innovation catalyst for water-smart agriculture is a 16-month long competition with a Prize purse of INR 2.6 cr. The challenge is an attempt to inspire innovative solutions which are scalable for efficient and sustainable water use in agriculture, thereby creating resilient livelihoods for small and marginal farmers in the face of water stress.

### Selection Process

Specifically designed giving enough time for the contestants to conceptualise, research and design, each contestant's journey began with a selection process, where their concepts were vetted through the lens

DCM Shriram Foundation & The/ Nudge Prize have thrown open a challenge to AgTech innovators & Agri Social Entrepreneurs from across the globe to develop & scale demonstrable solutions for Indian smallholder farmers (SHF) growing fine cereals (rice or wheat) or cash crops (sugarcane or cotton). The aim would be to

- improve cropping water efficiency or reducing water consumption by at least 40-60% ( 60% for rice | 40% for wheat | 30% for cotton |

50% for sugarcane)

- improve farmer profitability by at least 40-50% through better SHF package of practices
- deliver these tech intervention at costs not more than 20% of the cost of cultivation
- demonstrate a verifiable pool of 5,000 SHF (or, 5,000 hectares) by the end of the challenge

of the selection panel comprised of AgWater ecosystem spanning across investors, knowledge institutions, CSOs etc with a collaborative assistance from the advisors and mentors.

At the 1st phase, among the 134 applications received, the evaluators (The/ Nudge Prize team), checked for the relevance of the solutions to the problem statement to shortlist 80-100 organisations from

**Manoj Ahuja,**  
Secretary, Ministry  
of Agriculture  
(MoAFW)



"Agriculture needs unprecedented attention & technological support to empower smallholder farmers and make their practices resilient in the face of unseasonal rains, groundwater depletion & unpredictable climatic shifts. At the MoAFW, we have taken major initiatives for agriculture modernisation through infrastructural shifts, mechanization, policy and promoting technological proliferation. It's in times like these that we need initiatives like the DCM Shriram AgWater Challenge, to discover, spotlight & champion modern solutions to address systemic challenges in improving water efficiency & productivity at scale; for our largest crops"

### Ajay S Shriram, Chairman and Sr. Managing Director, DCM Shriram Ltd. and Board Member, DCM Shriram Foundation



"Water is a vital resource, as much as 80% of water in India is utilized for agriculture and what's concerning is that up to 60% of this precious resource is said to go to waste. Over the years, unregulated extraction of groundwater has resulted in an alarming fall in the water table across the country. Such a scenario can be a threat to food security as well as livelihood for millions of farmers. With this background, there is a pressing need to enhance water usage efficiency in agriculture through innovative and sustainable solutions. Hence any intervention for large-scale water conservation will essentially need to work closely with the needs of agriculture."

## The DCM Shriram AgWater Challenge, as an innovation catalyst for water-smart agriculture is a 16-month long competition with a Prize purse of INR 2.6 cr.

a pool of 130+ applications .

The 2nd stage screening involved bringing down the applicants to 78 applications and this was by assessment of shortlisted applications by a selection panel (18 members) composed of ecosystem partners on the below criteria (descending order of weightage)

- Product/solution fit
- Impact on farmers
- Scalability
- Technological readiness
- Entrepreneurial fit

Each application was evaluated by two different members

### Kanishka Chatterjee, Director, The/Nudge Prize

“While lucrative solutions addressing agri-water problems have gained momentum in recent years, there has been far less vitality in affordable and accessible models for the small and marginal farmers. Their high dependence on groundwater and increased vulnerability to water stress/climatic changes, land productivity, price and market risks call for audacious problem solving. An inducement challenge like the DCM Shriram AgWater Challenge, pushes AgTech to develop, demonstrate & deploy rapid innovation for this critical problem.”



### Aman Pannu, President, DCM Shriram Foundation.



“Any effort aimed at conserving water on a large scale must closely align with the needs of agriculture. Such a program would have to navigate through a complex web of factors, including weather conditions, selection of crops and varieties, yield potential, water requirements of crops, available irrigation resources, water-saving technologies, agronomic practices, agricultural extension services, accessibility of agricultural inputs, electricity availability, and numerous other variables.”

The stage 3 involved assimilation of all the scores and normalising for evaluator variability and creating a contestant pack of 26 organisations. An assignment was rolled out to the top 26 organisa-

tions to gauge the proposed strategic plan for the solution. Based on consultations with advisors and mentors, best 16 organisations were identified to form the cohort.

Conceived by Srinivas Malladi in 2015, AgriRain proposes a Data-driven Irrigation as a Service (IaaS) using hose reel rain gun system for small land parcels.



### Proposed Solution

- Movable and towable irrigation system (innovative hose reel rain gun system adapted to small land parcels)
- Data-driven Irrigation as a Service (IaaS) model, that can be shared by a cluster of 60-100 farmers in a serviceable model to reduce expenses
- Provide at Rs.1000@10mm per acre



**Srinivas Malladi**

Founded by Jagriti Dabas in 2019, CropCure, powered by Arms4AI, works on Geo-AI based crop/farm diagnosis.

ARMS 4 AI



**Jagriti Dabas**

### Proposed Solution

- Geospatial web application: A technology-driven platform that leverages space data to provide valuable agricultural, water, and carbon advisories for actionable insights in the field
- Through satellite imaging and advanced AI/ML analysis, offers data-driven farm insights leading to increasing crop yields and improving WuE



**BharatRoHan**



**Amandeep Panwar and Rishabh Choudhary**

Founded by Amandeep Panwar and Rishabh Choudhary in 2016, BharatRoHan uses hyperspectral imaging and thermal imagery through drone deployment, offering insights into AgWater management.

### Proposed Solution

- Hyperspectral Imaging - a combination of multispectral, high-resolution RGB, and thermal imagery based decision Support System
- Retrofit hyperspectral cameras into drones, to monitor crops, detecting minuscule colour changes that indicate pest or disease infestation



**Sanjay Dasari and Karthik Jayaraman**

Founded by Sanjay Dasari and Karthik Jayaraman in 2019, Censa provides IoT powered end-to-end crop management system.

### Proposed Solution

- Provides accurate irrigation recommendations at both individual plot and regional levels by collecting crop and soil moisture data using GWX100, GSX Soil (on field monitoring devices)
- The data is analyzed on AI and ML platforms, for both crop type and crop stage, using both real time and historical data enabling the delivery of daily irrigation recommendations through Mobile application, SMS and WhatsApp - Censa Reap



**Gopal Komandur**

Founded by Santana Gopal Komandur in 1985, Centre for Environment Concerns works on regulating root zone moisture by moisture diffuser to reduce water application and improve soil biology/crop productivity.

### Proposed Solution

- SWAR (System of Water for Agriculture Rejuvenation) - An integrated moisture diffuser embedded at plant root zone, to accurately measure moisture at the plant root zone, add-on to existing drip system
- This technology optimizes irrigation schedules and improves the effectiveness of plant and soil nutrient application, ultimately boosting crop productivity



Established in 2010 by Krishna Kumar and Kunal Prasad, Cropin proposes predictive and prescriptive machine learning based crop advisory service.



**Krishna Kumar and Kunal Prasad**

**Proposed Solution**

Enabling comprehensive crop planning and management utilizing remote sensing data and an integration of satellite, weather, and ground data for predictive and proactive water utilization this is applicable to both irrigated and rainfed farms



**Malleesh T M, Sudarshan B S and Bhavana M**

Established in 2016 by Malleesh T M, Sudarshan B S and Bhavana M, CultYvATE works on IoT-enabled Alternate Wetting & Drying (AWD) solution.

**Proposed Solution**

IoT based AWD solution in Paddy to

- Measure - Data acquired through remote sensors
- Notify - Analyse data through AI/ML and provide smart advisory to the farmers
- Monitor - continuous monitoring through auto escalate

Established in 2018 by Narayan Lal, Gurjar Purn Singh and Rajput Ankit Jain , EF Polymer has developed a biodegradable super absorbent polymer technology.



**Narayan Lal, Gurjar Purn Singh and Rajput Ankit Jain**

**Proposed Solution**

● Fasal Amrit - organic and water retention polymer, made from fruit peels that degrades in the soil within 12 months. Water-insoluble polymer is a three-dimensional network structure, cross-linked with UV- light due to this, it can absorb water 80-100X than its dry weight and gradually release the same asper the plant's demand.



Founded by Shrilesh Rajendra Mande and Shubham Sanjay Pardeshi in 2018, Industill Farmtech, works on IoT based sensors to monitor and manage irrigation effectively.

### Proposed Solution

- Autofarm (1 patent granted & 3 Trademarks registered) - wireless, modular irrigation automation system that collects data through in-house IoT-based sensors and manages irrigation effectively
- Automates fertigation through an advanced fertigation unit with robust hardware and software, providing a platform for data-based customized advisory
- Currently priced at 10-12K/Acre



**Shrilesh Rajendra Mande & Shubham Sanjay Pardeshi**



**Tarang Patel and Priya Patel**

Founded in 2018 by Tarang Patel and Priya Patel, Intech Harness Pvt Ltd., works on IoT-enabled data-driven irrigation automation.

### Proposed Solution

Jalaprayah Autotech pump controller - Automates farm irrigation with an ability to respond to power and water disruptions, operates through mobile application, eliminates human intervention, brings precision irrigation thereby reducing water and carbon footprint.

Founded by Amit Saraogi and Dr. Clementine Chambon, Oorja, provides Pay-Per-Use solar irrigation service and farm advisory.

### Proposed Solution

- Oonnati - A Pay-Per-Use community irrigation service that enables farmers to transition from diesel-based pumping to affordable and reliable solar irrigation along with complimentary climate e-smart farmer advisory services
- Water Pumping Charge: between 3.5 to 4 INR per cubic meter
- Each pump allows typically 15-25 farmers with avg landholding of 1.5 acres and with adjoining farmland to access irrigation water year-round on demand.



**Amit Saraogi and Dr. Clementine Chambon**



Oscillo Machines  
Pvt. Ltd.



**Prajwal M. and Shivanand S**

Established in 2019 by Prajwal M. and Shivanand S, Oscillo Machines Pvt. Ltd., propagates Self-propelled rider type Root Washed Paddy Transplanter and DSR(Direct Seeded Rice).

### Proposed Solution

- Electric and Diesel operated Farm Machinery powered by lithium ion batteries, mechanizing the traditional practices and thereby improving efficiency
- Diesel Operated Rider On Type Transplanter with efficiency : 1 acre 2-3 hours
- Diesel Operated Rider On Type E-DSR
- Paddy Weeder with efficiency: 0.5-1 acre per day

Established in 2019 by Naveen Singh and Ajay Mishra, PhyFarm has developed a data driven intelligent irrigation and fertigation system.



### Proposed Solution

- Community Irrigation Support:
- Real-time Data- Access water quality and soil moisture data in real-time through sensor technology
- Irrigation Schedule - Implement a comprehensive irrigation schedule with real-time alerts and notifications via WhatsApp
- Affordable Irrigation Starter Kit (25,000 INR):
- Smart Controller - Mobile app-based precision irrigation
- Control Capability - Manage up to 8 pumps, valves, and filters for complete automation
- Mobile App: Develop an Android/iOS mobile app for smart irrigation scheduling, weather monitoring, and AI assistance



**Naveen Singh**



**Kaushal Jaiswal and Mr. Richard Klapholz**

Founded by Kaushal Jaiswal and Mr. Richard Klapholz, Rivulus has developed remote Sensing based "Manna" Irrigation Intelligence software.

### Proposed Solution

- A sensor free, irrigation- focused precision and smart agriculture software solution that provides real time irrigation recommendations and crop monitoring through Geo-mapping & hydraulic design - Satellite imaging
- Data analysing and scheduling crop irrigation process - Manna platform



Established by Jasveer Singh, Faizan Shaikh and Gajanan Shidardi, Sicca works on digitizing irrigation management at the farms by optimizing water usage through sensor-based IoT system

**Proposed Solution**

- An IoT sensor system, optimizes water usage that can remotely control irrigation based on soil moisture levels
- Low-maintenance, retrofitted automation, powered by 4G and LoRa wireless tech, for remote irrigation
- Scalable system to address needs of both SHF as well as large farm holders



**Jasveer Singh, Faizan Shaikh and Gajanan Shidardi**

Established in 2018 by Satyam Khagen Bose, Virenixiaworks on Digitally-enabled Climate Smart Sustainable Agriculture (eCSSA)

**Proposed Solution**

- eCSSA - Integrated Framework for Digital Climate Smart Sustainable Agriculture
  - o Farmics - offers farmers specialized BioAg inputs to enhance yields during their transition away from conventional chemical farming
  - o AgTMS - Potable IoT, app enabled soil and water testing services
  - o AgriStim -fully automated Agri-advisory support system, powered with AI/ML



**Satyam Khagen Bose**

# DROPLETS OF PROSPERITY

## WATER MANAGEMENT FOR BIHAR'S SUSTAINABLE HARVESTS

**B**ihar is situated in the Indo-Gangetic plain, it is split into two roughly equal halves by the river Ganga, North Bihar and South Bihar. The State has also witnessed changes in the rainfall pattern which may be credited to Climate change. The rainfall trend for the last five years has been depicted in the graph below:

Considering the above scenario, and the fact that Bihar's economy is agriculture based with more than 70% population of the State engaged in this sector, it becomes critical for the government to reevaluate the water availability for agriculture and formulate initiatives keeping in mind the risk

resilience and sustainability.

### Irrigation initiatives

To reduce the over consumption of water while ensuring the sustainable use in Agriculture and maximizing agricultural productivity in the country, the Government is trying to introduce innovative initiatives in the form of policies and programmes.

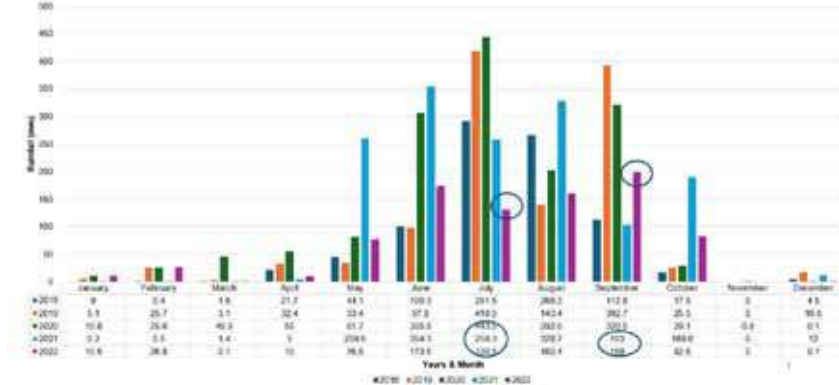
The State government has made praiseworthy efforts towards the irrigation in the last five years with public expenditure on the same being INR 2570.49 crore in FY 2021-22 with a CAGR of 16.8%. The efforts include restoration of canals, linking rivers for intra basin-transfer, command area development and flood control schemes



as well. In case of the source of irrigation, tubewells and wells are the major source of irrigation with 63.4% share.

Due to changing rainfall pattern and difference in the rainfall received in North and South Bihar, State government is progressively working towards increasing the water availability, especially in the drought prone areas. The highest irrigation potential

**Rainfall status of Bihar (2018-2022)**



Source: Rainfall Statistics, India Meteorological Department

Since 2019-20, there has been more than 16 times increase in the area covered by Micro-irrigation in the State.

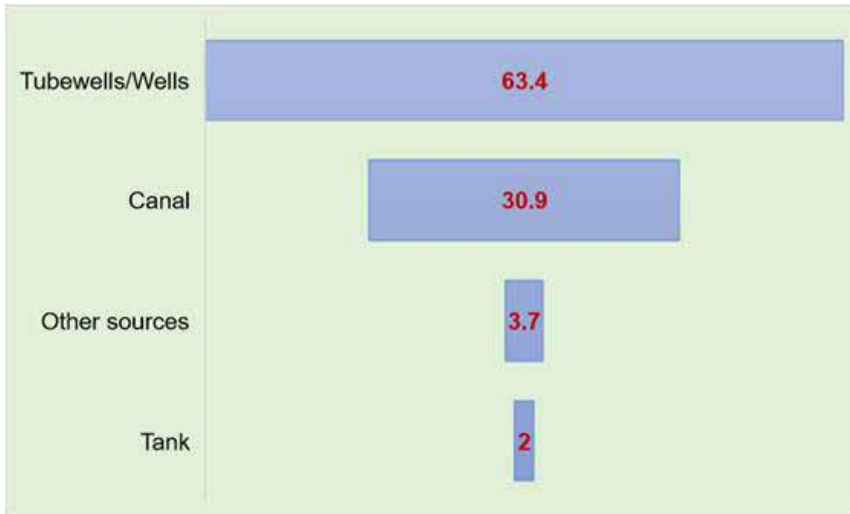
### About the AUTHOR

Mr. Sanjay Kumar Agarwal is Secretary, Department of Agriculture and Department of Transport in the Government of Bihar and is also serving as the Enquiry Commissioner in General Administration Department, Bihar. Shri Agrawal's stellar contributions in public administration have led him to numerous accolades including appreciation by the President of India. As the Secretary of Department of Agriculture, Government of Bihar he is overseeing the critical task of formulation, launch and implementation of the State's 4th Krishi Road Map 2023-28.





**Percentage share of irrigation sources in the State**



Source: Directorate of Economics and Statistics, GoB and analysis

created was of 2600 hectares under the residual work of Western Kosi Canal Project in 2021-22. Further, the overall water utilization efficiency of major and medium irrigation schemes was highest in kharif season with 97.5% followed by rabi with 96.2% and gamma / hot weather season being 85.2% in the year 2021-22. Further, the farmers in Bihar are being encouraged by the State Government to adopt participatory irrigation systems in order to enhance water use efficiency and equitable distribution.

**‘Har Khet Tak Sinchai Ka Paani’ – Enhancing Availability and Conservation**

As part of the Saat Nishchay 2, ‘Har Khet

**The State is focusing on maize mission and millet mission which are supporting and encouraging the cultivators of the State to shift from water guzzling crops to water efficient crops.**

Tak Sinchai Ka Paani’ has been added to provide irrigation to all unirrigated farms and several initiatives have been formulated and are being implemented by Water Resources Department, Agriculture Department, Minor Water Resources Department, Energy and Panchayati Raj. A total

of INR 100 cr. provided for year 2022-23 for these schemes in the districts of South Bihar. The Department of Agriculture has constructed almost 1000 pucca check dams in the 17 districts of the State, which prevents erosion downstream and promotes the recharge of groundwater and also the access water is conserved which is used for irrigation.

Apart from these, the State government is also undertaking construction of ponds for water conservation, sediment check dams, farm ponds and maintenance of ahar. Also, as part of the other components of Pradhan Mantri Krishi Sinchai Yojana, multiple rainwater harvesting projects are being implemented across the State.

**Micro Irrigation– Drops Of Prosperity**

The State Government is providing 80 percent subsidy to small and marginal farmers on drip and micro sprinkler systems to promote efficient judicious use of irrigation water. In order to promote increasing acreage under micro-irrigation in the State, the Department is implementing very effective supporting schemes for community borewell and individual borewell under the under the Saat Nishchay-II. An exclusive digital application has been deployed for generation of online application for the administration of subsidy to farmers. This has given transparency and accountability in its administration and the scheme has found a new impetus.

Since 2019-20, there has been more than 16 times increase in the area covered by Micro-irrigation in the State.



Check-dam



Pond

Area under MI for the last five years (2019-20 to 2023-24) in acres



Source: Directorate of Horticulture, Department of Agriculture, Government of Bihar



**Climate Resilient Agriculture– Sustaining Food Production**

As part of CRA, community irrigation model is being promoted to improve the water use efficiency and reduce the irrigation cost. This model covers 25 acres of land and 20 – 25 farmers and community based big water pumping facility will be created which will reduce the cost of pumping and that irrigation water will be supplied to the farmers through pipe to reduce the conveyance loss. Further, integration with sprinkler and drip in their individual farm to improve the water use efficiency is also part of the model.

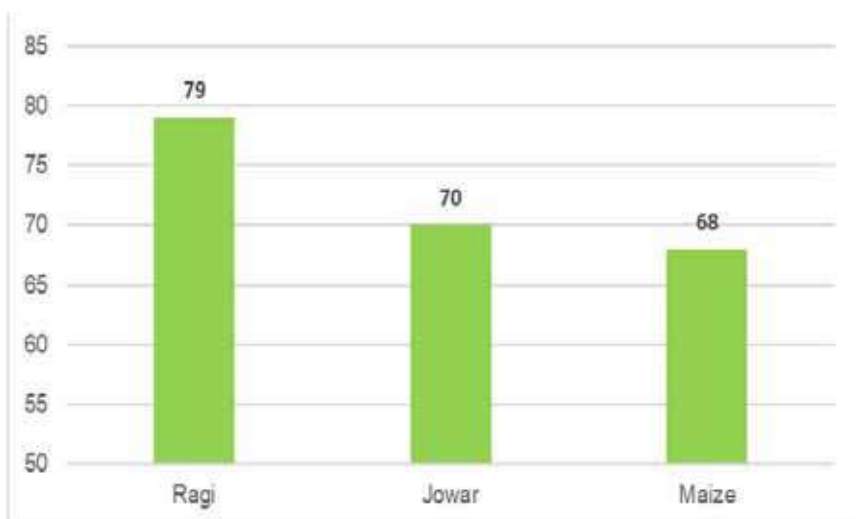
**Crop Diversification– Options for Efficiency**

The State is focusing on maize mission and millet mission which are supporting and encouraging the cultivators of the State to shift from water guzzling crops to water efficient crops. The State is also establishing Centre of Excellence for Millet Value Chain and Model Demonstration Centre for Soil and Water Conservation in Gaya, Bihar.

Development of agriculture sector is critical for Bihar along with the clear vision for sustaining the production systems. Bihar’s 4th Agriculture Roadmap (2023-24 to 2027-28), a holistic and comprehensive planning document of 5 years for the entire agriculture and allied sector, has also outlined the initiatives to be taken by agriculture and other line departments towards efficient irrigation and water management in the State. With Bihar’s focus on sustaining water for agriculture, utmost importance is being given on capacity building among farmers to enhance their understanding of water-efficient farming practices, the importance of water conservation and building community approach.




**Crop diversification from rice leading to water saving (in %age)**



Source: <https://www.orfonline.org/research/estimating-the-productivity-of-india-s-agricultural-waters-towards-water-and-nutritional-security-through-crop-choices>

# ‘DSR ADOPTION AT SCALE IS PIVOTAL’

A portrait of Simon Wiebusch, a middle-aged man with short, light brown hair, wearing a grey blazer over a light blue shirt. He is standing with his arms crossed, looking directly at the camera with a slight smile. The background is a solid blue color with some abstract circular shapes.

“India alone grows rice on around 45 million hectares with transplanting being the predominant cultivation practice. Increasing water scarcity due to climate change and challenges related to labour availability, energy usage, etc. are making this method of rice production unsustainable in the long term,” says Mr. Simon Wiebusch, President of Bayer South Asia and Vice Chairman, MD & CEO of Bayer CropScience Ltd (BCSL). In an interview with Agriculture Today, Simon talks about DSR and how its adoption can make a positive impact on water conservation. Excerpts from the interview.

**What are the benefits of DSR?**

Let us face it, as the third most-grown crop and a staple food for more than half the world's population, the importance of rice cannot be overstated. It is a critical food security crop. However, its cultivation is extremely water-intensive and requires heavy freshwater withdrawals. 40% of the world's irrigation water is applied for rice production. Direct seeding is a crop system wherein rice seeds are sown directly into the field, as opposed to the puddled transplanted method of growing seedlings in a nursery, and then transplanting into flooded fields. This shift can benefit farmers by reducing water usage by up to 40%, cutting greenhouse gas emissions by up to 45%, decreasing the reliance on manual labor by up to 50% and potential early harvesting of the crop. By 2030, Bayer plans to implement the DSR system on one million hectares across Asia, supporting over two million smallholder rice farmers.

**Measures like DSR are also acutely important for countries like ours, where labour shortages and water scarcity are impacting agriculture and overall food security.**

**How do you plan to implement DSR in such a large scale?**

In India, we initiated the Bayer DirectAcres Programme in 2022 and it is our pioneering effort to develop a comprehensive and sustainable rice cropping solution to support Rice DSR smallholder farmers at critical crop stages to maximize grower benefit. The key objective of DirectAcres is to make DSR smallholder farmers suc-

cessful in the first attempt through a hassle-free and seamless step-by-step agronomy advisory along with an effective seed and weed management package, mechanization service linkage and 24X7 information accessed digitally through our FarmRise and call center support.

Our teams on the ground are working to increase awareness around the practice and our solution package, engaging with 200+ distinct DSR clusters spread across 48 districts. The program positions them as hubs for catalyzing change in cluster villages, spanning advocacy, awareness, mechanization, and innovative solutions.

Supplementing the DirectAcres efforts, we have the "Bayer Rice Carbon Program" in place which is being tried out across states such as UP, Bihar, Odisha, West Bengal, Telangana, Andhra, Karnataka, Chhattisgarh, Jammu, Haryana, Tamil Nadu, wherein we are trying to mitigate climate change impact and reduce GHG emissions by promoting and scaling up the



adoption of techniques like direct-seeded rice (DSR) and Alternate Wetting and Drying method (AWD). We are hopeful that through these regenerative sustainable rice farming practices smallholder farmers will derive some benefits for themselves and the environment and reduction in resource consumption. Through this program, we also intend to build a voluntary market for carbon credits.

### What are the support systems you intend to extend to the early adopters?

At the forefront of our support system for early adopters within the DirectAcres program is a personalized approach aimed at addressing the specific needs and challenges faced by smallholder farmers. Through meticulous tailoring, we blend agri inputs with expert advisory services to equip early adopters with the critical tools and insights necessary to successfully embrace Direct Seeded Rice (DSR) practices.

Bayer's dedicated team of field experts are also committed to offering support directly to early adopters in their fields. Moreover, to empower early adopters with the benefits of mechanized processes, the program has established strategic collaborations with multiple service providers. The partnerships ensure that the latest mechanization technologies are readily accessible to farmers within the cluster villages.

In parallel, Under the Rice Carbon Program, Bayer had announced in 2023, a collaboration with GenZero, Shell Energy India Private Limited and others to create a carbon farming model to target GHG emission reductions in rice farming and generating carbon credits in the process. This initiative seeks to generate carbon credits through regenerative agricultural practices that can combat climate change through reduced emissions, water conservation, and soil health improvements while supporting smallholder farmers. Through these initiatives, we aim to facilitate a smooth and successful transition to innovative agricultural practices, ensuring that early adopters are well-equipped to lead the way towards sustainable and efficient farming methods.

You may already be aware of our col-

## By 2030, Bayer plans to implement the DSR system on one million hectares across Asia, supporting over two million smallholder rice farmers.

laborations in this space with ICAR and IRRI. Bayer joined hands with ICAR and IRRI to create integrated direct-seeded rice systems that are specifically tailored to the unique conditions of India through these partnerships. We aim to transform rice cultivation in India, making it more efficient, sustainable, and profitable for farmers. Bayer plans to support over 2 million smallholder rice farmers and bring one million hectares under its DirectAcres program by 2030.

### Do you think farmers will reject the conventional means of rice cultivation and adopt DSR?

The transition to DSR is not easy and it will require cross-industry support to create an ecosystem that will help farmers become successful without compromising their ROI. The ecosystem is developing, and the right seeds, agronomy, weed and nutrient management supplemented by access to mechanization and digital solutions will help assure the farmers and help in the transition process.

Farmers in India are accustomed to generational farming practices and while they may be hesitant towards the adoption of modern methodologies, confidence can be built through community engagement, real-time advisory, a lot of handholding and communication around the long-term benefits of DSR adoption. With an initial registration of 800 farmers to the DirectAcres program, the program's reach continues to expand, culminating in the registration and impact on a total of 2,000 farmers in 2023. This growth showcases the program's dedication to amplifying its influence and driving

transformative change within agriculture.

### How can DSR be promoted on a large scale in India? What kind of policy level changes would you like to see?

I do believe that DSR adoption at scale is pivotal if we are looking at a sustainable solution to food security and the growing impact of climate change on agriculture. Measures like DSR are also acutely important for countries like ours, where labor shortages and water scarcity are impacting agriculture and overall food security. We are seeing nascent levels of adoption right now; however, the transition has been impacted by several challenges. Weed and pest management, for example, remain crucial. Not only farmers but the entire value chain needs education. A conducive and supportive policy and regulatory framework will definitely help in the scale-up of DSR in the country.

Government(s) can formulate supportive policies and regulations to address challenges related to credit access, mechanization, insurance, incentivization in procurement and market linkages for DSR farmers. Additionally, enhancing smallholder farmers' access to credit and insurance services to mitigate risks associated with DSR adoption will help in the long run. Recognition for farmers/ villages adopting DSR may help in promoting the wider adoption of DSR.

Strengthening extension services to develop capacity and technical support to farmers on best practices for DSR cultivation and service providers on supporting various on- and off-farm operations are need of the hour as well. SAUs, KVKs, and seed companies, with their extensive reach in the rice belts, can also play a foundational role in this. Training and educational modules should be introduced to equip farmers with the knowledge and support needed to make a successful transition to DSR, which is not just sustainable, but also efficient and eco-friendly.

All in all, while we remain confident about the benefits it spurs, policy interventions and strong partnerships are very crucial to increase awareness and fuel sustainability in farming.

# WASTING EACH DROP, FORGOING MORE CROP

**F**armers and agriculture are issues that evoke spirited conversations in India, second only to politics or cricket, maybe. While there is a general concurrence that agriculture in India is in the doldrums, reasons attributed to it are multitudinous, ranging from a lack of political will to technology-constraints and from an absence of know-how to erratic weather conditions. Some of these are navigable by relevant policies but a lot gets lost between policy and implementation. Micro-irrigation is one such intervention with an enormous unmet potential.

Even within policy circles, the importance of drip technology was recognized way back in 2003 with a taskforce, and subsidies were extended through bodies like National Mission on Micro Irrigation (NMMI). Although a few states like Andhra Pradesh, Gujarat, Maharashtra & Karnataka fared well; limitations in fund

**It is seen that the Centre makes budgetary provisions, but there has been challenges in getting state contribution on time to the implementing agency and as result the funds allocated under- "Per drop More Crop" (PDMC) have remained underutilised since its inception.**

disbursement and non-uniform application rigged the system. Again, with the rising farmer's distress in 2015-16 and the need for doubling farmer's income while ensuring environment-friendly, sustainable agricultural practices was realized by way of Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). 'Per drop, more crop' with its focus on micro-irrigation to optimize water usage. Area coverage under Micro-Irrigation steadily increased till year 2019-20, but then COVID happened, and since last 4 years, the coverage has plateaued at around 1 Million Ha per annum.

### **Distant Centre, Reluctant States**

As a Centrally Sponsored Scheme, the

states are responsible for contributing 40% of funding under PDMC and the execution lies with the States. It is seen that the Centre makes budgetary provisions, but there has been challenges in getting state contribution on time to the implementing agency and as result the funds allocated under- "Per drop More Crop" (PDMC) have remained underutilised since its inception. And although the allocation to the scheme has been increasing over the years, it is consistently revised down at later stages.

The abysmal performance figures point to a lack of willingness amongst the state functionaries to take up Micro-irrigation projects. The underlying cause could be political, or a lack of receptiveness and a clear understanding of benefits that the project entails. The Pradhan Mantri Krishi Sinchai Yojana was launched in 2015 to increase the coverage of the area under irrigation. The Ministry implemented the 'Per Drop More Crop' component until 2021-22 under the scheme to increase water efficiency through micro-irrigation and other interventions. Since year 2022-23, PDMC component of the PMSKY scheme has been brought under Rashtriya Krishi Vikas Yojana, an umbrella scheme for farmer welfare and this has created more complexity in efficient execution at state level.

The situation presents an opportunity for improving Micro-irrigation projects by encouraging greater participation from state authorities, with state support being crucial. Enhanced engagement can be achieved through increased awareness and appreciation of project benefits.

### **MIS Companies & Farmers Face the Heat**

MSMEs in India play a pivotal role in foster-



#### **About the AUTHOR**

**Kaushal Jaiswal, MD, Rivulis;  
President, Irrigation  
Association of India**

## Area covered under MIS since inception of PMKSY is 7.8 million hectare



only states where the scheme remains functional for more than 10 months in a year. This in-built inconsistency makes the policy a mere façade because it remains dormant at a time when the farmers are to avail its benefits. Needless to say, the sowing season is fixed and cannot wait for funds allotment, or tendering process of the government. The farmers thus chose to proceed with the conventional forms of irrigation available or are discouraged in the face of complexities in availing the subsidies.

Despite the innumerable benefits of micro-irrigation and its potential to solve the twin problems of scarce water and hunger, it remains a tale of muffed opportunities.

### Concluding with the big picture

But why should we-you and me, sitting far away from the farms that supply our food, be concerned with the problems in executing micro-irrigation at all? The answer suggests a rather sombre picture. Agriculture accounts for approximately 85% of the freshwater usage in India. India uses or consumes more than 600 billion cubic meters (158 trillion gallons) of water annually. Of that amount, 245 billion cubic meters are drawn from aquifers. Well irrigation accounts for more than 60% of the net irrigated area in the country, compared to 29.2% for canal irrigation and 4.6% for tank irrigation.

Of all the economic sectors, agriculture is the one where water scarcity has the utmost relevance. Because there is no food without water. And a world with no food or water will be nasty, short and brutish. Any intervention that seeks to save water and produce food, is therefore, a matter of concern for all of us alike. And as we read this, the farmers are braving the challenging climatic conditions and water crisis looming large on their heads in the coming kharif season, that they think will put their livelihoods at stake. But if one is to look beyond the current stalemate, it essentially boils down to sustainable use of water and agricultural inputs ensuring sustained agricultural income for farmers. Can micro-irrigation offer a solution? The answer is best left to common-sense.

ing inclusive growth and development, with approximately 95% of Micro Irrigation Systems (MIS) Companies falling within this category. However, they have encountered challenges due to delays in payment and fund disbursement. Some states have notably lagged in settling dues owed to MI companies, adversely affecting their operational continuity. Consequently, these companies have faced difficulties in sustaining their operations, leading to layoffs and struggles in securing day-to-day funds. This situation has also deterred other MIS Companies from entering the market. The financial strain has further hindered timely equipment supply and installation, ultimately impacting farmers, who are left waiting for essential services. Additionally, delays in subsidy disbursement, even in states where it is directly transferred to farmer accounts, serve as a significant deterrent for farmers considering adopting

**In the states where subsidy is transferred directly to farmers' account, they have to wait for almost year or even more to get the subsidy and that is biggest impairment and discouraging factor for the farmers to come forward and adopt Micro-Irrigation.**

Micro-Irrigation.

A strategy paper for micro irrigation by Grant Thornton analyses PMKVY and concludes that the scheme remains effective for an average of 5 months in a year making it unavailable or inoperative during the sowing season. Based on state-specific guidelines, Gujarat and Tamil Nadu are the

### PDMC Budget Allocation in Rs Crore

FY	Allocation	Utilization	Shortfall
2015-16	1800	1556	14%
2016-17	2340	1991	15%
2017-18	3400	2819	17%
2018-19	4000	2918	27%
2019-20	3500	2700	23%
2020-21	4000	2562	36%
2021-22	4000	1796	55%
2022-23	4043	1807	55%

# WOMEN-LED COMMUNITY PARTICIPATION A SUCCESSFUL MODEL FOR WATER SAVING IN AGRICULTURE

**M**ore than 85 percent of groundwater extracted in India is used for agriculture, and the remainder goes for industrial and domestic usage. According to the Central Groundwater Board report, in 2023, 736 blocks/mandals/talukas (units) are over-exploited in terms of groundwater extraction. 199 units are critical (water extraction is between 90 and 100 percent), 698 units are semi-critical (extraction is between 70 and 90 percent). Overall, out of the 6,553 units that were assessed, 25 percent are already in the unsafe or danger zone. Sensitization and knowledge enhancement at mass scale along with incentivization can help in behaviour change.

## PANI's -Water-Saving and Enhancement of Farmers' Income

Peoples Action for National Integration (PANI) is implementing a project on water-saving and enhancement of farmers' income, with support from Hindustan Unilever Foundation and Tata Trusts in Balrampur district of Uttar Pradesh- one of the NITI Aayog aspirational districts. The project is being implemented with more than 70,000 small and marginal farmers. In the last seven years the project has been able to save water and create water potential to the tune of 286 billion litres; increase in the yield of major crops of more than 220,000 tons; and an aggregate increase in income of Rs 1.06 billion. Additionally, the increased economic activities generated 71.6 lakh person days of employment for local population. Increase of between three and ten percent in village GDP in a majority of the project villages is estimated.

Success of the project intervention is based on the project design as much as

**In the last seven years, the project has been able to save water and create water potential to the tune of 286 billion litres; increase in the yield of major crops of more than 220,000 tons; and an aggregate increase in income of Rs 1.06 billion.**

on the execution, and the guidance and support of the funding organizations. The project was designed to ensure community participation at every step. This not only brought in the user perspective and real needs that were addressed through various

activities but also gave a sense of ownership to the community, thereby increasing adoption. The project team was trained to have two-way communication channels open during meetings, training, and all interactions with the community. They were encouraged to solicit feedback and ideas to align the project activities with the aspirations and pain points of the community.

## Women Participation

An important factor that led to the success is the role of women. The project team encouraged women farmers to participate in weekly meetings organized by the team, by forming small groups of 15-20 women. Women play a crucial role in agriculture right from preparing the field, to sowing, irrigating, weeding, spraying of fertilizer and pesticides, and finally in harvesting, cleaning, packing/storing etc. Therefore, imparting technical knowledge and pack-

### About the AUTHORS



**Deo Datt Singh, Director, Operations and Development, PANI**  
**Mukesh Sadana, Lead Growth and Development, PANI**





age of practices (PoP) to women farmers is equally effective way of improving agriculture practices, if not more effective than imparting this knowledge to men.

The role of women in this model was critical from the supply side as well, in the form of Community Resource Person (CRP)- who were women in the age group of 18-25 with basic knowledge of agriculture, decent education, and who are convivial and entrepreneurial. The CRPs undergo an intensive training on agriculture- crop cycles, common diseases, irrigation, soil testing, efficient use of fertilizers, pesticides etc. The thrust of training sessions is to train them on methods to save water, use of bio-fertilizers and bio-pesticides, use of healthy seeds and inputs, and similar other practices that help increase productivity, reduce costs, improve soil health, and conserve natural resources. Often, CRPs set up demonstration plots on a piece of their own land to show empirical evidence to address the reluctance among farmers. After one or two crop cycles farmers not only listen to their advice but proactively reach out to them for guidance.

## The role of women in this model was critical from the supply side as well, in the form of Community Resource Person (CRP)

### Mahila Kisan Sangathan

Another factor that contributed to the project's success and will be instrumental in sustaining the project beyond the project duration, is the Mahila Kisan Sangathan (MKS). As the name suggests, MKS is an informal association of women farmers who meet periodically to discuss the best practices emerging out of the PoP suggested by the project team, and to provide guidance to the CRP so that her efforts can prove more effective. MKS also aggregates the demand for seeds and inputs and gives the list to CRPs, who in turn share the same

with Farmer Resource Centres (FRC)- another institution supported by the project. FRC is an outlet managed by an entrepreneur- often an agriculture graduate, with a passion to work with farmers providing them high quality seeds and inputs, farm equipment and tools on rent, and advice on best practices, market linkages, etc. CRPs act as an extended arm of FRC by providing the last-mile connectivity for distribution of inputs to the farmers.

The package of practices promoted in this project includes SRI for paddy, intensification for arhar, seed drill/zero tillage/SWI for wheat, on-bed for onion, mulching and SSI for sugarcane, and machan (trellis farming) for vegetables.

PANI's efforts are a drop in the ocean. More needs to be done to address the challenges of depleting ground water levels, increasing water efficiency, improving agriculture practices, and increasing farmer incomes along with conservation of natural resources. Balrampur model has given very encouraging results at a significant scale. This model can be customized, replicated, and scaled for large scale impact.

# WATER CONSERVATION IN RICE

## ALTERNATE WETTING AND DRYING CAN REDUCE WATER USAGE IN RICE CULTIVATION

**R**ice is the highest water guzzling crop, where approximately 3400 liters of water are used to grow one kilogram of rice (Hoekstra, 2008). In Assam, rice cultivation covers 2.35 million hectares of the total cropped area of 3.89 million hectares, accounting for 93 percent of the whole food grain production in Assam. Rice is grown in three seasons namely Ahu, kharif or Sali and Boro. Boro rice, occupying 3.70 lakh hectares exhibits a higher productivity in comparison to winter and autumn rice.

### Water Inefficient Traditional Cultivation Practices

In Assam, summer (Boro/early Ahu) rice is predominantly grown under continuous flooding in an irrigated ecosystem, and rice farmers have a habit of keeping continuous standing water in their rice fields. Boro rice cultivation relies heavily on irrigation, which is water-intensive, costly and amenable to greenhouse gas (GHG) emissions, contributing to global warming. However, this traditional water management method results into a high amount of surface runoff, seepage, and percolation, which can account for 50-80% of total water input.

To meet the food demand of a rapidly growing population in the face of increasing water scarcity, more efficient water management practices - water-saving technologies - are required so that rice productivity is stabilized can be maintained or increased while using less irrigation water. Producing more rice with less water presents a formidable challenge for achieving agricultural, economic, social,

**To meet the food demand of a rapidly growing population in the face of increasing water scarcity, more efficient water management practices - water-saving technologies - are required**

and water security in the region.

### Alternate Wetting and Drying (AWD) – Water Saving Technique in Rice

Among water-saving techniques, Alternate Wetting and Drying (AWD) is the attractive option and is being practiced in different parts of the world. AWD of rice, a method in which fields are periodically drained and re-flooded during the growing season, has been advocated as a practice to minimize the amount of irrigation water used and lower GHG emissions from rice cultivation, all the while maintaining or enhancing crop yields (Richards and Sander, 2014). It has primarily been promoted in Asia, with the highest level of acceptance in Bangladesh, the Philippines, and Vietnam (Lampayan et al., 2015).

While the AWD approach has many potential advantages, farmers have practical difficulties in its implementation. Without the development of simple irrigation indices, it becomes challenging for them to determine the optimal timing for irrigation application. IRRI developed a set of simple guidelines for implementing AWD, which involves utilizing a PVC tube to measure the water level in the field (Minamikawa et al., 2015).

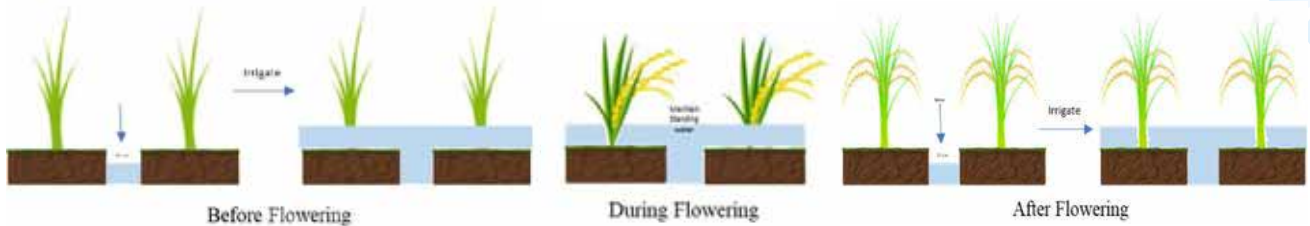
### AWD Using IRRI's Pani Pipe

Under AWD, fields are irrigated using the 'Safe AWD' principles, with flooding water depths inside field water pipe (pani pipe) checked daily. Fields are re-irrigated when the water level in these pani pipe drops to 15 cm below the soil surface, because rice is a shallow-rooted crop, with



#### About the AUTHORS

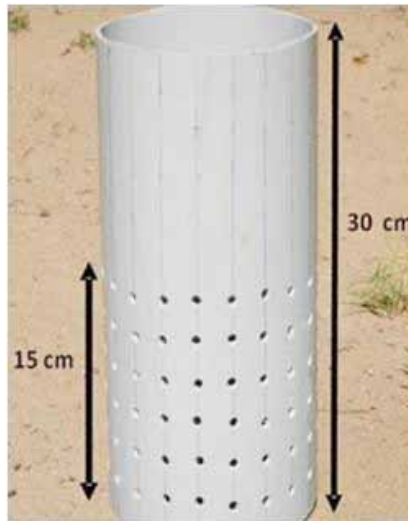
**Dr. Suryakanta Khandai**  
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**Mr. Vipin Kumar**, Associate  
Scientist, IRRI



maximum roots concentrated in the top 15 cm. In AWD practice, the field is irrigated when the water level drops 15 cm below the soil, so that root growth is not hampered, and soil drying may improve root growth, grain filling rate, and the remobilization of carbon stocks from vegetative tissues to grains. AWD is discontinued during herbicide application to increase herbicide efficacy. From one week before to one week after flowering, a water level of 2-5 cm is maintained in the field.

### AWD's Alternate Advantages

It has been noticed that no yield losses occur when practicing safe AWD (when soil



water potential is  $\geq -20$  kPa or field water level does not drop below 15 cm from the soil surface). During the moisture-sensitive period, especially during flowering, enough supply of water is maintained in the safe AWD practice. Alternate drying has the potential to improve oxygen delivery to roots. In contrast to Continuous Flooding (CF), it has the potential to boost field water's electrical conductivity (EC). Increased soil EC could be attributed to increased mineralization and dissolved ion concentrations (Adviento-Borbe et al., 2006).

### AWD Challenges

No significant yield variation is observed between the practice of AWD and CF in Assam. AWD results in a reduction of 2-3 irrigations compared to CF, leading to an average water saving of around 25% for irrigation. This practice allows rice growers to reduce methane emissions, lower pumping costs, and improve water use efficiency.

However, the worldwide adoption of the AWD is hindered by various factors, including climatic conditions, level of mechanization, quantity, and availability of irrigation water and rainfall, soil type, and the ability to maintain or increase crop yield (Van Den Berg et al., 2007; Wassmann et al., 2009). AWD has not been successful on light-textured soils due to increased water inputs and fluctuating nitrogen supplies. Heavy textured soil (clayey) requires less frequent heavy irrigation since field water depth decreases slowly, but light textured soil requires frequent and light irrigations, resulting in a greater number of AWD cycles observed than heavy textured soil. Furthermore, severe-AWD yields less in light-textured soil than it does in heavy-textured soil.



# ENHANCING FARM RESILIENCE

## WATER MANAGEMENT PRACTICES ELIGIBLE FOR CARBON CREDITS

Climate change is exacerbating the frequency and intensity of extreme weather events, posing significant challenges to the agricultural sector. Droughts, floods, and other weather-related disasters can devastate crops, disrupt food production, and threaten the livelihoods of farmers worldwide. In this context, implementing effective water management practices has become a crucial strategy for enhancing farm resilience and mitigating the impacts of these climatic extremes. Remarkably, many of these water management practices are eligible for carbon credits, providing an additional incentive for farmers to adopt sustainable practices while contributing to global climate change mitigation efforts.

### The Challenges of Extreme Weather on Agriculture

Extreme weather presents formidable challenges to agriculture, jeopardising crop yields and food security. Prolonged droughts stress plants due to insufficient rainfall, leading to stunted growth and crop failures. Groundwater depletion worsens irrigation water scarcity, compromising agricultural sustainability.

Conversely, floods, triggered by heavy rainfall or rising sea levels, inundate farmlands, causing crop losses, erosion, and infrastructure damage. This disrupts irrigation systems and transportation routes, impeding the agricultural supply chain.

Moreover, hailstorms inflict physical damage on crops, frost harms sensitive

### Rainwater harvesting and storage systems can play a crucial role in mitigating the impacts of both droughts and floods

plants, and heat waves exacerbate water stress, particularly in arid regions. Addressing these extreme weather events necessitates urgent implementation of adaptive strategies to safeguard agricultural productivity and ensure food security.

### Water Management Practices: A Pathway to Resilience

Implementing effective water management practices is crucial for enhancing farm resilience and mitigating the impacts of extreme weather events. These practices not only improve water use efficiency and conservation but also contribute to carbon sequestration and greenhouse gas emission reductions, making them eligible for carbon credits.

### Irrigation Efficiency and Water Conservation

Improving irrigation efficiency is a key water management strategy that can significantly enhance farm resilience to droughts and water scarcity. Practices such as drip irrigation, sprinkler systems, and precision irrigation techniques can optimise water usage, reduce water losses, and minimise soil erosion. These practices

often involve the installation of efficient irrigation systems, soil moisture monitoring, and precise water application based on crop needs, resulting in reduced water consumption and improved crop yields.

### Rainwater Harvesting and Storage

Rainwater harvesting and storage systems can play a crucial role in mitigating the impacts of both droughts and floods. During periods of abundant rainfall, these systems capture and store water for later use, reducing reliance on groundwater or surface water sources. Rainwater harvesting techniques, such as constructing farm ponds, tanks, or cisterns, can provide a reliable water source during dry spells, enhancing drought resilience and reducing the need for supplemental irrigation.

### Soil and Water Conservation Practices

Implementing soil and water conservation practices can help improve water retention,

### About the AUTHOR

Mr. Shailendra Singh Rao, Founder, Creduce



reduce erosion, and enhance soil fertility, ultimately contributing to farm resilience. Practices like contour farming, terracing, and the use of vegetative barriers can slow down water runoff, allowing more water to infiltrate the soil and reducing the risk of soil erosion during heavy rainfall events. Additionally, practices such as mulching, cover cropping, and incorporating organic matter into the soil can improve soil structure and water-holding capacity, reducing water stress during dry periods.

### Agroforestry and Integrated Farming Systems

Agroforestry and integrated farming systems can play a significant role in enhancing farm resilience by diversifying production systems and promoting sustainable resource management. Agroforestry involves integrating trees or shrubs into agricultural landscapes, providing numerous benefits such as improved soil fertility, water retention, and microclimate regulation. Integrated farming systems combine various agricultural practices, such as crop rotation, intercropping, and livestock integration, to create a more resilient and sustainable farming system.

### Carbon Credits: Incentivising Sustainable Water Management Practices

Many of the water management practices mentioned above are eligible for carbon credits, providing an additional incentive for farmers to adopt sustainable practices while contributing to global climate change mitigation efforts.

Farmers who implement eligible water management practices can earn carbon credits by quantifying the reduction in greenhouse gas emissions or the amount of carbon sequestered through their practices. These credits can then be traded on carbon markets, generating additional revenue for farmers and offsetting the costs associated with implementing sustainable practices.

Certain water management practices, like conservation tillage, cover cropping, and agroforestry, enhance soil carbon sequestration by capturing atmospheric



carbon dioxide and increasing soil organic matter, acting as a carbon sink. This potential earns carbon credits for farmers. Meanwhile, improved irrigation efficiency minimises water losses and energy use, thus reducing greenhouse gas emissions. Additionally, optimised water management enhances fertiliser efficiency, further curbing emissions associated with synthetic fertiliser production and application. Effective manure management, including anaerobic digestion and composting, in integrated farming systems mitigate methane emissions and generates carbon credits, contributing to sustainable waste management practices.

### Overcoming Challenges and Promoting Adoption

Addressing challenges and promoting adoption of water management practices eligible for carbon credits require strategic interventions. Access to financing and technical assistance is crucial, especially for smallholder farmers and those in resource-constrained areas. Providing low-interest loans, grants, and technical support can alleviate initial investment barriers and equip farmers with the necessary skills.

Strengthening carbon markets and

monitoring systems is essential for transaction credibility. Standardising methodologies for quantifying emission reductions and enhancing monitoring, reporting, and verification systems will bolster confidence in carbon credit integrity.

Policy support is pivotal. Governments can incentivise adoption through tax benefits, subsidies, and integration of carbon credit incentives into agricultural support programs. These measures foster an enabling environment for widespread adoption, ensuring sustainable practices benefit both farmers and the environment.

### To conclude

Enhancing farm resilience to droughts, floods, and other extreme weather events is a critical challenge. Implementing water management practices can significantly improve the capacity of agricultural systems to withstand and recover from these climatic extremes. Collaboration among farmers, policymakers, researchers, and other stakeholders is crucial to fostering an enabling environment for the widespread adoption of water management practices eligible for carbon credits, ultimately safeguarding food security and rural livelihoods in the face of a changing climate.

# IRRIGATION AS A SERVICE

## AgriRain's Journey

In India, agriculture isn't merely a livelihood but a way of life. Significance of water cannot be undermined as it is vital for crops, communities, and our future.

With each passing year, the threat of water scarcity looms larger, emphasizing the urgent need for innovative irrigation solutions. AgriRain, founded in 2017 provides access to modern, efficient, and hassle-free irrigation solutions. Recognizing the plight of small farmers grappling with erratic rainfall and diminishing water resources, AgriRain pioneered the "Irrigation as a Service (IaaS)" model. This approach uses hose reel irrigation systems which have been retrofitted to suit Indian terrain, to deliver data-driven precision irrigation, thereby transforming the way farmers cultivate their lands.

### A Paradigm Shift in Irrigation

At the heart of AgriRain's transformative impact lies its pioneering approach to irrigation. Through the innovative Irrigation as a Service (IaaS) model, AgriRain revolutionizes the traditional paradigm of irrigation, offering small farmers hassle-free, pay-per-use, and scalable irrigation solutions tailored to their needs. This model represents a departure from conventional irrigation methods, which often require farmers to deal with complex designs for drip systems or spend significant time and resources on labor for shifting sprinkler

**Through the innovative Irrigation as a Service (IaaS) model, AgriRain revolutionizes the traditional paradigm of irrigation, offering small and farmers hassle-free, pay-per-use, and scalable irrigation solutions tailored to their needs.**

sets.

For these small and marginal farmers who may face labour shortages or struggle with rising labour expenses, AgriRain's operator-led model proves to be a boon. The per-acre cost includes providing irrigation, operator services, collection of data—including tracking the farm on GPS, monitoring rainfall, and running algorithms to create irrigation schedules. This comprehensive package pricing approach simplifies irrigation budgeting for farmers and ensures transparency in cost calculations.

### How it Works?

By leveraging a network of trained operators and advanced technologies like the

hosereel—a mobile, self-propelled raingun integrated with satellite imagery and soil moisture sensors—AgriRain simplifies the irrigation process. Farmers no longer need extensive technical expertise to optimize water usage and enhance crop yields. Instead, they can rely on AgriRain to handle the complexities of irrigation scheduling and data analysis.

This shift towards a more accessible and user-friendly irrigation model signifies a significant step forward in promoting sustainability and efficiency in Indian agriculture. It not only addresses the challenges faced by small farmers in adopting modern irrigation technologies but also contributes to water conservation efforts and improves overall agricultural productivity. AgriRain promotes economic prosperity and environmental sustainability in rural areas while enabling farmers to survive in an increasingly unpredictable climate with its comprehensive approach to irrigation management.

### Irrigation as a Service Business Model

AgriRain's business model transforms delivery of irrigation services to small and marginal farmers through a multi-faceted approach. At its core, the model focuses on rural entrepreneurship and social engineering, where local entrepreneurs, known as 'Jal Sevaks' are recruited and trained at the village level. These Jal Sevaks undergo training on irrigation technology, cluster-based crop agronomy relating to critical stages in irrigation, using hose reel machines, gathering field data, and facilitating farmer enrollment on the AgriRain app. This grassroots approach not only empowers local communities but also ensures that farmers receive personalized support and guidance tailored to their specific needs.

### About the AUTHOR

**Sri Malladi**  
Founder & CEO, AgriRain



This data-centric approach uses satellite imagery and soil moisture sensors to manage irrigation schedule for each farmer, optimizing water usage and crop yield. Through engagement on ground with Jal Sevaks and a pay-per-use model, AgriRain ensures transparent and efficient irrigation practices, charging farmers for the volume of water delivered. The integration of a mobile app streamlines communication between water entrepreneurs and farmers, providing real-time updates and enabling informed decision-making.

By implementing a cluster-based approach, AgriRain promotes collaboration among farmers and Jal Sevaks, maximizing the impact of its interventions. This decentralized model creates village-level employment opportunities, strengthens community ties, and promotes local ownership of irrigation initiatives. Overall, AgriRain's innovative model combines technology, entrepreneurship, and community engagement to address farmers' water needs and drive sustainable agricultural development.

### AgriRain's Interventions

#### Wardha, Maharashtra

In Wardha, Maharashtra, AgriRain's intervention has brought about a remarkable transformation in irrigation practices. Through collaborations with local farmers and entrepreneurs, AgriRain has aided the adoption of data-driven precision irrigation, leading to a significant increase in crop yields and farm profitability. By providing timely and precise irrigation solutions, AgriRain has empowered farmers to overcome the challenges of water scarcity and maximize the potential of their land. With over 500 farmers across 11 clusters in Wardha, AgriRain's impact is seen in these villages, driving economic growth and resilience in rural communities.

#### NSC Suratgarh and Sardargarh, Rajasthan

In the arid landscapes of Suratgarh and Sardargarh, Rajasthan, AgriRain's innovative approach to irrigation has yielded remarkable results in gram crop sown in Rabi season. By using existing canal systems as the water source and deploying Hosereel

**Through engagement on ground with Jal Sevaks and a pay-per-use model, AgriRain ensures transparent and efficient irrigation practices, charging farmers for the volume of water delivered.**



**By leveraging a network of trained operators and advanced technologies like the hosereel—a mobile, self-propelled raingun integrated with satellite imagery and soil moisture sensors—AgriRain simplifies the irrigation process**

technology, AgriRain has enabled farmers to achieve high levels of agricultural productivity. The findings were significant and highlighted the efficacy of AgriRain's approach as it saved at least 67% of water, achieved irrigation efficiency of 85 to 90% and increased yield by 35% and profitability by 22%.

#### Anantapur, Andhra Pradesh

In the drought-prone district of Anantapur, Andhra Pradesh, AgriRain's intervention has provided a lifeline to struggling farmers. Through the judicious application of precision irrigation technology, AgriRain has enabled farmers to overcome the challenges posed by erratic rainfall and water scarcity, thereby safeguarding their

livelihoods and ensuring food security for their families. The yield response to single protective irrigation through hosereel was to the extent of 52.67% compared to non-irrigated groundnut. Fifteen out of twenty farmer reported that despite 46% deficit rainfall and severe moisture stress during middle of the cropping season, they could save the crop and obtain a yield of 2.50 to 3.00 q/ha by giving a single protective irrigation (20 mm) during pre-flowering stage.

### Collaborative Partnerships

Central to AgriRain's success is its collaborative approach to partnership building. Through the establishment of strategic partnerships with agricultural universities, research groups, and corporations, AgriRain has successfully tapped into technology and research to transform the irrigation industry. AgriRain's collaborative culture highlights its dedication to promoting agricultural innovation and sustainability.

### A Sustainable Path Forward

With each new precision irrigation technological advancement made by AgriRain, the prospect of a sustainable and water-secure farming future becomes more and more real. Through its innovative IaaS model, transformative technology, and collaborative partnerships, AgriRain is empowering small and marginal farmers to tackle the challenges of water scarcity, maximize crop yields, and develop resilient agricultural communities.

Beyond maximizing crop yields, AgriRain's impact extends far beyond the farm gate. By promoting water conservation and sustainable agricultural practices, AgriRain is laying the foundation for a more resilient and equitable agricultural future. Through its collaborative efforts with local communities, AgriRain isn't just transforming agriculture—it's transforming lives.

# ADDRESSING INDIA'S WATER CRISIS

## WATERSHED SOLUTIONS AND DEMAND-SIDE INTERVENTIONS

India is staring down a perfect storm. As El Niño's scorching grip intensifies and as land degrades at an alarming rate and droughts become a grim regularity, the very foundation of India's food security and economic growth is under threat. Bengaluru's water woes – a once-water plentiful city – is a stark reminder: India's water crisis is no longer a distant threat, it's a reality demanding immediate action. The time to act is now.

This crisis stems from its uneven distribution of resources. Despite housing 18% of the world's population, India possesses only 4% of its water, leading to severe water stress for 600 million people. An alarming report by Niti Aayog underscores the urgency, predicting groundwater depletion for 21 major cities – including Delhi, Bengaluru, Chennai, and Hyderabad. Anywhere between 27 - 33 million borewells

**Overall, across 3 decades, WOTR has impacted over 6.93 million lives in 7,124 villages, rejuvenating 2.60 million hectares of land.**

are drawing water incessantly, often fuelled by subsidised or free power. This dire situation is worsened by contamination affecting 70% of water sources and frequent droughts across vast regions.

A decades-long focus on supply-side solutions – building dams, reservoirs, and pipelines – has proven insufficient to achieve true water security. To forge a sustainable future, India must rethink its approach to water management, placing equal emphasis on demand-side solutions alongside traditional infrastructure development.

### **Watershed Development – A Sustainable and Scalable Solution**

In regions prone to drought, where rainfall occurs over a few concentrated days, storing water above ground, beyond the rainy

season and cool winter months, is inefficient and susceptible to high evaporation rates. Instead, the emphasis should shift towards replenishing groundwater aquifers. Watershed development, rooted in both scientific knowledge and traditional wisdom, offers a solution that is both sustainable, and scalable. By creating interlinked networks of water harvesting structures such as bunds, trenches, and check dams, runoff is slowed, infiltration is promoted, and soil moisture is significantly enhanced. This not only improves water availability but also boosts agricultural productivity and incomes, and arrests distress migration, benefiting entire communities both economically and socially.

### **Community Approach**

Since 1993, WOTR has pioneered this unique approach to water security and poverty alleviation in India. WOTR's approach goes well beyond just augmenting water supply – the participatory model prioritises mobilising communities and community ownership of watershed activities through representative and inclusive Village Watershed Committees. This ensures fair planning, execution, and benefit distribution across all strata of society. WOTR prioritises capacity building, including for women and fostering ownership through technical training and leadership development. Communities contribute labour and some portion of the costs, taking a stake in the project's success.

WOTR also works to build resilience in its communities, by enabling them to adopt sustainable agricultural practices, use water-saving and efficiency-enhancing methods and diversify livelihoods. With smartphones now widespread, WOTR's

### **About the AUTHOR**

**Mr. Crispino Lobo,**  
Co-founder and  
Managing Trustee,  
Watershed  
Organisation Trust  
(WOTR)



FarmPrecise App puts personalised weather forecasts and crop management advice directly in farmers' hands, helping them boost yields and save money.

### Policy Push

In collaboration with NABARD, WOTR's proposals led to the creation of the Watershed Development Fund at NABARD and the National Adaptation Fund for Climate Change at the Ministry of Environment, Forests and Climate Change (MoEFCC). It also contributed to the development of the Central Facilitation Team model adopted by MGNREGA, and actively continues to support government and civil society initiatives through participation in committees and by providing training and facilitation support.

India's water crisis, however, now requires a paradigm shift on the demand side as well. Recognising this, WOTR has implemented a slew of measures to address this.

### Water Governance

WOTR works to strengthen water governance at the village level, establishing Water User Groups and Groundwater Management Committees. These community-led groups set their own rules for fair water access, conflict resolution, and efficient water use.

In pursuit of broader impact, WOTR and W-CReS (WOTR's research unit) have developed the Water Governance Standard (WGS) which is a rating and accrediting system. This path-breaking tool seeks to incentivise water-positive behavioural change in stressed communities in order to attract the water-related investments they need, thus leading to sustainable water practices. The WGS operates on a "water market" concept where responsible group or community water behaviours alert and



signal, as it were, investors seeking impactful projects. These dynamics align the interests of water users and investors, alike, promoting positive water and investment outcomes. The WGS can be downloaded at: <https://wotr.org/wgs/>

### Water Stewardship

Water stewardship views water users as effective water managers or stewards. It is defined as using water in a way that is economically advantageous, socially just and sustainable for the environment. The various water users who utilise water for drinking, livelihoods, agriculture, and industry are regarded as significant stakeholders in the management of available water resources.

The Water Stewardship Initiative (WSI) focuses on the co-production of knowledge for institutional and behavioural change in order to improve community understanding and capacity to deal with weather conditions, estimated water stocks (surface and groundwater) as well as address equity in access to and use of water for human and nature needs.

### Water Budgeting

Water budgeting empowers communities to make informed decisions about water use against estimated water availability. Undertaken twice a year before and post the monsoon rains by the community, water budgeting enables a community to estimate overall water availability (surface and groundwater) and net water balance in the light of forecasted monsoons, actual rains received and water demands. On this basis, decisions can be accordingly made, at the individual and community levels, regarding cropping pattern to be adopted, livestock holdings, livelihoods and human consumption. Water deficit, if any, can be addressed by adoption of water-smart technologies, augmenting water infrastructure and enforcing community-mandated water access and use norms. WOTR guides villages in creating detailed water budgets, allowing them to track progress, plan for contingencies, and adapt their practices for long-term resilience.

India's water challenges are complex, but solutions are within reach. Demand-side management, grounded in strong governance, community stewardship, and informed water budgeting, offers a path toward a sustainable water future. It's time for India to embrace this transformational approach.

The impact of this holistic approach is evident in villages like Pasodi in Jalna, Maharashtra. Once heavily reliant on water tankers, Pasodi's community now thrives with two annual crop cycles thanks to watershed development, sustainable agriculture practices, and robust water governance. No private water tankers are now needed in the village. About 18,300 hectares of land have been treated creating a water harvesting potential of 52.27 billion litres. Overall, across 3 decades, WOTR has impacted over 6.93 million lives in 7,124 villages, rejuvenating 2.60 million hectares of land.

# HARNESSING IOT

## ENHANCING AGRICULTURAL EFFICIENCY AND SUSTAINABILITY

Over the last decade, the global recognition of mechanization and technological advancements as essential elements in agriculture has surged. This acknowledgment stems from their role in enhancing productivity, maintaining crop health, ensuring farmer profitability, and promoting environmental sustainability amidst climate change challenges. Crucial breakthroughs in IoT, AI, and ML technologies have become linchpins in fostering sustainable and profitable agricultural practices. By synergizing sensor technology with Artificial Intelligence and Machine Learning algorithms, farmers can finely tune resource utilization, minimize waste, and amplify crop yields. As a result, farmers can make data-driven decisions to bolster productivity while mitigating environmental impact, thereby ensuring a sustainable and economically viable agricultural ecosystem for all stakeholders.

### Precision Irrigation

Precision irrigation stands as a pivotal facet of modern agricultural practices, aimed at optimizing water usage and fostering sustainable crop production. This approach capitalizes on advanced technologies like IoT sensors and AI algorithms to meticulously monitor and manage irrigation pro-



cesses. Sensors installed throughout fields continually monitor soil moisture levels at various depths, alongside weather conditions and specific crop water needs, providing real-time data for actionable insights. AI algorithms analyse this data, leveraging machine learning techniques to craft tailored irrigation schedules, considering factors such as crop and soil type, weather forecasts, and historical data. This precision irrigation system fine-tunes the timing, duration, and volume of irrigation, ensur-

ing crops receive optimal water supply, minimizing waste, and conserving water resources. Consequently, improved crop yields and reduced water consumption per unit of output are achieved, enhancing agricultural sustainability.

### Smart Pest and Disease Management

Effective pest and disease management represent critical components of modern agriculture, where precision irrigation

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**Mallesh Tigali, Founder and CEO**  
**and Bhavana Mallesh - Co-founder**  
**and CMO**  
**CultYvate, Farms2fork**  
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plays an integral role. Appropriate water management significantly influences crop health and resilience against pest and disease attacks. Precision irrigation ensures crops receive adequate water at the right time, bolstering their immunity and reducing susceptibility to pests and pathogens. Notably, farmers adopting precision irrigation observe fewer pest attacks and reduced reliance on fungicides. Additionally, IoT devices integrated into automatic weather stations continuously monitor environmental parameters relevant to pest and disease outbreaks and furnish real-time data. Machine learning algorithms analyze this data, identifying patterns and trends to predict potential pest outbreaks and recommend proactive management measures. Farmers are able to minimize crop losses and preserve yield potential while minimizing environmental impact with tech supported insights.

### Predictive Analytics

Predictive analytics, driven by advanced systems and machine learning (ML), mark a breakthrough in farming practices, providing insights into crop growth, yield projections, and harvest timing. Sensors deployed in fields collect data on crop cultivation aspects like growth stages, soil moisture levels, and environmental parameters. ML models then analyze this data, incorporating historical and real-time information to forecast crop growth and estimate yield potential. This empowers farmers to make informed decisions, optimize operations, and boost agricultural productivity, promoting sustainability.

### Climate Resilience

Climate resilience is vital in agriculture amid climate change. Sensors monitor environmental parameters, providing real-time insights. Algorithms analyse data to predict weather events and assess climate risks. Empowered by these insights, farmers implement adaptive strategies, optimizing water management and investing in climate-smart technologies. This proactive approach mitigates risks, ensures productivity, and fosters sustainability in agricultural systems.

## Through IoT-enabled Alternate Wetting and Drying (AWD) techniques, AI algorithms continuously monitor and regulate water levels in paddy fields, minimizing methane emissions and conserving water resources.

### Water Treatment for crops

Effective water management is paramount in modern agriculture, especially for crops with distinct water needs and sensitivities.

Sugarcane a water guzzler, known for its high water requirements, poses challenges in water management. IoT-enabled soil moisture sensors and pump controllers along with weather monitoring devices optimize irrigation practices. Precise irrigation can be fully automated, thereby ensuring significant yield increase along with water saving and promoting of soil health.

Grapes is sensitive to water stress, require careful management for optimal growth and quality. IoT offers tailored solutions for precision irrigation and moisture monitoring in vineyards. IoT sensors and AI analytics monitor soil moisture, weather, and vine water status in real time. IoT-driven practices enhance grape quality, flavor, and vineyard productivity, supporting sustainability.

Paddy cultivation faces water scarcity with traditional flood irrigation. IoT offers solutions to optimize water usage and productivity. IoT sensors and AI analytics monitor water levels, weather, and crop needs, enabling precise irrigation management. This facilitates water-saving techniques like alternate wetting and drying (AWD), reducing water consumption while maintaining yields. IoT also aids in pest and disease detection, ensuring sustainable water management and food security in rice cultivation.

### Carbon Credits for Paddy

Through IoT-enabled Alternate Wetting and Drying (AWD) techniques, AI algorithms continuously monitor and regulate water levels in paddy fields, minimizing methane emissions and conserving water resources. Data collected can be analysed to optimize low tillage practices, reducing soil disturbance and enhancing carbon sequestration. Furthermore, IoT integration enables efficient conversion of biomass into biochar through precise monitoring and control of pyrolysis processes. This comprehensive approach not only promotes sustainable farming but also empowers farmers to generate carbon credits, thereby contributing significantly to climate change mitigation efforts.

### Integration of IoT Remains Essential

IoT technologies are pivotal in modern agriculture, facilitating precision management practices, data-driven decision-making, and sustainable resource utilization. Across diverse crop sectors, from grains to fruits, IoT-driven innovations drive increased productivity, reduced environmental impact, and enhanced food security on a global scale. As agricultural practices continue to evolve, the integration of IoT remains essential in addressing the challenges of feeding a growing population while conserving natural resources such as water for future generations.

While the farmers are our end users, our clients primarily consist of large corporations engaging with us as part of their corporate social responsibility (CSR) initiatives or exporters seeking digital traceability on water usage, fertilizer, and pesticide footprint. While government initiatives support farmers' livelihoods, we advocate for policies and schemes that directly incentivize farmers to embrace technology-driven solutions, fostering regenerative practices and enhancing resilience to climate change. Through collaborative efforts between the private sector, government, and agricultural stakeholders, we strive to create a more sustainable and resilient agricultural ecosystem for the benefit of all.

# IMPROVED AGRICULTURE THROUGH WATER CONSERVATION

## *Intervention of Parmarth*

India is an agrarian country, where mostly rain fed farming is practiced. Due to climate change and exploitation of ground water, water scarcity is increasing that is affecting the ecosystem. Continuous felling of trees is causing soil erosion and deteriorating ecological balance. Only 8% of the rain water is being conserved in the entire country though the livelihood of half of India's population depends on rainwater. Due to these factors the rural population is in the grip of a perennial economic crisis.

Agriculture in Bundelkhand is rainfed, diverse, complex, under-invested and vulnerable. The yields obtained by the Bundelkhand Farmers are usually lower than the state average for the majority of the crops. The region has also been famous for drought due to which the area has suffered the most economic disparity, water crisis, poverty and illiteracy. It is still seen struggling with water contingency, poverty, lack of facilities in terms of education and health and poor employment opportunities.

### Our Jal Saheli Model

Jal Saheli is Parmarth's most successful

**Jal Saheli is Parmarth's most successful model to engage the community women in seeking water rights, improving water conservation & restoration**

model to engage the community women in seeking water rights, improving water conservation & restoration. The Jal Saheli's are responsible for carrying forward the water security agenda and provide leadership towards collective assertion for water rights & entitlements, including government schemes, through processes such as awareness generation. In this way, the Jal Saheli engages the community in village water development as well as preparation of water user master plan. She also does liaising with panchayat, government and politicians and raises water issues at

village level. Over 216 new water bodies have been created and revived through Jal Sahelis. 1250 Jal Sahelis have been instrumental in hand pump repairing and their installation for resolving drinking water crisis in 551 plus villages through Paani Panchayat.

### Migration and Livelihood

There is neither facility for qualitative education nor employment opportunities. Due to water crisis and less available water for farming, Bundelkhand faced migration since last several years.

Agriculture is still the major source of livelihood for more than 80 percent of Bundelkhand population. Due to the lack of nutrients in the soil, slow progress of technology in the agriculture sector, lack of crop diversification, uncertainty of weather, the agriculture sector is facing serious challenges in current times. This has resulted in increase in rural poverty and is creating a critical situation for the larger population. Parmarth has designed its agricultural interventions plan considering these factors.

### Parmarth's Intervention in Command Areas

Parmarth Samaj Sevi Sansthan is continuously trying to help people to address these irrigation woes. To help agriculture in Bundelkhand region, Parmarth supports them with sprinkler. Our Paani Panchayat and Jal Saheli model has been working on water saving and proper management of water in many districts of Bundelkhand for the last several years. After the intervention of Parmarth, we have not only raised awareness on water conservation but also

#### About the AUTHOR

**Sanjay Singh,  
Secretary,  
Parmarth Samaj Sevi  
Sansathan Jhansi**



promoted cash crop, especially amongst those farmers who were previously practicing traditional farming.

Focusing on Agriculture we have worked and introduced many approaches and models. Drip Irrigation, Farm Bunding, Farm Ponds, and Seed Sowing through Seed Drills and AmritPani to enhance the quality and quantity of Agriculture are a few of them. These models not only ease water management and conservation, but also promote agricultural livelihood which eventually stop migration.

Parmarth have also developed SOP for Package of Practices. This model promotes line sowing, micro irrigation, input cost reduction and increase use of organic fertilizers. Till now, Parmarth has trained more than 10,000 farmers. These approaches and water conservation and management efforts and awareness of Parmarth increased the agricultural production from 15 to 25 percent.

### Geeta Devi - The Water Crusader

Geeta Devi is a Jal Saheli from village Manpur of Babina block of Jhansi district. She is 41 years old active and committed

Over 216 new water bodies have been created and revived through Jal Sahelis.

lady. Village Manpur from Babina block of Jhansi district in Bundelkhand region of Uttar Pradesh is among those villages that are facing water crisis.

In February 2017, Parmarth Samaj Sevi Sansthan formed Pani Panchayat Committee in this village. Geeta Devi was selected as Jal Saheli by the Pani Panchayat members. There is only one pond in the village which went dry due to low rainfall and three hand pumps out of which one was defunct and the two others across a National Highway. She motivated the Pani Panchayat members and other villagers to come forward to repair the crack of the pond. Due to her con-

sistent advocacy efforts, the headman of Village Panchayat finally provided funds for pucca repair with stones and cement. Now the pond is full of water and provides ample water for irrigation for the farmers of the village and they can cultivate two crops a year. She fought against feudal norms in her villages and she organized women to petition the water board and district collector to build new pipelines and taps. With her persistence regular water supply for all communities in her village is now a reality.

Geeta was felicitated with Jal Prahari Award and UNDP Women Water Warriors Award for her exemplary efforts.

### Babita a Mountain Girl

#### Jiski Ladai Uski Agwai

We all have heard this phrase but Babita from a small village- Agrotha of District Chattarpur of Madhya Pradesh has actually lived it. Agrotha village of was also a part of water struggle because of the huge mountain located near their village.

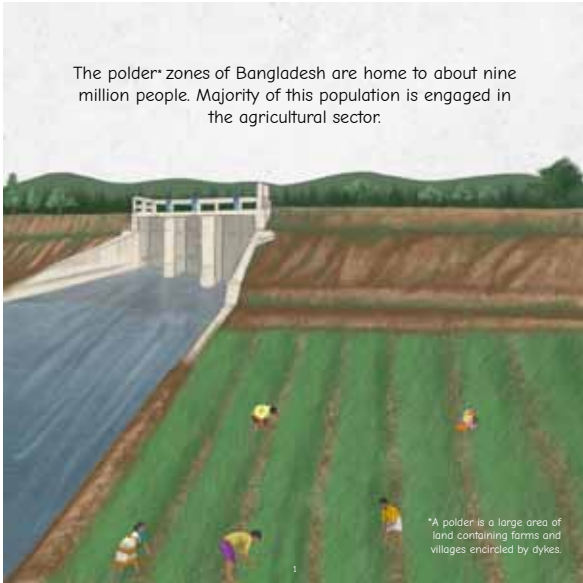
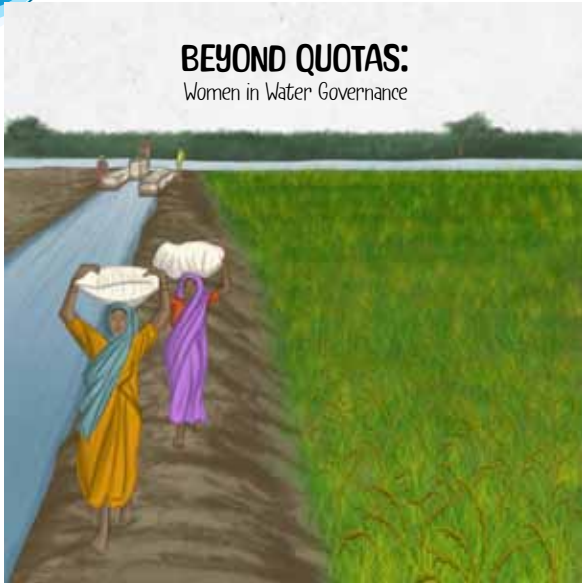
But the young Babita led the women and mobilized them to dig through the mountain and she mobilized nearly 200 women from her village and three other nearby villages- Bhelda, Sevar and Bandha- that were dealing with the same problem. They decided to cut through the 107 kilometre long mountain which was the major hurdle. By taking the permission of forest department the women led by Babita started digging the channel and within 18 months they dug through the mountain and made a channel and turned the flow of rain water through that channel into the Pond.

Babita says, " It was full of struggle for the women of our village to fulfil the daily needs of water. That struggle gave us the courage to do this work for the sake of village people."

Babita became a role model for the young women and on February 28th '2021 Hon'ble Prime Minister 'Shri Narendra Modi' mentioned about her feat in "Man Ki Baat" programme. Because of her courage and passion, the women of Agrotha village solved the water crisis of their village.



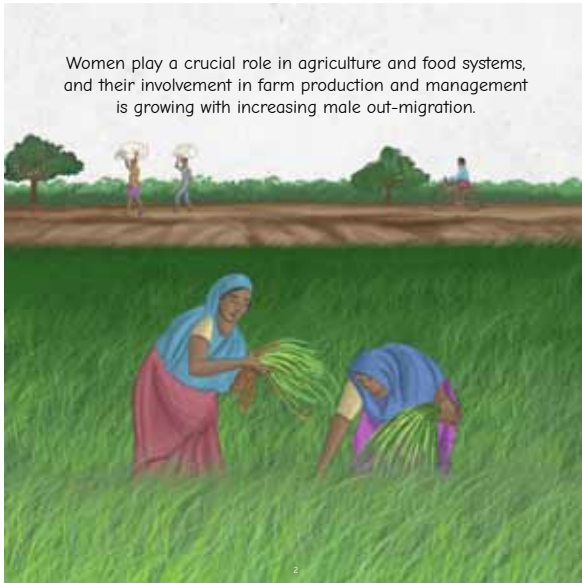
**BEYOND QUOTAS:**  
Women in Water Governance



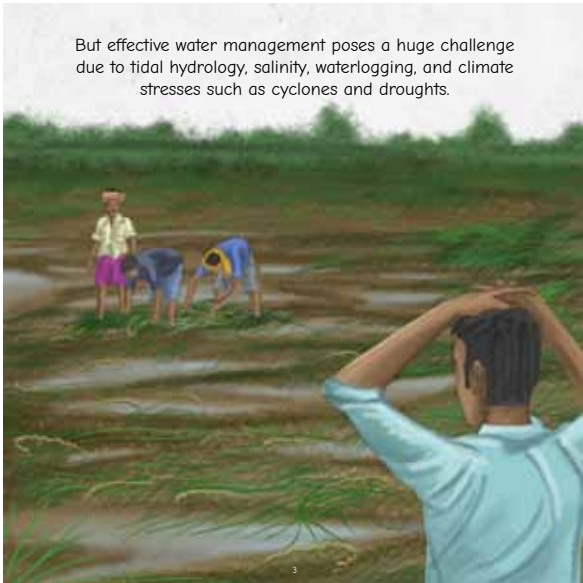
The polder<sup>\*</sup> zones of Bangladesh are home to about nine million people. Majority of this population is engaged in the agricultural sector.

\*A polder is a large area of land containing farms and villages encircled by dykes.

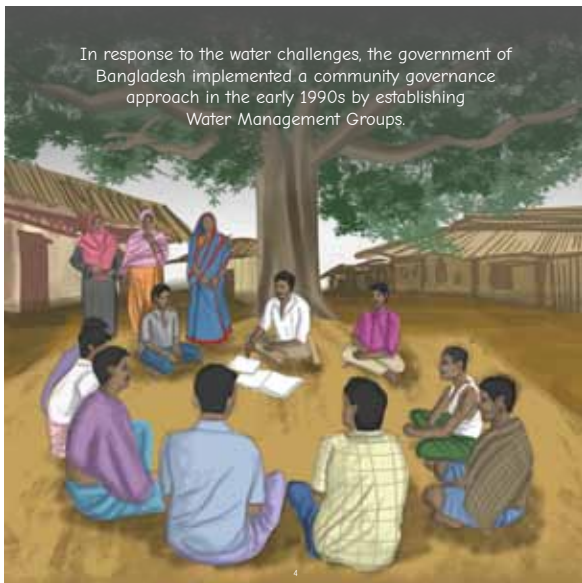
Women play a crucial role in agriculture and food systems, and their involvement in farm production and management is growing with increasing male out-migration.



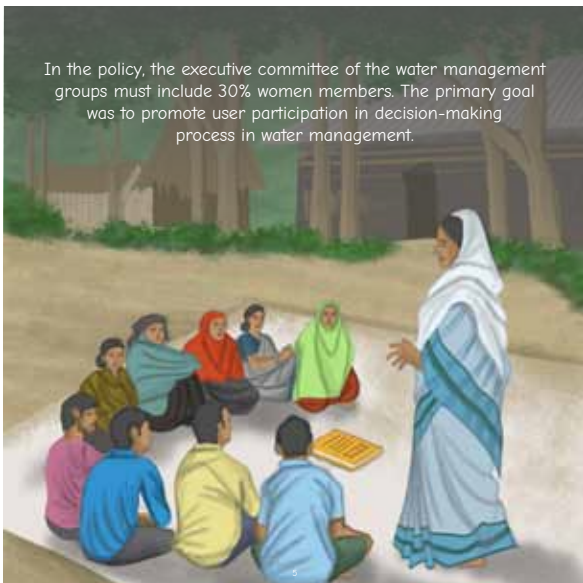
But effective water management poses a huge challenge due to tidal hydrology, salinity, waterlogging, and climate stresses such as cyclones and droughts.

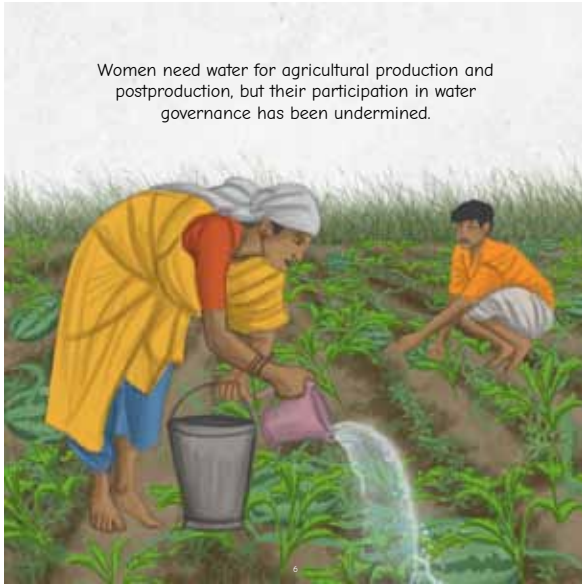


In response to the water challenges, the government of Bangladesh implemented a community governance approach in the early 1990s by establishing Water Management Groups.



In the policy, the executive committee of the water management groups must include 30% women members. The primary goal was to promote user participation in decision-making process in water management.

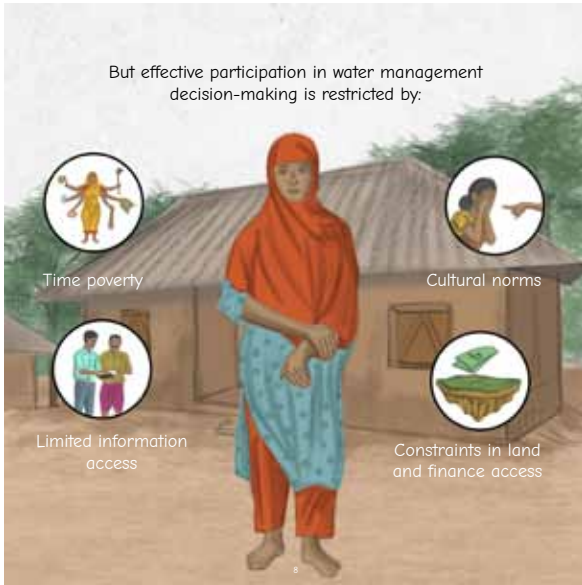




Women need water for agricultural production and postproduction, but their participation in water governance has been undermined.



Formal structures, including quotas, have an increased representation of women in water management groups.



But effective participation in water management decision-making is restricted by:



Time poverty



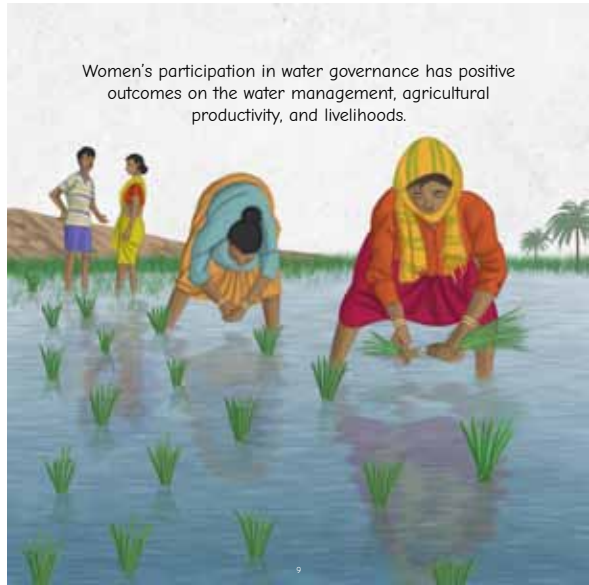
Cultural norms



Limited information access



Constraints in land and finance access



Women's participation in water governance has positive outcomes on the water management, agricultural productivity, and livelihoods.



To promote effective women's participation in water governance in polder zones, a holistic approach is needed, encompassing:

- Gender-sensitive campaigns
- Recognition & redistribution of unpaid work
- Equal land access
- Control over income
- Training and capacity-building

## BEYOND QUOTAS: Women in Water Governance

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To know more about AMD visit <https://www.cgiar.org/initiative/asian-mega-deltas/>

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# BHUNGROO

## *Saving Water, Saving Life*



In developing nations and low-income countries, smallholders grapple with inadequate and poorly timed irrigation, exacerbated by unpredictable rainfall and waterlogging. In India, over 6.72 million hectares suffer from salinity and seasonal waterlogging, affecting nearly 5 million smallholders. Globally, around 260 million farming families endure over 15 days of waterlogging, depriving them of crucial irrigation during lean periods (FAO 2011). This leads to crop failures, financial crises, and, tragically, farmer suicides.

### **BHUNGROO**

BHUNGROO, a preoperatory knowledge of Naireeta Services is a revolutionary solution, which adeptly filters, injects, and securely stores surplus farm or stormwater within adaptable subsoil formations, ensuring its judicious reuse during periods



### About the **AUTHOR**

**Biplabketan Paul,**  
**Director (Technical),**  
**Naireeta Services Pvt. Ltd**

of water scarcity. This innovation facilitates optimal irrigation without leaving a discernible water footprint, achieved through the meticulous reutilization of stored rainwater.

Operating within a minimal surface area of just one square meter, each BHUNGROO unit has the capacity to augment and conserve an impressive one to four million liters of water annually within its subsurface zone. With a diverse portfolio comprising 17 technical designs, BHUNGROO serves the unique needs of women smallholders in various agro-climatic zones across India, Bangladesh, Vietnam, and Ghana. The entire system is intricately designed to leverage locally available resources, skills, and, critically, locally manageable maintenance processes.

### **Women Climate Leaders (WCLs)**

Naireeta's BHUNGROO technology, com-



**Naireeta's BHUNGROO technology, complemented by the support of Women's Climate Leaders (WCLs), has been pivotal in uplifting ultra-poor women smallholders and their families from abject poverty and food insecurity.**

plemented by the support of Women's Climate Leaders (WCLs), has been pivotal in uplifting ultra-poor women smallholders and their families from abject poverty and food insecurity. This initiative addresses climate shocks like irregular rainfall and floods, empowering communities to withstand disasters, notably droughts.

Over 5,000 BHUNGROO units have been distributed, benefiting approximately 250,000 individuals in economically challenged rural areas. Collaboration with governmental, private, and corporate entities has been instrumental in achieving these milestones. Beneficiary farmers have experienced improved food security and a significant rise in annual family income, from \$197 to \$700, over five years. They've also been relieved of debt burdens, fostering economic stability. WCLs have seen their yearly income surge from \$180 to \$500, enhancing their financial independence and leadership roles in their communities.

The program's emphasis on gender-driven initiatives, like BHUNGROO's Water Rights, has empowered women farmers, reinstating their land rights and social dignity. This inclusive approach fosters equity in agriculture, leading to tangible benefits in economic prosperity, food security, and empowerment for ultra-poor women smallholders and Women Climate leaders in targeted regions.

### Recognition

BHUNGROO's impactful work has garnered numerous prestigious awards, affirming its dedication to sustainability and innovation. Notably, they have earned the United Nations Framework Convention on



**The program's emphasis on gender-driven initiatives, like BHUNGROO's Water Rights, has empowered women farmers, reinstating their land rights and social dignity.**

Climate Change's Climate Action Award at COP20, demonstrating leadership in addressing climate issues. Their commitment to gender equality in climate technology was recognized with the Gender Just Climate Technology Solution Award at COP24. Collaborations with esteemed institutions like the World Bank, Indian Government, and Indo-US Science and Technology Forum underscore their strategic partnerships. Support from entities such as USAID and Lockheed Martin further enhance their global initiatives. Their accolades include the Cartier Women Initiative Awards, showcasing empowerment of women in entrepreneurship.

# GROWING THE FUTURE

## INDIA GRAINS AND PULSES COUNCIL (IGPC) FOR AGRICULTURAL REVOLUTION

India is a leading global producer of staple grains, notably rice and wheat, with outputs of 130 and 106 million tonnes respectively, during 2022-2023. The country also excels in coarse grains production, including maize, sorghum, pearl millet, and finger millet, reaching 51.9 million tonnes during the same period. India's total pulse production is significant, contributing to its protein supply, with a recent estimate of 25.6 million tonnes. India is fast becoming a global trade hub in agriculture commodities trading with more than 150 countries, accounting for close to \$50 billion in exports and \$30 billion in imports. The sector's dynamics are influenced by domestic demands, export potential, and global market trends, positioning India as a key player in the international agricultural arena.

However, this sector faces multifaceted challenges that restrict its growth

and sustainability. Inadequate storage and transport facilities, lead to substantial post-harvest losses. Policy dynamics and regulatory hurdles, including complex subsidy schemes and trade restrictions, create operational inefficiencies and market distortions. Counterparty defaults in trade transactions pose financial risks, undermining trust in the market. Climate change introduces uncertainty with erratic weather patterns affecting crop yields and quality. Additionally, technological gaps, particularly in rural farming practices, limit productivity improvements and quality enhancements. Addressing these challenges is vital for the sector's modernization and for ensuring the long-term food security and economic prosperity of India.

### Challenges Facing the Grain and Pulses Industries

#### Market Access and Price Volatility:

Farmers and traders in the grain and pulses sectors often struggle with market access and face significant price volatility. This unpredictability affects income stability and investment capacity in the sector.

**Infrastructural Limitations:** Inadequate storage and logistics facilities lead to post-harvest losses, reducing the overall efficiency and profitability of the grains and pulses industry.

**Technological Gaps:** Limited access to modern technology and best practices hamper productivity and quality, leaving Indian grains and pulses less competitive on the global stage.

**Regulatory and Policy Constraints:** Complex and sometimes contradictory policies create uncertainties and operational difficulties for stakeholders in this sector.

**Environmental Concerns:** The increasing impact of climate change, water scarcity, and land degradation poses significant risks to the sustainability of grain and pulse cultivation.

**Skill and Knowledge Gaps:** There is a critical need for capacity building and knowledge sharing among farmers, trad-

The IGPC is set to play a crucial role in improving market access and reducing price volatility through strategic marketing, trade facilitation, and international partnerships.

### About the AUTHOR

Deepak Pareek is the founding Convener of the India Grains and Pulses Council, and an ecosystem builder in the agriculture domain. With 25 years of diverse experience working across 34 countries, he is a well-decorated technocrat.



ers, and other stakeholders to enhance industry standards and practices.

**Counterparty Defaults and Trade Disputes:** Aberrations and defaults in payments or deliveries in commodity trading can lead to significant financial losses, eroding trust among market participants. These defaults impact liquidity and stability in the market.

### Role of the IGPC in Addressing These Challenges

**Enhancing Market Access and Stability**  
The IGPC is set to play a crucial role in improving market access and reducing price volatility through strategic marketing, trade facilitation, and international partnerships. By creating more predictable and stable markets, the council can help ensure better stability for all ecosystem players.

#### Infrastructure Development

One of the council's strategic objectives is to address infrastructural deficiencies by advocating for investment in storage and logistics facilities. This would help reduce post-harvest losses and improve the overall supply chain efficiency in the grains and pulses sector.

#### Technological Advancement and Innovation

The IGPC aims to bridge technological gaps by promoting the adoption of advanced technologies and innovative farming practices. This includes supporting research and development initiatives and facilitating access to modern tools and techniques, thereby enhancing productivity and product quality.

#### Policy Advocacy and Regulatory Reforms

Advocacy for supportive policies is a cornerstone of the IGPC's mission. The council plans to work with the government for policy reforms that simplify regulations and create a more conducive environment for the growth and expansion of the grains and pulses sector, both domestically and internationally.

#### Sustainable Agricultural Practices



**The IGPC has collaborated with the International Agro Arbitration Centre (IAAC), the world's pioneering agro-focused dispute settlement entity, to transform dispute resolution in the agriculture and food sectors both in India and globally.**

Promoting sustainability is central to the IGPC's vision. The council intends to encourage sustainable agricultural methods that minimize environmental impact, enhance soil health, and ensure the long-term viability of the sector, addressing concerns related to climate change, water use, and land management.

#### Capacity Building and Knowledge Sharing

The IGPC is committed to empowering stakeholders through education, training, and networking opportunities. By enhancing the skills and knowledge of those involved in the grains and pulses value chain, the council aims to elevate industry standards and drive collective

advancement.

#### Conflict Mitigation and Dispute Resolution

The IGPC has collaborated with the International Agro Arbitration Centre (IAAC), the world's pioneering agro-focused dispute settlement entity, to transform dispute resolution in the agriculture and food sectors both in India and globally. This partnership aims to enable the swift and economical resolution of trade conflicts.

#### A Comprehensive and Coordinated Approach

The India Grains and Pulses Council, with its vision of making Indian agriculture globally competitive and sustainable, is poised to lead this transformation. Through its strategic objectives and operations focused on market development, infrastructure improvement, technological innovation, policy advocacy, sustainable practice promotion, and stakeholder capacity building, the IGPC is well-positioned to address the current challenges and drive the future growth of the grains and pulses sector in India. This initiative not only promises to enhance the economic well-being of farmers and traders but also contributes to the national goal of food security and environmental sustainability, marking a new era in the agricultural landscape of India.

# AGRICULTURE VALUE CHAIN TRANSFORMATION

## ROLE OF CONSULTANCY

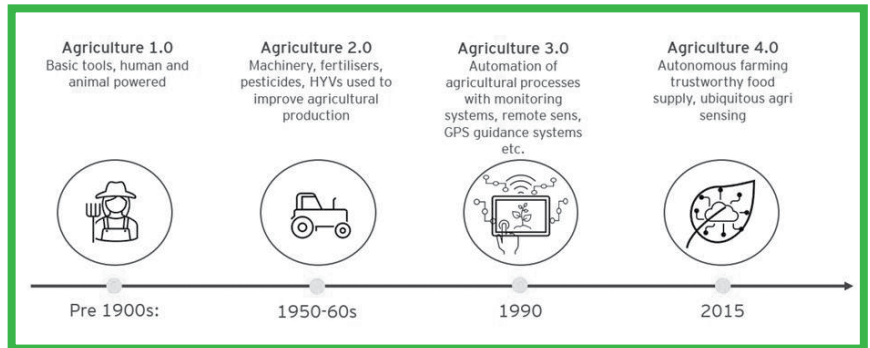
**A**griculture value chains are multifaceted, encompassing multitude of activities spanning from input acquisition and farm production to processing, post-production, packaging, marketing, and distribution to consumers.

### Challenges along the Value Chain

Challenges exist at each stage of this value chain, varying based on factors such as product type, crop variety, agroclimatic conditions, geography, and demographics. Common challenges encountered during the input and farm production stages include difficulties in accessing quality inputs, resource constraints such as limited land, water, finance, and skills, as well as risks associated with erratic weather patterns and extreme events, which can adversely affect crop growth, pest management, and overall farm resilience.

Similarly, challenges in the post-production and processing stages revolve around infrastructure gaps, such as inadequate processing and storage facilities, as well as technological obsolescence, leading to post-harvest losses and compromised product quality, thereby impacting regulatory compliance standards.

Downstream challenges include limited access to market information, reaching target markets, and pricing products competitively, particularly for smallholder farmers who often struggle to earn a fair share of the end product value, exacerbating sustainability concerns. Furthermore, distribution and logistics inefficiencies stemming from inadequate transportation and storage infrastructure, along with market



**Consultancy plays a crucial role in facilitating the adoption of cutting-edge practices tailored to local requirements, thus enabling the establishment of a fully operational digital agriculture ecosystem.**

fragmentation, further strain the margins across the value chain.

### Consultancy Services – For Seamless Collaboration

In the agriculture sector, a diverse array of stakeholders converge to form an ecosystem, encompassing farmers, agribusiness entities, governmental bodies, supply chain participants, research and technical institutions, NGOs, financial institutions, input suppliers, service providers, and trade associations. In an optimally functioning ecosystem, these actors seamlessly collaborate, ensuring efficient interaction and minimal information disparities across the



### About the **AUTHOR**

**Utsav Mishra,**  
Director, EY.



**Within the realm of agriculture, consultancy services serve as a cornerstone in managing the intricacies of the sector, spanning from strategy development to on-the-ground execution.**

### Inputs and Production

- o Precision Agriculture technologies such as GPS-guided tractors, drones, and satellite imaging enabling precise application of inputs, including seeds, fertilizers, and pesticides, optimizing resource use and minimizing environmental impact.
- o Remote sensing technologies providing real-time data on soil health, moisture levels, and crop conditions, empowering farmers to make informed decisions and tailor inputs to specific crop requirements
- o Smart Farming Systems, IoT sensors, automation, and data analytics platforms facilitating monitoring and management of farm operations, from irrigation and pest control to livestock management, enhancing productivity and reducing labour costs.
- o Genetic engineering and biotech innovations improving crop resilience, disease resistance, and nutritional content, enabling farmers to produce higher yields and superior-quality crops.

### Processing & post production

- o Automated processing equipment and robotics streamlining production processes, reducing labour requirements, improving product consistency, and enhancing food safety standards
- o Quality Control Systems based on Advanced sensors, imaging technologies, and machine learning algorithms enabling real-time quality assessment and sorting of agricultural products, ensuring compliance with industry standards and consumer preferences.
- o Blockchain technology enhancing traceability and transparency in the supply chain, enabling stakeholders to track product origins, monitor handling conditions, and verify authenticity, thereby reducing food fraud and waste.
- o Predictive analytics and demand forecasting tools optimizing inventory management, transportation logistics, and distribution routes, minimizing stockouts, reducing costs, and improving delivery efficiency.

### Market Linkages

- o Online marketplaces and digital platforms connecting farmers directly with buyers, expanding market access, eliminating intermediaries, and enabling farmers to capture a larger share of the value chain surplus.
- o Mobile Applications providing farmers with access to market information, price trends, weather forecasts, and agricultural advisory services, empowering them to make informed decisions and negotiate better prices.

value chain.

Within the realm of agriculture, consultancy services serve as a cornerstone in managing the intricacies of the sector, spanning from strategy development to on-the-ground execution. Internationally, meticulously crafted consulting projects have yielded substantial impact, whether through comprehensive value chain transformations or targeted interventions addressing specific challenges within segments of the value chain. These include

- Providing strategic design, planning and policy assistance to conceptualize and implement vital initiatives
- Facilitating informed decision-making by leveraging expert insights and learnings from best practices
- Strengthening linkages among value chain participants and addressing information asymmetries
- Empowering stakeholders to navigate evolving market dynamics, adopt new technologies, mitigate risks, and seize emerging opportunities

### Technology Application

Today, technology is playing a transformative role in revolutionizing agriculture value chains. From precision farming and IoT-enabled monitoring to blockchain-based traceability systems, technological innovations enable stakeholders to enhance transparency, traceability, and efficiency across the value chain. Consultants leverage technology to develop customised solutions that empower farmers, processors, distributors, and retailers to harness data-driven insights, optimize resource al-



location, and unlock new avenues for value creation. Going forward, with limited land & other resources, technology is going to play an increasingly higher role in improving agricultural productivity and distribution systems to meet the increasing food & nutrition requirements while being climate sustainable at the same time. Some key applications at different value chain stages are being:

### Impactful Initiatives

"Drip to Market Agri Corridor" implemented in Karnataka, saw implementation of drip irrigation over 5 lakh hectares of land utilizing state-of-the-art technology to enhance efficiency and productivity. This initiative also facilitated appropriate market linkages to ensure the uptake and realization of favourable prices, thereby benefiting farmers and stakeholders throughout the entire value chain.

A climate innovation centre was established with the objective of implementing a comprehensive, country-driven strategy to expedite the development, deployment, and transfer of climate-resilient technologies tailored to local contexts. This initiative involved the establishment of regional innovation clusters to maximize the utilization of available resources and infrastructure, fostering collaboration, and cultivating an ecosystem that consolidates existing partnerships. Additionally, it focused on enhancing the capacity of both new and

**Consultants leverage technology and best practices to develop customised solutions that empower farmers, processors, distributors, and retailers to harness data-driven insights, optimize resource allocation, and unlock new avenues for value creation.**

established enterprises, facilitating the exchange of innovative concepts, technologies, and enterprises with larger industry counterparts, and offering access to strategic flexible financing options

Another initiative focused on bolstering climate-resilience and economic viability of small holder farming systems within rainfed, drought-prone, salinity affected districts of Maharashtra panning over 26 lakh hectares of agricultural land and benefiting approximately 19 lakh farmers

### Role of Consultancy

Over the span of a century, agriculture has witnessed a series of transformative revolutions, enhancing efficiency, productivity, and profitability to unprecedented levels. Each subsequent revolution has taken progressively shorter periods to materialize. From the rudimentary tools and animal-

based practices of the first agricultural revolution, we have now entered the era of Agriculture 4.0. Agriculture 4.0 signifies the convergence of digitalization and artificial intelligence in agriculture, facilitating autonomous methodologies and widespread sensing mechanisms to ensure food security. This digital agriculture paradigm has the potential to be the most transformative and disruptive yet, revolutionizing not only farming practices but also reshaping every aspect of the agricultural value chain.

Consultancy plays a crucial role in facilitating the adoption of cutting-edge practices tailored to local requirements, thus enabling the establishment of a fully operational digital agriculture ecosystem. Moreover, as global climate regulations come into effect, consultants will assume an increasingly significant role in ensuring sustained growth and compliance with policies and regulations. This will involve identifying tailored solutions for specific sectors and geographic regions, promoting the dissemination of best practices, fostering stakeholder connections, and ensuring the efficient and timely execution of initiatives.

By leveraging these technological innovations across the agriculture value chain, stakeholders can unlock new opportunities for innovation, sustainability, and inclusive growth, ultimately driving positive socio-economic and environmental outcomes and consultants will have a key role to play.

*\* Views are personal*

# TRANSFORMATIVE INFLUENCE OF TECHNOLOGY ON CROP INSURANCE

**W**ith the constant advancement of technology, the agricultural industry in India is going through a major transformation. Among the various changes, crop insurance is a key area that is seeing a remarkable shift. The use of technology has transformed the way insurance companies track and manage crop insurance using Remote Sensing, Satellite Imagery, Data Analytics, and more making it efficient and cost-effective.

This is a positive change for farmers, especially because in the past, they have encountered numerous difficulties related to insuring their crops. For example, the first-ever crop insurance in India was for cotton and was launched by the General Insurance Corporation (GIC) around 1972-73. Post that, while many insurance schemes were launched, it was still a difficult task to scale them up owing to manual processes involved in enrolment and claim assessment, making the implementation of such schemes expensive and inefficient. Lack of transparency in the claim assessment process has been another major challenge in the past Schemes.

However, with the infusion of technology, the landscape of crop insurance in India is undergoing a total makeover, resulting in improved accessibility and affordability. This is also evident from the government's effort to implement technology in crop insurance with schemes such as Pradhan Mantri Fasal Bima Yojana (PMFBY).

## Satellite Technology for Crop Monitoring

One of the key technological advancements in the crop insurance sector is the use of satellite imagery to monitor crop fields. Satellite-derived bio-physical parameters help detect vegetation and crop

**Leveraging satellite data, crop insurance companies gain a more precise analysis of the condition of crops both before and after losses.**

health status. Additionally, this technology aids in predicting climatic risks such as droughts, floods, and pests.

Leveraging satellite data, crop insurance companies gain a more precise analysis of the condition of crops both before and after losses. It allows them to make better and more profitable policies. This heightened accuracy enables them to formulate more effective and profitable insurance policies. Consequently, farmers and agribusiness consultants can leverage the benefits of crop insurance to en-

hance the quality of agricultural practices and safeguard production from potential losses.

The data collected is compared with historical data categories in indices including Normalized Difference Vegetation Index (NDVI), Land Surface Wetness Index (LSWI), Synthetic Aperture Radar (SAR), Backscatter, Fraction of Photosynthetic Active Radiation (fAPAR), and more. This helps in increasing accuracy for crop monitoring and taking preventive measures for risk mitigation against extreme weather conditions and disasters.

## Implementation of Yield Estimation System through Technology

Implementation of the Yield Estimation System through Technology (YES-TECH) under PMFBY since 2023 aims to bolster the precision and reliability of crop yield estimations essential for PMFBY. The launch of YES-TECH follows the successful implementation of similar model in the State of West Bengal under Bangla Sashya Bima (BSB) Scheme since 2020, which is a fully remote-sensing based claim assessment model. BSB has been successful in enabling swift and accurate claim payment to farmers right after their losses, when the claim amount is most needed by them to restart their agricultural practice.

As YES-TECH significantly relies on the satellite imagery data collected at granular levels, the quantity and quality of such data plays a huge role in successful implementation of this initiative. The Sentinel-1 and Sentinel-2 satellites of the European Space Agency (ESA) are pivotal in crop insurance for supplying high-resolution spatial and temporal data. Together, they provide unparalleled spatial resolutions (up to 20m for Sentinel-1 and 10m for Sentinel-2) and frequent revisits



### About the AUTHOR

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(every 12 days/5 days for Sentinel-1 and Sentinel-2, respectively), enhancing the precision of crop loss assessment in an efficient and transparent manner. Access to Sentinel data is offered free of charge, promoting its extensive use in agricultural monitoring and insurance applications.

### Implementation of National Weather Information Network & Data System

Another major initiative of Government of India is the implementation of the National Weather Information Network & Data System (WINDS) which aims to setup a national network of Automatic Weather Stations (AWSs) and Automatic Rain Gauges (ARGs) at granular levels to capture accurate weather data at real-time. This national data will have wide-ranging applications in the fields of crop insurance, sowing, cropping, harvesting and market planning, and providing timely crop advisories to farmers. Apart from this, WINDS network will also nurture further research and development in other related fields for a wider application and strategic utilization across multiple sectors of the economy.

By marrying technology-driven methodologies with conventional crop cutting experiments (CCEs), YES-TECH seeks to refine the insurance claim assessment process. This strategy is anticipated to enable prompt and accurate compensation to farmers for crop losses, fostering increased participation in the scheme and bolstering the agricultural sector's resilience to adverse events.

### Unmanned Aerial Vehicles

Unmanned Aerial Vehicles (UAVs) or Drones have emerged as valuable tools in assessing crop damage and estimating crop losses. Equipped with high-resolution cameras and sensors, drones can capture detailed images of agricultural fields, providing real-time information on crop health/damage. Insurers can use this information to accurately assess the extent of crop losses caused by natural disasters, pests, diseases, or other factors

## Unmanned Aerial Vehicles (UAVs) or Drones have emerged as valuable tools in assessing crop damage and estimating crop losses.

without physical inspections, which can be time-consuming and costly. Drones can cover a large area of farmland quickly and efficiently, capturing images from different angles and heights. By combining this data with satellite imagery and weather-based indices, complete crop health information products can also be developed.

### Data Analytics for Faster Claim Settlement

Data analytics has emerged as a game-changer in the crop insurance sector. Large volumes of data streams on crops are now available from various sources such as satellites, weather stations, and mobile applications. This makes it easier for insurers to check the correctness of data during the entire policy lifecycle from enrolment till loss assessment.

Insurers can now corroborate enrolment under crop insurance Schemes with satellite imagery data to identify cases of over insurance or insurance of wrong crop. Modern data analytics tools also provide quick assessment of data to identify duplicate enrolments thereby further reducing over insurance.

In the past, claim assessment relied only on manual crop-cutting experiments, which were prone to sampling and non-sampling bias. However, with the availability of extensive data on crop health indicators, it is now possible to develop more accurate and objective assessments of crop losses. This can be used to increase the insurance settlement process between insurers and farmers.

### On Actuarial Techniques for Crop Loss Modelling

Advanced statistical and computational

methods are utilized in Actuarial Techniques for crop loss modelling to assess agricultural risks and damages. The entropy method, a non-parametric approach, analyses variability in RST-based data to assign weights to each RST parameter, attributing greater importance to parameters that introduce more information, thus offering a solid framework for insurance assessments without presuming a specific data distribution. Conversely, Machine Learning (ML) models, and other parametric models, exploit historical data and recognizable patterns to predict crop yields and losses with increasingly accurate outcomes over time. By leveraging a variety of data analysis techniques, these methodologies furnish sophisticated tools for crafting precise and adaptable crop insurance models.

### Conclusion: What does the future hold?

There has already been a rise in the number of technology-driven crop insurance initiatives by Insurtech players as well as the Indian government, showcasing the transformative potential of these advancements.

Government of India is also promoting insurance companies to launch new innovative products based on technology solutions under the PMFBY Sandbox. This would not only drive innovation but also offer a single source platform for farmers to access such products thereby making it easier to scale-up these products.

As technology continues to evolve, the outlook for the future of crop insurance appears promising. Insurers are poised to provide more accurate risk assessments, faster claims settlement, and customised insurance products. For farmers, these developments translate into enhanced accessibility, affordability, and transparency within the insurance process. This, in turn, empowers farmers to manage risks more effectively, thereby stabilizing their income. Ultimately, these technological strides contribute to fostering sustainability in the Indian agriculture ecosystem and ensuring the livelihoods of farmers.





# INDIA FOOD 2024

INDIA INTERNATIONAL FOOD TRADE AND TECHNOLOGY FAIR 2024

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- ❖ Ayurvedic-Medicinal -Plant based
- ❖ Confectionery, Bakery, Dairy products
- ❖ Halal products, Meat, Marine
- ❖ Edible oil, Spices
- ❖ Organic -Nature products
- ❖ Packaging-Preservation Centres
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- ❖ Rice, Grains, Pulses
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# EMPOWERING WOMEN

## DRIVING GENDER EQUALITY AND ENTREPRENEURSHIP

**O**n March 8, 2024, in connection with International Women's day, Agriculture Today Group in partnership with Heifer International organised a webinar, "Empowering Women : Driving Gender Equality and Entrepreneurship."

The webinar was attended by Ms. Anjana Nair, Group Editor, Agriculture Today Group; Ms.Rina Soni, Executive Director, Passing Gifts (Heifer India); Mr. NK Rajavelu, CEO, Crop Protection, Godrej Agrovet; Mr. Amit Patjoshi, CEO, Palladium India, Ms.Tehseen Zaidi, Corporate Communications Head India, Syngenta; Dr.Udita Sarkar, Director (CII), Grameen Foundation India, Dr. Deepti Rai, Senior

**Ms. Kavita Singh** said that she got a new identity after she associated with Heifer in 2015. She received training which helped her acquire knowledge and awareness which changed her life.

**Ms. Phulamanin Hembram** talked at length how access to information changed her life and gave her a new identity. She said that she received training in administering vaccination and medicine for poultry and she in turn gave training to other women. She talked about how economic independence helped her give better life to her children and plan ahead for the future.



Research Associate, Mobius Foundation; Ms. Priyanka Mallick, MD, QQRI; Mr. Deepak Pareek; Mr. Shawan Ali, Country Manager, Pepsico GDA and Ms. Vinita Singh, Senior Manager, Agriculture Today Group. Apart from this Women smallholder Farmers associated with Heifer India such as Ms. Kabita, BOD, Odisha; Ms. Phulamanin Hembram, CAVE, Odisha; Ms. Nutan Devi, Board of Director, PO Bihar and Ms. D Gunja Das, CAVE, Bihar also spoke at the webinar.

**Ms. Anjana Nair** while welcoming the panellists noted that agriculture employs 80% of economically active women in India and there is a growing feminisation in agriculture sector due to rural to urban migration of men. She said that empowering and mainstreaming women workforce in agriculture can bring about a paradigm shift in agriculture and it will enhance India's food and nutrition security. By helping women access new technology, knowledge, market and subsidies, we are inadvertently helping Indian agriculture to prosper and develop, she added.

**Ms. Reena Soni** said that Heifer had the first hand knowledge of how giving access to women to technology can change their lives. Currently there are 1,20,000 women associated with Heifer.

**Mr. Rajavelu** was quite emphatic about the role played by women in agriculture. He also informed that Godrej Agrovet will partner with the Agriculture Skill Council of India and the Future Agriculture Leaders of India to nurture one lakh women in the sector for better employment opportunities and economic upliftment.

**Mr. Amit Patjoshi** talked about investing in women and how it can increase productivity in different sectors. He talked about the initiative of Palladium, "Go Orange" and how a group of remarkable women known as the "Siba Baba Brahma Kumari" Self-Help Group (SHG) are inspiring changes.

**Ms. Tehseen Zaidi**, believed that empowered women empower women. She called for creating a chain of empowered women. She talked about how women don't have an identity, right to land or access to credit and should be given access



**Ms. Nutan Devi**, talked about how she got acquainted with good agricultural practices. She realised that the trainings that she received from Heifer helped her become self reliant. Having associated with heifer since 2018, she has received training and she noted that this has helped women to become decision makers. She also elaborated on the activities of FPO.

**Ms. Gunjan Das** talk about how training had helped her get recognition in the village. She said that with the vehicular help she received she could cover longer distances. She recounted how her economic situation had improved and helped her set up a shop. She also said that she gave training to other women and passed on the knowledge that she received to them.

to technology and knowledge. She also gave a brief account of Syngenta's CSR initiatives of empowering women.

**Mr. Shawan Ali** talked about the Global Development Alliance created by the collaboration of Pepsico and USDA. He talked about Pepsico's potato supply chain and how engaging women can drive business. He also mentioned that Pepsico was training women in new job roles such as drip irrigation maintenance, spraying etc., that were not traditionally assigned to them.

**Dr. Udita Sarkar** said that the exact number of women working in agriculture is

more than what is reported. She believed that women have always been entrepreneurs and was not recognised. She also noted that NRLM bought a sea change in the status of women. Self Help Groups also played a major role.

**Ms. Deepti Rai** talked about gender inequality and the gender gap in payment. She believed that emotionally a change should be brought in women. She also was conversant about how knowledge can change the lives of women and can empower them at ground level.

**Ms. Priyanka Malik** brought the discussion to the corporate sector. She noted that less than two percentage Fortune 500 companies had women CEOs. She also noted that there is a drop in women in senior roles. Marriage and motherhood being two stages where women drop out from their active career.

**Mr. Deepak Pareek** talk about the difference in mind set in women and men. He discussed about the need to invest in women and how their role will potentially increase in years to come.

**Ms. Vinita Singh** thanked all the panellist for their participation and noted that the webinar was a success.

# BIOGAS SLURRY FOR SUSTAINABLE AGRICULTURE



**O**rganic farming is gaining momentum globally, and India stands at the forefront with the highest number of organic producers. To sustainably meet the demands of the global organic market, India must transition to organic practices while adopting renewable energy sources like biogas.

## Indian Scenario

The adoption of Biogas has the potential to provide dual benefits of energy and bio-product. Biogas slurry is fermented to form Fermented Organic Manure (FOM), which is also known as Fermented Organic Fertilizer. India has the world's largest livestock population, generating substantial quantities of animal waste. For example, bovine dung alone (cow and buffalo dung) contributes 256.2 MT to the annual production of 730 MT of dung by animals, resulting in an estimated annual production of 76.8 MT of BGS (assuming 1 kg of cattle dung produces approximately 0.4 kg of BGS). These figures highlight the availability of biogas slurry from biogas plants, which can

## Biogas

Biogas production is a process that converts organic waste into energy through anaerobic digestion (AD). This process is facilitated by microorganisms that break down organic matter, generating biogas. Biodegradable materials such as cow dung and agricultural residues are broken down in an oxygen-free environment during the AD process, resulting in the production of biogas - a versatile energy source that can be used for various applications. The by-product of anaerobic digestion, known as digestate or biogas slurry (BGS), exists in either a solid or liquid form. The slurry enriched with a diverse range of microorganisms and secondary metabolites is a rich source of macro and micronutrients. Recent studies have confirmed that biogas slurry (BGS) derived from cow dung is nutrient-rich.

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be used as bio slurry to supply agriculture.

### GOBARdhan Initiative

The Galvanizing Organic Bio-Agro Resources Dhan (GOBARdhan) initiative launched by Ministry of Jal Shakti, includes various schemes and programs from different ministries and departments. The government has launched initiatives under the GOBARdhan umbrella to promote sustainable agriculture and a circular economy by leveraging biogas-generated residual fermented organic manure (FOM) and liquid fermented organic manure (LFOM). The GOBARdhan initiative serves the purpose of fulfilling the need for cleaner energy sources, promoting responsible resource management, reducing greenhouse gas emissions, improving health outcomes, and supporting environmental sustainability. Furthermore, GOBARdhan aims to promote environmental sanitation, prevent vector-borne diseases, and empower rural communities through entrepreneurship and income generation.

The objectives of the GOBARdhan initiative include establishing 500 "waste to wealth" plants, comprising 200 compressed biogas (CBG) plants, 75 plants in urban areas, and 300 community or cluster-based plants at a total investment of Rs.10,000 crore. This initiative aligns with



By promoting the use of BGS in crop production, India can enhance agricultural productivity while minimizing environmental impact.

Sustainable Development Goals (SDGs), specifically contributing to SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

Initiatives like GOBARdhan underscore the government's commitment to addressing waste management challenges while promoting agricultural sustainability.

### Applications in Agriculture

Fermented organic manure (FOM) and liquid fermented organic manure (LFOM) derived from BGS offer several advantages for Indian agriculture. They enrich soil health, reduce reliance on chemical fertilizers, and facilitate waste management. By promoting the use of BGS in crop production, India can enhance agricultural productivity while minimizing environmental impact.

### Case Studies and Research

International examples, particularly from China, demonstrate the efficacy of biogas slurry in improving crop yields and soil fertility. Studies indicate its potential as a foliar fertilizer, reducing the need for pesticides and enhancing chlorophyll levels. Moreover, BGS application has shown superior results compared to chemical fertilizers, highlighting its promise for sustainable agriculture.

### For Food Security

The integration of biogas production and the utilization of its by-products present a promising pathway for India's sustainable development journey. Initiatives like GOBARdhan underscore the government's commitment to addressing waste management challenges while promoting agricultural sustainability. By embracing biogas technology and its applications, India can achieve food security, environmental conservation, and rural development goals, ensuring a prosperous future for generations to come.



Other initiative taken by government was Waste to Energy Scheme by the Ministry of New and Renewable Energy, the SATAT (Sustainable Alternative Towards Affordable Transportation) scheme by the Ministry of Petroleum and Natural Gas, the Swachh Bharat Mission Grameen (SBM(G) Phase II program by the Department of Drinking Water and Sanitation (DDWS), the Agri Infrastructure Fund (AIF) of the Department of Agriculture Cooperation & Farmers Welfare, and the Animal Husbandry Infrastructure Development Fund (AHIDF) by the Department of Animal Husbandry & Dairy.

# PESTICIDE TRENDS IN INDIA

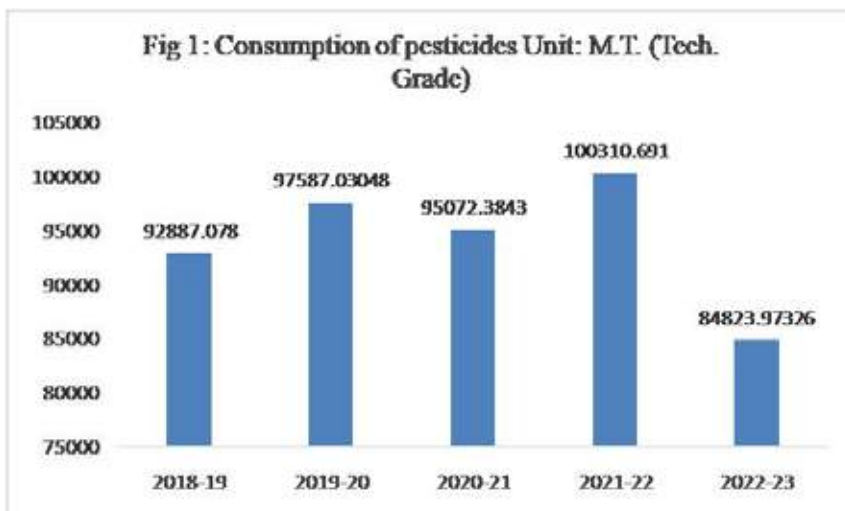
**F**armers employ various methods, including cultural, physical, mechanical, biological, and chemical approaches, for pest management. However, chemical control has been predominantly favored by farmers, including those with small land holdings, due to its ability to deliver immediate results. The data available on website of Directorate of Plant Protection, Quarantine and Storage, Faridabad revealed that consumption of pesticides in India was 92887.078 M.T. (Tech. Grade) during the year 2018-19. It follows a definite pattern that pesticide consumption increased and decreased alternately by two to five thousand M.T. (Tech. Grade). It may be because of farmers' belief that if they used heavy dose of insecticides one year, then next year some less extent of pesticides is enough for pest management.

**Over the period of five year (2018-19 to 2022-23) slight but appreciable change in pesticides consumption has been noticed**

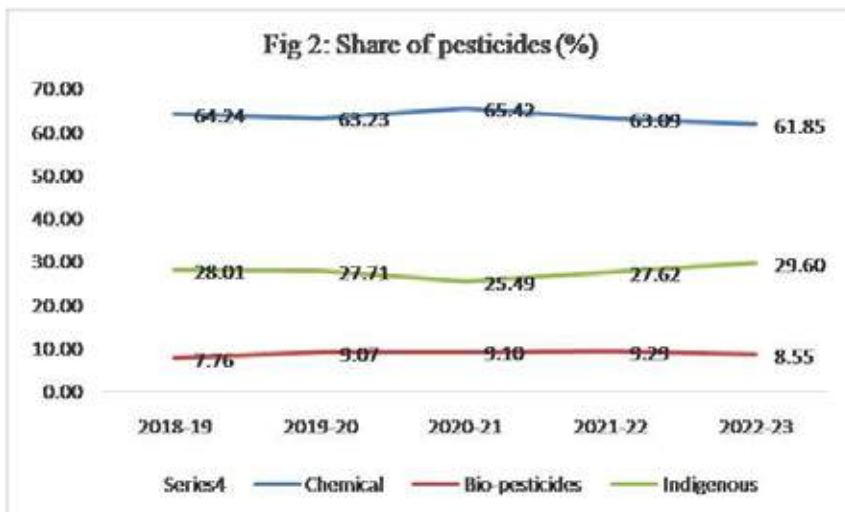
The share of chemical pesticide is much more than the indigenous pesticides and bio-pesticide. It holds 61.85 to 65.42 per cent which indicates its adoption by the farmers. The main drawback of indigenous pesticides is that most of the indigenous pesticides is applied at high dose so more amount of pesticide is required and it is also not effective as chemical pesticides. The report of Standing Committee on Chemicals and Fertilizers (Chair: Dr. Shashi Tharoor) published on 19th Dec 2023 indicating that herbicides used to kill weed have 44 per cent share in market followed by fungicides (27%) and insecticides (22%).

## Farmers Prefer Chemicals over Biopesticides

The government, agricultural institution



Source: DPPQ&S



Source: DPPQ&S



**Dr. Sudeepa Kumari Jha, Asst. Prof-cum-Jr. Sci., VKSCoA, Dumraon, Buxar and Dr. Monobrullah, Pr. Sci., ICAR-ATARI, Patna**

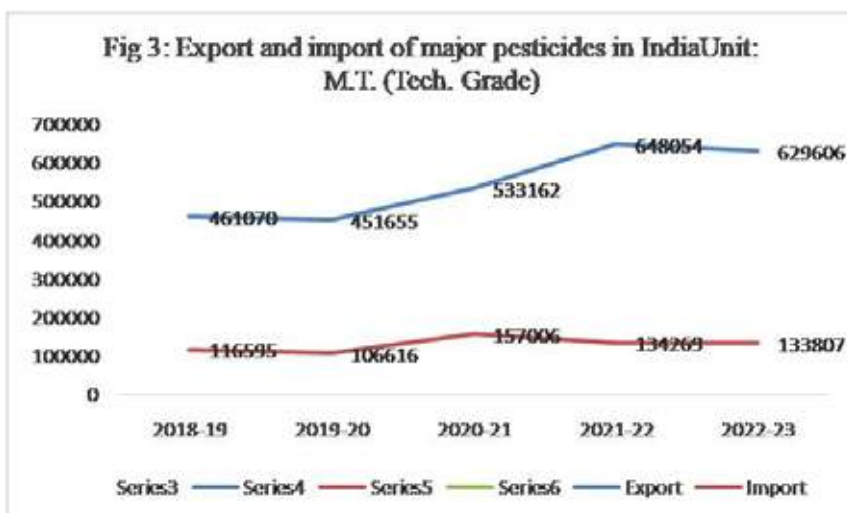
and many non-government organisations working in field of agriculture tried very hard to create awareness on the benefit of bio-pesticides over chemical pesticides. But it is not very much acceptable among the farmers community. The major cause is it's specificity. Specificity means it's capable for management of only specific group of pests. For example, most popular among microbial insecticides is *Bacillus thuringiensis* can be used against only lepidopteran larvae. NPV is a virus based microbial insecticides which is species specific. Its HaNPV strain is effective against only *Helicoverpa armigera*. Due to this region, farmers do not prefer bio-pesticides. The other reason is lack of education in farmers and buyers. Most of the farmers only think about instant profit. They ignore the harmful effects of chemical insecticides like resistance development in pests species, resurgence and residue problem which can be minimized by the use of bio-pesticides. The shelf life of chemical pesticides is relatively longer than the bio-pesticides. In short term chemical insecticides are relatively more economical than bio-pesticides. The efficacy of chemical pesticides is also much more than the other pesticides.

The market demand is such that the produce that appear free from pest has higher price. Most of the buyers don't prefer fruits or vegetables even slightly affected by the pest. Most of the farmers of India have small land holdings and they are totally dependent on agriculture for their livelihood. So, they are averse to any risk that affect their income even in short term.

**Change in Trend**

Over the period of five year (2018-19 to 2022-23) slight but appreciable change in pesticides consumption has been noticed. The chemical pesticides consumption was decreased by 12.07 per cent and bio-pesticides consumption increased by 0.62 per cent.

The major pesticide consuming crop was cereal followed by oilseeds and pulses. Cereal crop consumes 36.21 to 40.05 per cent of total pesticide utilized. The



Source: DPPQ&S

**The report of Standing Committee on Chemicals and Fertilizers (Chair: Dr. Shashi Tharoor) published on 19th Dec 2023 indicating that herbicides used to kill weed have 44 per cent share in market followed by fungicides (27%) and insecticides (22%).**

number of sale point for pesticide distribution increased from 222731 to 285865 in this period of time. In the international trade, India has consistently demonstrated a surplus in exports over imports. Over the course of five years, the export volume of major pesticides has risen from 461,070 to 629,606 M.T. (Tech. Grade). Concur-

rently, the import of pesticides has also seen an increase, climbing from 116,595 to 133,807 M.T. (Tech. Grade).

For sustainable agriculture, farmers should adopt integrated pest management that means amalgamation of all the management practices including use of bio-pesticides and chemical pesticides.

# UTTAR PRADESH AGROTECH 2024

1st-3rd March, Indian Institute of Sugarcane Research, Lucknow



The 20th edition of Agrotech organized by the Indian Chamber of Food and Agriculture in collaboration with the Department of Agriculture, Government of Uttar Pradesh took place in Lucknow, Uttar Pradesh, from March 1st to 3rd, at the Indian Institute of Sugarcane Research, ICAR.

Over the course of three days, the event featured an exhibition highlighting the newest advancements and innovations in agriculture, informative sessions led by industry professionals, workshops tailored for farmers, a Development Meet, and the presentation of the Innovative Farmers Award 2024. Approximately 4000 farmers attended the event, making it a significant gathering for the agricultural community.

## DAY 1: 1ST MARCH, 2024

The event commenced with its inauguration, graced by the presence of Shri Devesh Chaturvedi, Additional Chief Secretary of the Government of Uttar Pradesh, alongside various other dignitaries. Following the inaugural session, a Development Meet focused on Uttar Pradesh ensued,

aiming to delve into the state's strengths, challenges, and potential opportunities.

## Cultivating Change: Uttar Pradesh's Progressive Push for Crop Diversification

The Inaugural Ceremony of the event was graced by Shri Devesh Chaturvedi, Additional Chief Secretary, Government of Uttar Pradesh; Dr MJ Khan, Chairman, Indian Chamber of Food & Agriculture; Dr Rasappa Vishwanathan, Director, Indian Institute of Sugarcane Research, Lucknow; Dr Anesh Kumar Sharma, Technical Director, Electronics Corporation India Ltd and Mr. Mukesh Singh, Managing Director, Indo American Chamber of Commerce.

**Dr. MJ Khan**, during his welcome address, emphasized on the crucial role of partnerships between the industry and Farmer Producer Organizations (FPOs) in strengthening agriculture and leveraging technological advancements. He also underscored the significant investment, innovation, and developmental opportunities available within the state. Dr. Khan further stressed the importance of enhancing and consolidating exports for holistic develop-

ment.

**Dr Rasappa Vishwanathan** expressed his optimism that Uttar Pradesh Agrotech 2024 would mark a transformative milestone for agriculture, offering farmers invaluable insights through technology demonstrations and product showcases.

**Dr Anesh Kumar Sharma** underscored the significance of soil testing and the importance of micronutrients in augmenting productivity. He introduced ECIL's ground breaking product designed to assess soil nutrient levels, facilitating precise nutrient application to optimize productivity.

**Mr Mukesh Singh** stressed the pivotal role of public-private partnerships in bolstering exports, enhancing market linkages and ensuring fair prices for farmers, echoing the progressive policies of the Uttar Pradesh Government.

**Shri Devesh Chaturvedi** articulated how the Agrotech exhibition stands poised to offer holistic solutions to farmers, spanning from tillage to post harvest management, through innovative industry initiatives. He underscored the state government's commitment to promoting crop diversification, emphasizing the inclusion



of pulses, oilseeds, millets and maize in its diversification scheme, with assured procurement at MSP. With agriculture encompassing 12% of total area and contributing to 20% of the country's production, Shri Chaturvedi reiterated the government's dedication to fostering agricultural prosperity and sustainable growth in Uttar Pradesh.

## Development Meet on Uttar Pradesh

**Dr. MJ Khan**, Chairman of the Indian Chamber of Food and Agriculture, moderated the Round Table discussion. The session saw thirty participants representing various sectors including industry, academia, progressive farming, financial institutions, and others.

Dr. MJ Khan emphasized Uttar Pradesh's pivotal contribution to the country's economy, with exports totalling Rs. 19,000 Crores. He further highlighted the state's significant role in the sugar, dairy, and horticulture sectors. Dr. Khan stressed on the necessity of empowering the farming community through forward linkages and value addition initiatives. He also discussed the price parity challenge faced by the sector between producers and consumers, advocated for district-level farmer awareness programs, and emphasized the importance of Precision Farming and advancing post-production practices to bridge this gap.

**Dr. Rasappa Vishwanathan**, Director, IISR underscored Uttar Pradesh's status as the state hosting the highest number of ICAR institutes. He noted a remarkable increase in sugarcane productivity over recent years, with India establishing itself as a benchmark for sugarcane productivity globally. Dr. Vishwanathan highlighted that crop diversification initiatives have resulted in savings of Rs 20,000 crores. Regarding suggestions, he emphasized the need for greater emphasis on the mechanization sector to empower farmers.

**Dr. Bhuvaneshwar Pandey** advocated for the adoption of practices that require minimal inputs yet yield maximum outputs. He then highlighted the pressing issue of stubble burning in the state, noting its det-



ritmental effects on both soil health and air pollution. He stressed the importance of transitioning from "Swastha Dhara to Khet Hara" (from healthy soil to green fields).

**Hemanth Kumar**, Shaktiman highlighted Uttar Pradesh as a burgeoning state with abundant opportunities for investment, growth, and development. He emphasized on the need for capacity-building programs within Uttar Pradesh to educate farmers on the utilization of farm machinery, thereby harnessing technology for agricultural advancement. Additionally, he suggested providing subsidies on farm machinery to

promote mechanization in Indian agriculture and enhance its efficiency.

**Vishal and Swati Sharma** from VST Tillers and Tractors Ltd advocated for the formulation of policies that promote a mechanized environment in Indian agriculture. Discussing their sugarcane harvesters, they emphasized the significant role Uttar Pradesh will play in utilizing these machines, considering its status as the largest producer of sugarcane.

**Abhishek Das**, TAFE highlighted some of their new products and requested the participants to visit the stall to get more information of the same.

**PK Pandey** from Crystal Crop provided an overview of the company's products, emphasizing the importance of plant health, plant nutrition, and plant production in achieving high-quality yields. He expressed Crystal Crop's commitment to elevating Uttar Pradesh to "Uttam Pradesh" (the best state). Pandey stressed the significance of maintaining soil health and enhancing productivity through the principles of using the Right Chemical, Right Dose, Right Crop, and Right Time.

**Jitender Gaur**, IPL Biologicals identified soil health, nutrient management, and carbon content as prominent challenges in contemporary agriculture. He proposed addressing these challenges by integrating technology for soil health management, employing biological solutions, managing residues effectively, and adopting precision



farming techniques to ensure food safety.

**Karthik Rawal**, SSK Bharat Group discussed the benefits of natural and organic farming in preserving soil health.

**Alok Tiwari** from the State Bank of India mentioned their focus on implementing the "Cluster to Connect" initiative and providing financing support to Farmer Producer Organizations (FPOs). Additionally, he highlighted SBI's involvement in extension services.

**Anand**, a Progressive Farmer from Sultanpur, recounted his transition from a soldier to a farmer and emphasized the importance of organizing awareness campaigns for high-value crops to transform farming into a lucrative venture.

**Manish Dubey**, Swaraj discussed about the portfolio of Swaraj Tractors which are AI integrated and has location tracking features.

**Suresh Babu** from Electronics Corporation India Ltd (ECIL) highlighted the prevalent deficiency of zinc and selenium in Indian soil and informed the audience about ECIL's system designed to assess soil health and determine nutrient content accurately.

**Piyush**, Krishi Udaan underscored the significance of drones in agriculture and suggested that the government should offer subsidies on drones to encourage their utilization in the fields.

## DAY 2: 2ND MARCH, 2023

### Session 1: Seed Health and Soil Health

**Mr. RK Singh**, Additional Director of Extension for the Government of Uttar Pradesh, highlighted the state government's initiative to establish 200 Farmer Producer Organizations (FPOs) to empower farmers. Additionally, he underscored the government's commitment to supporting farmers by providing subsidies for seeds, fertilizers, and farm machinery.

**Jitendra Gaur** from IPL Biologicals emphasized the vital role of soil in ensuring sustainability in agriculture. He proposed the installation of soil health meters to promote the precise application of chemicals. Additionally, he advocated for the utilization of biologicals and drones for pesticide



application.

**Sandeep Pattnaik** from HarvestPlus addressed the biofortification initiatives undertaken by the organization and highlighted the hidden hunger prevalent in India.

### Session 2: Farm Machinery

**Aashish**, TAFE told about a sensor-based tractor in the 50HP category that operates without a driver, emphasizing its fuel efficiency and contribution to sustainable agriculture.

**Hemanth Kumar** from Shaktiman highlighted Uttar Pradesh's significance in agriculture, especially for sugarcane, inviting participants to test their sugarcane harvester.

**Pankaj, Swaraj** outlined their current initiatives and future plans aimed at empowering farmers through technology and community involvement.

**Sandeep**, JCB showcased agricultural equipment and emphasized their initiatives for women empowerment and capacity building.

**Rahul Saini** of VST Tillers and Tractors Ltd. discussed the company's journey, vision, and mission.

### Concluding Ceremony and Presentation of Innovative Farmers Awards 2024

The event was concluded on 3rd March. Shri Brajesh Pathak, Hon'ble Deputy Chief Minister, Govt of Uttar Pradesh graced the event as the Chief Guest, celebrated the outstanding contributions of 11 farmers hailing from different districts of Uttar Pradesh.

Shri Brajesh Pathak said, recognizing farmers for their outstanding work will encourage more farmers for greater innovations in agriculture. He added that the UP government is fully committed to empowering farmers with technology and marketing support.

Dr. MJ Khan, Chairman of the Indian Chamber of Food and Agriculture, highlighted the pivotal role of such events in strengthening the bond between farmers and innovation.

Dr. Bhuvaneshwar Pandey commended the organizers for convening this significant event, which facilitated the gathering of key stakeholders to enhance the farming sector.

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