



AGRICULTURE WORLD

the pulse of global agriculture

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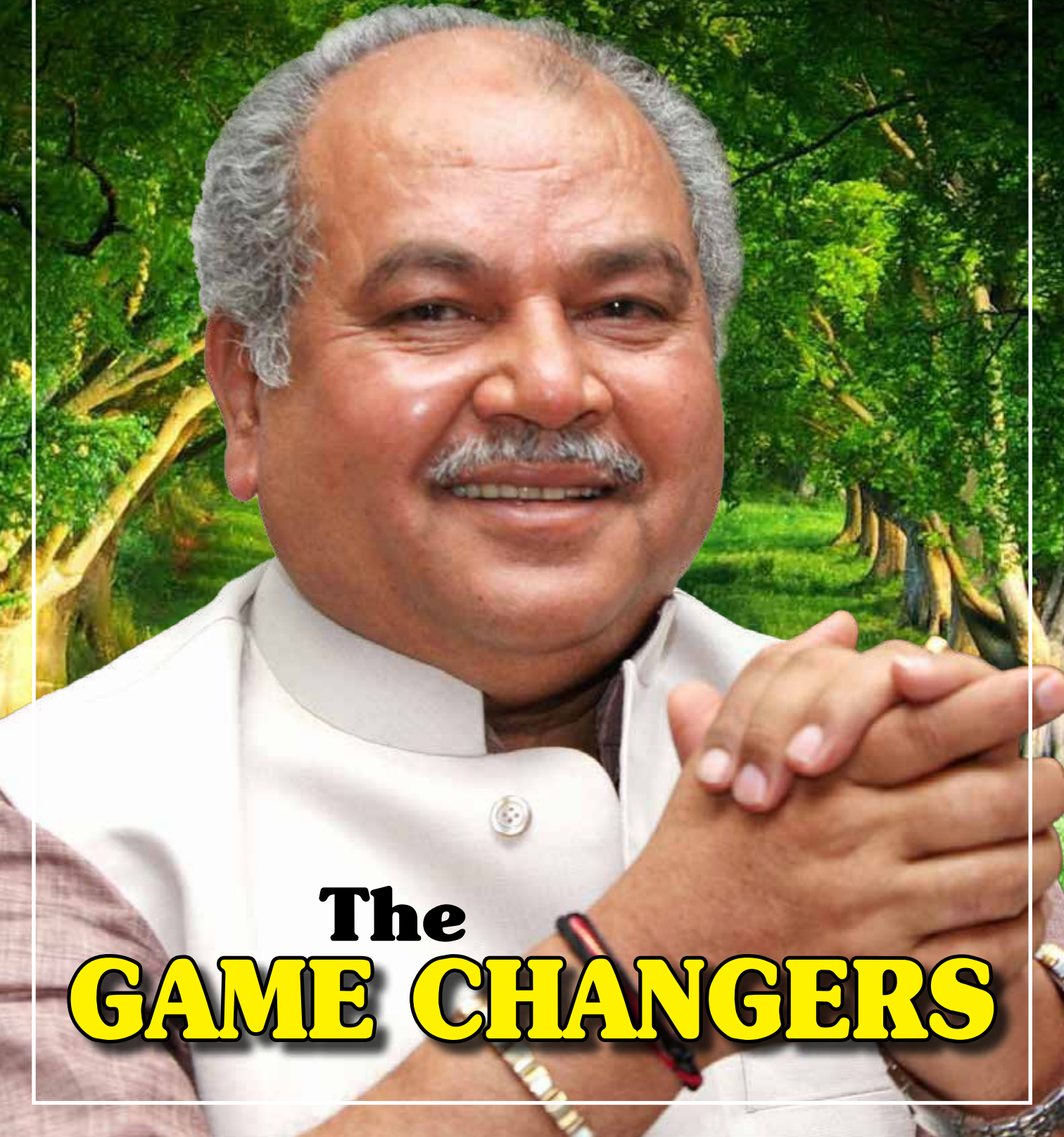


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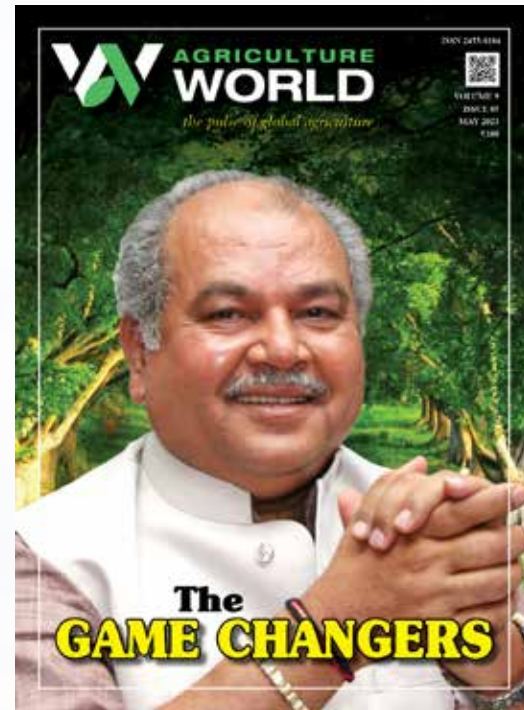
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08 **SHRI NARENDRA SINGH TOMAR**

10 **Dr Raj Paroda**

12 **Dr P Chandra Shekara**

14 **Dr Ashok Dalwai**

16 **Mr Ajit Jain**

20 **Dr Tarun Shridhar**

22 **Mr RG Agarwal**

24 **Dr AK Singh**

28 **Mr RS Sodhi**

30 **Mr Ram Kaundinya**

CONTENT

- | | |
|--|--------------------------------------|
| 8. <i>Shri Narendra Singh Tomar</i> | 62. <i>ANGRAU</i> |
| <i>Minister of Agriculture & Farmers' Welfare, GOI</i> | 66. <i>Dr Deepak Jain</i> |
| 10. <i>Dr Raj Paroda</i> | 68. <i>Dr Ravi KC</i> |
| 12. <i>Dr P Chandra Shekara</i> | 72. <i>Dr Surinder Tikoo</i> |
| 14. <i>Dr Ashok Dalwai</i> | 74. <i>Dr Praveen Malik</i> |
| 16. <i>Mr Ajit Jain</i> | 76. <i>Dr Satyen Yadav</i> |
| 20. <i>Dr Tarun Shridhar</i> | 80. <i>Dr Suresh Kumar Malhotra</i> |
| 22. <i>Mr RG Agarwal</i> | 82. <i>Dr D Narain</i> |
| 24. <i>Dr AK Singh</i> | 84. <i>Dr Tolety Janakiram</i> |
| 26. <i>IRRI</i> | 86. <i>Mr Ashok Anantharaman</i> |
| 28. <i>Mr RS Sodhi</i> | 88. <i>Mr Debabrata Sarkar</i> |
| 30. <i>Mr Ram Kaundinya</i> | 90. <i>Mr GS Grewal</i> |
| 32. <i>Mr Samuel Praveen</i> | 92. <i>Mr Kartheeswaran KK</i> |
| 34. <i>Dr RC Agarwal</i> | 94. <i>Mr Morup Namgail</i> |
| 38. <i>Mr Kesavan</i> | 96. <i>Mr Mukul Varshney</i> |
| 42. <i>Dr SN Jha</i> | 98. <i>Mr Parikshit Mundhra</i> |
| 44. <i>Mr Ravi Pokharna</i> | 102. <i>Mr Roshan Tamak</i> |
| 46. <i>Andhra Report</i> | 104. <i>Mr S Narayanan</i> |
| 48. <i>Mr Rajesh Agarwal</i> | 106. <i>Mr Shantanu Pendsey</i> |
| 50. <i>Dr Maninder Kaur</i> | 108. <i>Dr Bhavna Sharma</i> |
| 52. <i>Mr Deepak Shah</i> | 110. <i>Ms Debika Goswami</i> |
| 54. <i>Mr RS Dixit</i> | 112. <i>Mrs Sharmila Oswal</i> |
| 56. <i>Mr Hemant Sikka</i> | 114. <i>Mr Kannan M</i> |
| 58. <i>Mr Pradipta Sahoo</i> | 116. <i>Mr Agnishwar Jayaprakash</i> |



Revolutionizing Indian Agriculture

Over the past few years, India's agriculture sector has shown tremendous growth and is one of the major contributors to the country's GDP and the economy. It is also one of the largest employers, with over half the population engaged in agriculture or related activities. Over the years, the agriculture scenario has changed significantly.

From the Green Revolution of the 60s to smart farming of today, Indian agriculture sector has been revolutionized with the new technologies. From Artificial Intelligence to GIS and the use of drones and robots, new technologies have been game changers in the way farming is carried out today.

Over-exploitation of land, shrinking farm sizes, volatile markets and climate change present major challenges.

But it is through smart farming by application of sensors and automated irrigation practices and even climate-smart farming that the sector has been able to address the powerful headwinds. Smart farming can also help integrate digital and physical infrastructure, benefitting small farmers.

By embracing smart farming, farmers can raise their income substantially. Research has shown that a 1% increase in agricultural value added per hectare can bring about a 0.4% drop in poverty in the short term and 1.9% in the long term. Add to it the use of

solar power to transform the rural landscape. Solar power helps in saving precious water resources and can emerge as an additional revenue stream for farmers.

Government of India is implementing Digital Agriculture Mission (DAM), which includes India Digital Ecosystem of Agriculture (IDEA), Farmers' Database, Unified Farmers Service Interface (UFSI), funding to the states on the new technology (NeGPA), revamping Mahalanobis National Crop Forecast Centre (MNCFC), soil health, fertility and profile mapping.

In addition, the plan to form 10,000 Farmer Producer Organizations (FPOs) along with the Agri Infrastructure Fund (AIF) has the potential to transform these FPOs into 10,000 agri businesses. This will help further strengthen the mission of Primary Agricultural Credit Societies to extend its reach in penetrating the grassroots.

Investing in and adopting new technologies is essential for sustainable development and makes the country more stable. It is these game changers that will revolutionize Indian agriculture and take it to the next level.

M C Dominic
Founder & Editor-in-Chief



“
Journalism is what we need to make a democracy work - Walter Cronkite
”

Communication and dissemination of knowledge is essential for a Nation's development and a crucial role is played by MEDIA, which acts as a catalyst in making the communication more effective, prompt, accessible and affordable with an outreach to the outermost social periphery. With a fast changing global scenario, the definition of journalism has been broadening in India too.

In the current context, where mainstream media highlights only sensational subjects and political issues for TRPs, **Development Agriculture Journalism** in both electronic as well as print media is paving a way for the unheard, but essentially meaningful, voices of Experts, Farmers, Scientists, Policy and Decision Makers. In an agrarian nation like India, it is imperative to strengthen this fourth pillar of democracy for agriculture and rural development.

KRISHI JAGRAN GROUP of publications has been recognized by the **LIMCA BOOK OF RECORDS** for the largest circulation, maximum number of languages and highest readership. With excellence in knowledge dissemination since more than two and a half decades, the group caters to our rural & farming communities with latest updates from the agriculture and allied sectors. Krishi Jagran is the undisputed **leader in Digital and Social media platforms** in Agri domain with **23 monthly magazine editions**, almost a **million visitors daily** on our websites, **100,000 views daily** on YouTube agri news channels and a Facebook page reach of **more than 230 million** every month.

We feel delighted in presenting the creatively revamped and re-structured version of Krishi Jagran's English magazine, **AGRICULTURE WORLD**. With thought provoking, peer reviewed interventions from eminent Global Stalwarts of the sector, we envision creating cyclopedias on pertinent subjects that will feature novel innovations, government policies, the very dynamic agriculture industry, brain storming dialogues on critical concerns, new products and services for farmers and professionals.

Contrary to most media forums that are affected by ideological mindsets and contorted realities, **Agriculture World** promises to feature meaningful insights, latest updates, unexplored horizons, untapped potential and opportunities, new perspectives for smart professionals, global market scenario, networking possibilities with key stakeholders along with an access to your target audience for advertorials and advertisements.

The May edition of Agriculture World showcases **Game Changers of Indian Agriculture**.

We have the honour of featuring Sh Narendra Singh Tomar Sir, Hon'ble Agriculture Minister, Government of India on the Cover of this special edition.

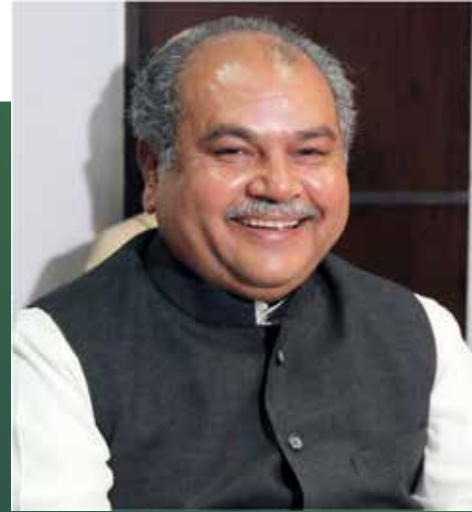
We humbly solicit your feedback and suggestions

Mamta

HON'BLE SHRI NARENDRA SINGH TOMAR

STARTUPS

There was a time when there was talent in our country and we were not able to recognize it. There was no environment to showcase their talent and dynamic youngsters were forced to go abroad, but today it is not so. Prime Minister Shri Modi grasped this situation and created a positive environment in the country, due to which not only India but the whole world has changed. Before 2014, there used to be only 31-32 Startups in the country, but today their number has increased to more than 6,500. In the Agriculture sector alone, their number is above 2,000. Today the whole world is recognizing the power of India and also accepting its stature.



MINISTER OF AGRICULTURE & FARMERS' WELFARE, GOI

STUDENTS & YOUTH

Students & Youth should contribute to make Agriculture more remunerative and make villages more prosperous. Prime Minister Modi constantly emphasizes that we should not only make the present beautiful, but also make India a developed nation by the time we celebrate the centenary of India's Independence, this is a golden and historic opportunity for India. It is the responsibility of the new generation to take advantage of it. The future of the country in 2047 should be such that India becomes the torchlight to the world.

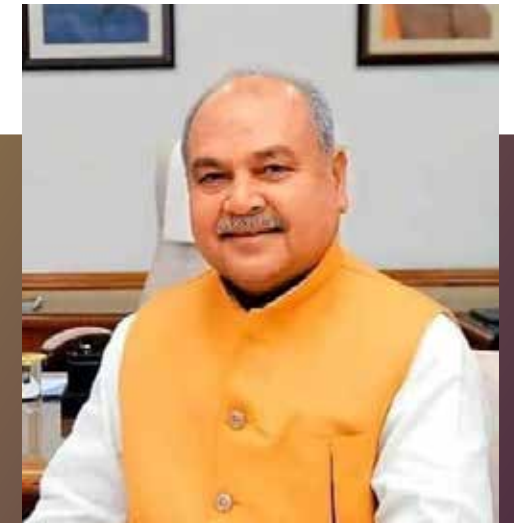


MILLETS

By terming Millets as Shree Anna, Prime Minister Narendra Modi gave the "Miracle Food" a new meaning & dimension. International Year of Millets (IYM) – 2023 will provide an opportunity to increase global production, efficient processing and better use of crop rotation and promote millets as a major component of the food basket. The Ministry of Agriculture and Farmers Welfare is working in mission mode to increase millet production and consumption in collaboration with other Central Ministries, all State Governments and other stakeholders.

DRONES

Nearly Rs 127 crore released for Kisan Drone promotion. This includes Rs. 52.5 crores released to ICAR for purchase of 300 Kisan Drones and organizing their demonstrations on the farmers' fields in 75000 hectares through 100 KVKs, 75 ICAR institutions and 25 SAUs. It also includes funds released to various State Governments for supply of more than 300 Kisan Drone to farmers on subsidy and establishment of more than 1500 Kisan Drone CHCs to provide drone services to the farmers. The use of Kisan Drones has a potential to provide ample opportunities of employment to people in rural areas.



ICAR, UNIVERSITIES & INDUSTRY

From farmers to the Industry, all should work together to strive for excellence in agriculture. If feedback is received on how industry can apply the research done by ICAR, how to take it forward by complementing each other, what does the industry, working at the grassroots level want, then the delivery will improve. The importance of our agricultural products has increased in the world. It is everyone's responsibility to ensure that the quality of our products is good. The shortcomings or gaps in this sector need to be filled, as well as how India can achieve excellence in the agriculture sector. While facing the current international challenges, everyone from farmers to industry should work together in that direction.



SATHI

SATHI (Seed Traceability, Authentication, and Holistic Inventory) portal will prove to be revolutionary in the Agriculture sector. Government of India is constantly trying to overcome the challenges and difficulties faced by the sector through various schemes and programs. Seeds, pesticides, fertilizers and irrigation play a major role in agriculture. Inferior quality or spurious seeds affect the growth of agriculture. This causes loss to the farmers and affects agricultural production of the country. We should devise a system so that the market of spurious seeds is checked and quality seeds reach the farmers. SATHI portal is an important step in this direction.

TECHNOLOGY



Critical Role For Paradigm Shift



Youths as agri-preneurs, technological agents, input and knowledge providers will make all the difference in achieving our food and nutritional security

Agriculture is the backbone of Indian economy. The agribusiness ecosystem significantly contributes to the socioeconomic fabric of India.

Over the last few decades, agriculture sector has progressed by leaps and bounds. Currently valued at \$370 billion, agriculture is one of the major contributors to the country's GDP. According to the Economic Survey 2020-21, GDP contribution by theW agriculture sector was 19.9 per cent. The agriculture sector has to grow at around 6.0 per cent in order to effectively contribute 1 trillion towards US\$ 5 trillion projected economy by the Hon'ble Prime Minister of India. Agriculture is also the largest employer, with over half the population engaged in agriculture and related activities and it is one of the sectors that has embraced the use of cutting-edge technologies, especially by involving youth (including women) as agritech startups and enlightened farmers.

Agriculture Faces Second Generation Problems

Despite remarkable achievements like Green, White and Blue Revolutions, agriculture is faced today with second generation problems of factor productivity decline, deteriorating soil health, depleting water table, loss of agrobiodiversity, besides adverse impact of climate change. By 2030, we need to meet sustainable development goals (SDGs), especially no poverty and zero hunger. Also to feed additional population of about 15 million per year, we shall have to produce additional 5 million tons of food annually.

The economic impact of catastrophic weather events and the social pressures including the recent push for natural and organic farming – all these demand game changing initiatives towards sustainable farm practices with reduced use of fertilizers, chemicals, water, energy etc.

In view of above, paradigm shift becomes critical for farmers to diversify agriculture that is sustainable, diversified and efficient as well as economical. Youths as agri-preneurs, technological agents, input and knowledge providers will make all the difference in achieving our food and nutritional security.

In this context, the use of artificial intelligence (AI), machine learning (ML), big data, internet of things (IoT), sensors, drones and new technologies for secondary and specialty agriculture could help increasing yields, improving efficiency of water and other input uses, and build much needed resilience for higher income by the farmers. This will be a game changer for agri-preneurship and much needed motivation and attraction of youth in agriculture (MAYA).

Emphasis On FPOs, GAP

With the Government resolve to double the farmers' income, important game changer now is to have a shift from "Krishi Pradhan Desh" to "Krishak Pradhan Desh" since 58 per cent of our population is still dependent on agriculture and allied sectors. Government efforts to establish large number of Farmer Producer Organisations (FPOs) throughout the country, and emphasis to convert subsidies into incentives for diversified and good agricultural practices (GAP) will also be the real game changer for linking farmers to the market and to avoid distress sale. Another game changer currently is the emergence of private enterprises such as Big Basket, Reliance Mart, Walmart, Amazon and startup as 'Agri 10X', 'DeHaat', etc. These do connect farmers directly to buyers on a single platform benefitting both sides as win-win, Smart farming like use of sensors and automated micro-irrigation practices can help monitor agricultural land, crops, temperature and soil moisture resulting in higher crop yields. In this regard, agri-based and tech-driven startups have been quite innovative in assisting farmers and revolutionising farming practices. Climate-smart farming is another game changer to ensure certainty and predictability.

Maximizing Farm Output

In order to maximize the farm output, there are new game

changers that can help assessing the market trends, predict yearly outcomes, and consumer needs so that the farmers are efficiently able to produce timely and maximize their returns. AI-powered chatbots/chatGPT platforms, AI along with machine learning (ML) techniques will enable to interact with users/consumers in more personalized way. Moreover, AI/ML algorithms can generate real-time actionable insights to help improve crop yields, predict pest emergence, assist in soil testing, and provide actionable data for farmers to reduce their workload. Blockchain technology offers tamper-proof and precise data about farms, inventories, quick and secure transactions and food tracking.

Thus, the scientists, entrepreneurs and farmers need not be dependent now only on recorded data stored in files.

Recently, five MoUs have been signed with CISCO, Ninjacart, Jio Platforms Limited, ITC Limited and NCDEX e-Markets Ltd (NeML), to promote digital agriculture through pilot projects. GoI's Jio Agri (JioKrishi) platform (2020) at Jalna and Nashik (Maharashtra) will digitise the agricultural ecosystem along the entire value-chain to empower farmers by providing advisory that is both accurate and personalised.

ITC's e-Choupal 4.0 digital platform 'Site Specific Crop Advisory' at Sehore and Vidisha (Madhya Pradesh) will give personalised site-specific crop advisory to farmers. GoI's 'Digital Agriculture Mission 2021-2025' aims to support and accelerate projects using these novel technologies. Moreover, electronic National Agriculture Market (eNAM) could also help the farmers to sell their products without the interference of any brokers or mediators, by generating competitive returns from their investment.

Tech Shall Transform

The 'Direct Benefit Transfer (DBT) Agri Portal' is a unified central portal for agricultural schemes across the country which helps farmers adopt modern farm machineries through government subsidies. With GPS driven precision farming equipment, new ways have been developed to make farming more efficient and grow more food. The work is going on to find new ways to irrigate crops or breed more disease resistant varieties.

5G technology will facilitate geo-location services and real-time connectivity to communicate information on animal health, fertility, and feed and fodder intake. It will also help livestock owners to reduce their overall cost on livestock management for their improved performance. These technological options will definitely prove to be the game changers for Indian Agriculture.

Dr RS Paroda

Padma Bhushan Awardee, is Chairman, TAAS and Former Secretary, DARE & DG, ICAR

FPOs USHERING THE CHANGE

The major constraint of Indian agriculture is diminishing size of land holding. As per the 2015 census, the proportion of small and marginal farmers is more than 85 per cent of total land holdings in the agricultural economy of India.

Being smallholders, these farmers suffer from some inherent problems such as absence of economies of scale, lack of access to credit, input, technology information and their inability to participate in the price discovery mechanism. Thus, given the situation of the smallholders, their problems are of prime concern for the sector. In order to overcome the challenges faced by them, the only way is to aggregate these small farmers through an appropriate model.

Efforts to Aggregate Smallholders

Various interventions by the government or NGOs have tried to aggregate smallholders. One such pioneering attempt was promotion of cooperatives which were meant for performing various activities in agriculture including input supply. By and large, the experiences of cooperatives has been poor with an exception of co-operative sugar factories in Maharashtra and dairy cooperatives in some Indian States.

Apart from these cooperatives, Amalsad cooperative Society for sapota and farming co-operative (Gambhira) in Gujarat, MAHAGRAPES in Maharashtra, HOPCOMS and CAMPCO in Karnataka, Mulkanoor women cooperative groups in combined Andhra Pradesh etc., have performed well. There are also a few examples of successful SHG women's farming groups in Andhra Pradesh. These successful models

could not be emulated in other regions of the country.

GOI initiated a new policy towards creation of a new aggregation model which can take care of various agricultural activities such as inputs, production, technology, credit and marketing. FPOs in many parts of the country have proved to be successful in fetching the remunerative prices to its farmer members by establishing a direct market linkages for their produce.

Many Milestones

The role played by FPOs in marketing helped its members in minimizing the post-harvest losses through value addition and efficient management of value chain. Few FPOs were involved in exporting the farmer member produce to various countries and thus helped in stabilizing the price fluctuations. In addition to these, the FPOs are also involved in integration with APMCs, e-NAM, exporters and linkage with various agencies involved in agricultural marketing.

In India, some of the successful FPOs are Sahyadri farms, Maharashtra, Visaka Dairy Producer Company Ltd. in Andhra Pradesh, Savithribai Phule Goat Farming Producer Company, Maharashtra, Shree Chhatrapati Shahu Milk and Dairy & Agro Producer Co. Maharashtra, Begoti Tea Producer Co. Ltd. Assam and Palakkad Coconut Producer Co.

As on 01.03.2021, about 18,500 producer organizations were promoted in India and this number is expected to be more than double over the next few years, bringing the total coverage to about 10% of all agricultural households. In order to achieve this target,



Dr. P Chandra Shekara
Director General
MANAGE



Formation and promotion of FPOs is the first step for converting Krishi into Atmanirbhar Krishi. This will enhance cost effective production and productivity, and higher net incomes to the members

around 50% of FPCs are in just 4 states and 25% of FPCs are in just 20 districts. The Pune district in Maharashtra alone has 185 FPCs, the highest in India and 32 districts have more than 1 lakh farmers but no PCs. Nearly 79% of FPCs are in formative stage and aged 3 years or less. Ironically only 14% of FPCs have paid-up capital of ₹10 Lakh or more and 49% of FPCs have paid-up capital of ₹1 lakh or less (Azim Premji University Report 2020).

Gradual growth inducing sustainability in functioning growth of the FPOs/FPCs should be the approach of the promoters rather than expecting the quick results. Capacity Building of any form of farmer organization assumes greater importance to enhance the efficiency and bring peer group pressure among members of the group for effective functioning. Credit support and linking these FPCs to government schemes are very crucial for attaining the sustainability.

Challenges Faced

The experience so far reveals that there are certain regulatory issues being faced by the Farmer Producer Companies in India. These include compliance of legal issues relating to submission of audit report, AGM report, quarterly reports, minutes of the meetings etc. Due to lack of awareness among the BODs and members, the FPCs are inviting hefty fines for non-compliances of these legal issues as provided in the Companies Act. These regulations can be modified either by amending company regulations to allow exemptions for FPCs from certain requirements and/or by creating FPC specific rules. Ministry of Corporate Affairs (MCA) should explore the possibilities of differential compliance requirements for FPCs.

Hence, there is a need for "Ease of Doing Business" guidelines for FPCs and mentoring the FPCs to follow the same.

during 2020-21, Government of India has launched Central Sector Scheme "Formation and Promotion of 10,000 new Farmer Producer Organizations (FPOs)" with an outlay of Rs. 6865 crore.

As it was emphasized by GOI, formation and promotion of FPOs is the first step for converting Krishi into Atmanirbhar Krishi. This will enhance cost effective production and productivity and higher net incomes to the member of the FPO. Also improve rural economy and create job opportunities for rural youths in villages itself. This was the major step towards improving farmers' income substantially.

Formation Not Uniform Across Country

Over a period of time, it is found that the formation of FPOs across the country is not uniform. Moreover, the studies have indicated that only around 25% of the FPOs are running successfully in a sustainable manner. Several studies have revealed that

Titans of Change



The Legacy of Norman Borlaug



Mr. Norman Borlaug's idea was to combine genetic improvements with the application of modern technology to boost agricultural productivity. He believed that the best way to address global hunger was through increasing agricultural productivity rather than food aid

Dr Ashok Dalwai

Chief Executive Officer, NRRRA

With an ever-growing population and limited land resources, scientists and researchers have been continuously working to increase agricultural productivity while minimizing the environmental impact. One such scientist who revolutionized the field of agriculture was Norman Borlaug, an American agronomist who oversaw global programs that greatly increased agricultural productivity during the "Green Revolution."

Born in Iowa in 1914, Borlaug studied forestry at the University of Minnesota, where he received his B.S. degree in 1937. Later, he obtained a Ph.D. in plant pathology and genetics from the same university. After completing his education, he moved to Mexico to work on a project to improve the yield of wheat. In Mexico, he developed semi-dwarf, high-yielding, and disease-resistant wheat types, which significantly increased agricultural productivity. This led to what is now known as the Green Revolution, a period of significant agricultural productivity growth in developing countries during the 1960s and 1970s.

Father Of The Green Revolution

Borlaug's work resulted in over a billion people being saved from starvation, and he is known as the father of the Green Revolution. His contribution to the field of agriculture was recognized with several awards, including the Nobel Peace Prize, Presidential Medal of Freedom, and the Congressional Gold Medal.

Address Global Hunger

Apart from his work on genetic resistance to crop loss, he also argued that the high-yielding varieties of crops that he developed could help address global food security issues. His idea was to combine genetic improvements with the application of modern technology to boost agricultural productivity. He believed that the best way to address global hunger was through increasing agricultural productivity rather than food aid.

Collaborative Efforts In Addressing Global Challenges

Borlaug's work also highlights the importance of collaborative efforts in addressing global challenges. He worked with farmers, governments, and international organizations to improve agricultural productivity worldwide. His work inspired others to join the cause and further develop agricultural technologies that could benefit farmers around the world.

Need For Sustainable Agriculture

Today, Borlaug's legacy lives on, and his work continues to inspire scientists and researchers to develop sustainable agricultural practices. With the growing population and climate change, the need for sustainable agriculture has become more crucial than ever. Innovations in the field of agriculture have the potential to address some of the most significant global challenges, such as food insecurity, poverty, and climate change.

AI-Driven Game Changing Technologies

Several game-changing technologies have emerged in recent years that have the potential to revolutionize the field of agriculture. One such technology is precision agriculture, which uses data-driven techniques to optimize crop production, reduce waste, and minimize environmental impact. Another technology is gene editing, which has the potential to develop crops with improved yield, disease resistance and nutrition.

Power Of Scientific Research And Collaborative Efforts

The legacy of Norman Borlaug serves as a reminder of the transformative power of scientific research and collaborative efforts in addressing global challenges. As we move forward, we must continue to support research and development in the field of agriculture to ensure a sustainable future for generations to come.

Industry Must Boost Precision Agriculture

“

Precision agriculture is an approach where improved inputs and agricultural practices are used in precise manner to make every aspect of agriculture profitable and sustainable



Mr Ajit Jain
Managing Director
Jain Irrigation Systems



Precision agriculture is an approach where improved inputs and agricultural practices are used in precise manner to make every aspect of agriculture profitable and sustainable.

Avenues of Precision Agriculture by Jain Irrigation

We have pioneered several new concepts and practices for multiple crops which helped to change the way agriculture is done today. On the output side, we provide better market linkages to the farmers and also buy back and process fruits, spices, onions and vegetables. We are also in financing through our microfinance company - Safal. Our prime focus is to enable the farmers for better utilization of technology to increase remuneration and profitability per acre. Some of our interventions in precision agriculture are discussed below.

Precision in Planting Material- Tissue Culture

Jain Irrigation is situated in Banana bowl of the country, Jalgaon district of Maharashtra, where about 14% of the country's Banana is produced. Yields of conventional varieties were low, also it was highly perishable and not gaining much export value. After extensive research, we have first introduced a specially selected variety called Grand Nain. This tissue cultured variety has replaced the century old practice of Rizom/ sucker planting. We added value to it by working a precise irrigation and fertigation schedule to be applied through drip irrigation. This helped the farmer to harvest 3 crops in 30 months as against 2 crops in 36 months for conventional banana varieties. We ensure disease free and uniform plants,

standardize the package of practices. As a result we revolutionized the Banana Production System - Long finger length, more caliper and spotless lustrous banana, increased bunch weight from average 9 kg to 30 kg. We helped the farmer to revamp the mat & bunch management, making it export feasible. This resulted in enhanced income of banana growers by many folds.

Jain Irrigation has introduced tissue culture for many other crops like pomegranate, strawberry, potato, coffee etc.

Improved Irrigation Inputs

Drip irrigation is an important tool to achieve precision in irrigation. It ensures that water is directly applied to the root zone rather than irrigating the entire land. It ensures water saving more than 50% while yield increases more than 100% for most of the crops. It saves labor, energy and fertilizers which are crucial inputs in agriculture. Jain irrigation has pioneered the concept of drip irrigation in India.

Although with conventional drip irrigation uniformity of water distribution is fairly achieved (up to 90%) still there is some loss due to hydraulic constraints of the system design. Jain Irrigation has introduced a pressure compensated (PC) dripper and dripline which overcomes the hydraulic and topographical limitations and improves water distribution efficiency up as high as 98%. Moreover, uniform distribution of fertilizers can also be achieved with PC dripper which is an important step towards precision agriculture. We worked extensively for subsurface application of

drip irrigation for crop like sugarcane. To overcome the issue of soil suction due to siphoning and intrusion of roots inside the dripper, we have introduced Anti Siphon dripper and also introduced a dripper variant having root intrusion deterrent. Application of subsurface drip irrigation facilitated the use of mechanical harvesting for Sugarcane.

Digital-Tech Solution - Jain Logic:

To make irrigation more precise, we have introduced a digital-tech platform “Jain Logic”. Jain Logic is an amalgam of Digital - Tech Solutions created to fulfill precision agriculture and irrigation management requirements. It includes monitoring and control devices, software applications and real time analytical intelligence and prediction analysis for decision support system.

Working of Jain Logic: Irrigation decision tools boil down to two key questions: “when and how much?”. An irrigator wants to know when to irrigate and how much irrigation to apply to the crop.

Jain Irricare - Precision Farming Solution for Large Community Irrigation Projects

Jain Irrigation has come with a pathbreaking concept of “Resource To Root” in which water is distributed from reservoir till every plant through a network of closed conduits integrated with drip irrigation system. This revolutionary concept helped to increase water use efficiency to 90%. To control and monitor such a large distribution network remotely and to ensure every farmer within the command area gets his share of water, we came up with a unique IOT based Irrigation Management System - Jain Irricare.

We all know that if farmers prosper, the entire industry will prosper. There are traditional ways to increase farmers income which we all are doing, but some factors which really affect his income and which are beyond his control like climate vagaries, pest attack, untimely rain, drought situations, market fluctuations etc. Industry shall focus on alleviating all these issues to boost the agricultural economy. While doing so care shall be taken that any technological interventions, solutions shall be thoroughly studied well before it reaches to the end user, farmer. No half baked product shall reach the farmers. At Jain Irrigation, we strive hard to deliver the solution which will increase the farmers income by increasing yield, decreasing the input cost and at the same time technology shall be environmentally friendly and sustainable.



“ Powering rural India, Empowering the masses ”



Development Bank of the Nation for Fostering Rural Prosperity



India boasts of an infrastructure of around 600 shrimp hatcheries feeding 1,70,000 hectares of farming generating a production of more than a million tonnes per annum. We now command 26% share of the global shrimp trade



SECURING THE LIVESTOCK

The difficulty lies not so much in developing new ideas as in escaping from the old ones.

—John Maynard Keynes

There have been formidable game changers in the past, when the lexicon such as startup or artificial intelligence or FPOs had not entered the discussions on agriculture. Many were simple common sense driven ideas, backed by a passion and commitment as against the technology and management triggered game changers of the present.

White Revolution

“I am in the business of empowerment. Milk is just a tool for that.” This simple statement of Dr Verghese Kurien captures the essence of the White Revolution, a movement that catapulted a woefully milk deficit India into an undisputed global leader for nearly three decades now. A paltry trickle of 17 million metric tonnes with a per capita per day availability of 130 grams in the year 1950-51, has grown today into a flood of 211 mmt constituting almost one fourth of the global milk production.

How did we realise this seemingly impossible achievement?

Dairy has consistently grown at over 6% ever since the White Revolution was launched under the impressively named scheme Operation Flood.

The Success of Amul

The pivot of this model of growth has been the Gujarat Cooperative Milk Marketing Federation (GCMMF), known by its popular moniker Amul. And if amongst the millions that created this organisation credit were to be apportioned to a few, the foremost would undoubtedly be its chief architect late Dr Verghese Kurien supported by Tribhuvan Das Patel.

The two village and 247 litres milk per day cooperative today handles 27 million litres a day, a contribution of 3.64 million farmers. making it one of the top ten global dairy companies. Adoption of the Amul example has created a unique dairy cooperative model in the country comprising more than 16 million milk producers in a network of 1,86,000 village milk societies affiliated to 222 district milk unions and 28 state milk federations. This has decidedly been the most impactful intervention in the history of dairy not only in India, but anywhere in the world.

Shrimp Story

India’s shrimp aquaculture has been another fairy tale. The sector was at the verge of closure in the early 2000s. The White Spot Syndrome Virus (WSSV), a shrimp pandemic spread faster than a wildfire leading to the closure of an enormously large number of hatcheries and farms. To compound matters, around the same time the concerns of environmental cost of shrimp culture too found a voice leading to unreasonable restrictions.

Introduction of the disease resistant, though exotic, shrimp Litopenaeus Vannamei appeared to be an answer to this severe distress. There was stiff opposition from several influential

quarters raising concerns about the environmental and health repercussions of introduction of an alien species. However, the Litopenaeus Vannamei, once introduced, changed the fortunes and revolutionised the sector overnight.

We now boast of an infrastructure of around 600 shrimp hatcheries feeding 1,70,000 hectares of farming generating a production of more than a million tonnes per annum; from a mere 76,000 tonnes in the year 2008-09 when Litopenaeus vannamei entered the shrimp culture. We now command 26% share of the global shrimp trade.

Sex Sorted Technology

Sexed semen is the technological solution for addressing the problem of male bovines. Sex sorted semen technology has been patented and is available with two US companies viz. Sexing Technology and ABS Global Genus. So far, the use of sexed semen has shown an accuracy of more than 90% in production of only female calves.

GOI has sanctioned and financially supported projects for establishment of stations for production of sexed semen in the states of Gujarat, Haryana, Kerala, Karnataka, Madhya Pradesh, Maharashtra, Tamil Nadu, Telangana, Uttar Pradesh, Uttarakhand, Punjab and Himachal Pradesh.

The results so far have been quite encouraging, but the acceptability remains low. The reason primarily is the cost which our small and marginal farmers can ill afford. Recognising this problem, the government, under the Accelerated Breed Improvement Programme, has decided to provide subsidy up to 50% of the cost of the sexed semen. The farmer’s liability would be restricted to only Rs 250 per artificial insemination (AI), and even this amount would be refunded if even two AIs do not cause pregnancy. The service is made available at the farmer’s doorstep.

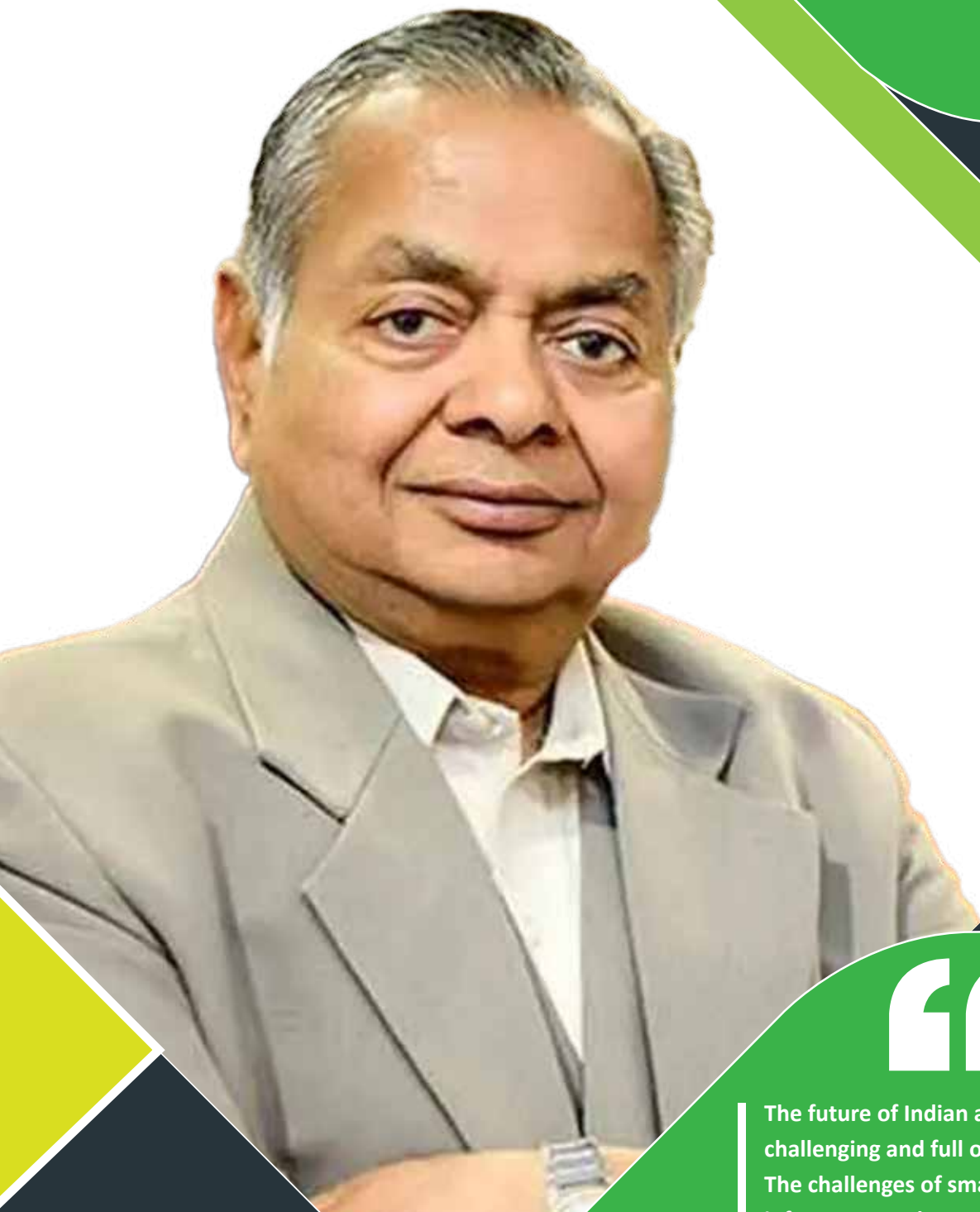
The project targets 90 lakh Artificial Inseminations (AI) over a five-year period. This should result in the birth of 24.12 lakh high milk yielding females, assuming a conception rate with sexed semen as 30% and accuracy as 90% female calves. This further translates into additional 36 million tonnes of milk annually, valued at approximately Rs 1.4 lakh crore at current prices. Isn’t it a supreme irony that a society preferring the male child displays a reverse bias towards a female calf.

Good things come to those who hustle. Therefore, let us celebrate with pride these more than significant initiatives.

Dr Tarun Shridhar

Former Secretary

Ministry of Fisheries, Animal Husbandry and Dairying, GOI



HEALTH HIGHWAY



The future of Indian agriculture is both challenging and full of opportunities. The challenges of small holdings, poor infrastructure, low productivity and low returns on investment can be addressed through the use of technology, innovation, and sustainable farming practices

Sh RG Agarwal
Chairman
Dhanuka Group

Agriculture in India has always been a significant part of the country's economy and culture. With more than half of the population dependent on agriculture, it has been the backbone of the country's food security. However, the contribution of agriculture in the gross domestic product (GDP) has reduced to less than 20 per cent, while the contribution of other sectors has increased at a faster rate. Nonetheless, agricultural production has grown, making India self-sufficient and a net exporter of agriculture and allied products.

The Demand for Food

As per the estimates of Indian Council for Agricultural Research (ICAR), demand for food grain would increase to 345 million tonnes by 2030. This increase in demand is due to various reasons like increasing population, increasing average income, and globalization effects in India, which will increase the demand for quantity, quality, and nutritious food, and variety of food. Therefore, the pressure on decreasing available cultivable land to produce more quantity, variety, and quality of food will keep on increasing.

Challenges in Indian Agriculture

In spite of having large arable land with 15 agro-climatic zones as defined by ICAR, having almost all types of weather conditions, soil types, and capable of growing a variety of crops, the average productivity of many crops in India is quite low. The country's population in the next decade is expected to become the largest in the world, and providing food for them will be a prime issue. Majority of the farmers are still facing problems of poor production and/or poor returns. Major constraints in Indian agriculture are farming for subsistence, low access to credit, less use of technology, mechanization, and poor productivity, very less value addition, poor infrastructure for farming making more dependence on weather, marketing and supply chain suitable for high-value crops.

The Future of Indian Agriculture

The future of agriculture is a very important question for the planners and all other stakeholders. Government and other organizations are trying to address the key challenges of agriculture in India, including small holdings of farmers, primary and secondary processing, supply chain, infrastructure supporting the efficient use of resources and marketing, reducing intermediaries in the market. There is a need to work on cost-effective technologies with environmental protection and on conserving our natural resources.

The reforms towards privatization, liberalization, and globalization affected the inputs market at a faster pace. Agricultural marketing reforms after 2003 made changes in marketing of agricultural outputs by permitting private investment in developing markets, contract farming, and futures trading, etc. These amendments in marketing acts have brought about some changes but the rate is less.

Along with this, the information technology revolution in India, new technologies in agriculture, private investments especially on

R&D, government efforts to rejuvenate the cooperative movement to address the problems of small holdings and small produce, etc are changing the face of agriculture in India.

Many startups in agriculture by highly educated young ones show that they are able to understand the high potential of putting money and efforts in this sector. Cumulative effects of technology over the next decade will change the face of agriculture.

Key Trends Expected

Changing demand due to increase in incomes, globalisation and health consciousness is affecting and going to affect more the production in future. Demand for fruits and vegetables, dairy products, fish, and meat is going to increase in future.

Researches, technology improvements, protected cultivation of high value greens and other vegetables will be more. There will be more demand for processed and affordable quality products.

More competition will be there among private companies giving innovative products, better seeds, fertilizers, plant protection chemicals, customised farm machinery and feed for animals etc in cost-effective ways at competitive prices.

The use of precision agriculture will increase, allowing farmers to make informed decisions regarding the use of inputs such as water, fertilizers, and pesticides, leading to more efficient use of resources and higher yields.

Climate-smart agriculture will become more important as climate change continues to impact agricultural production. This will include the use of drought-resistant crops, water harvesting and conservation, and the development of climate-resilient farming practices.

The role of women in agriculture will continue to grow, with more women entering the sector as farmers, entrepreneurs, and researchers.

Sustainable farming practices, such as organic farming, will become more popular as consumers demand products that are environmentally friendly and free from harmful chemicals.

Finally, there will be a shift towards a more integrated approach to agriculture, with a focus on the entire value chain, from production to marketing and distribution. This will require collaboration between farmers, researchers, policymakers, and other stakeholders.

The Road Ahead

The future of Indian agriculture is both challenging and full of opportunities. The challenges of small holdings, poor infrastructure, low productivity, and low returns on investment can be addressed through the use of technology, innovation, and sustainable farming practices.

The government, private companies, startups, and farmers themselves all have a role to play in shaping the future of agriculture in India. By working together, we can create a sustainable and profitable agricultural sector that meets the growing demand for quality and nutritious food, while also protecting our natural resources and promoting economic growth.

AGRI STARTUPS IN INDIA

BRINGING AGRICULTURE STAKEHOLDERS TOGETHER



“The major hurdle in growth of startups is market access. Innovation needs to be matched with proper markets

Dr AK Singh

Vice-Chancellor, RLBCAU, Jhansi (UP)

Dr RR Burman

ADG (Agricultural Extension), ICAR

Dr Girijesh Singh Mahra

Scientist (SS), Division of Agricultural Extension, ICAR-IARI, New Delhi

Government of India launched the ‘Startup India’ program on 16 January 2016 with a stated objective to build a strong ecosystem for nurturing innovation and startups in the country that would drive sustainable economic growth and generate large scale employment opportunities. The Startup India, a flagship initiative of GOI has further given a stimulus to the Agri-Business Incubators to nurture innovation and Startups in the country. A Startup India Action Plan was announced on 16 January 2016.

It comprised of 19 action items spanning across three key areas of ‘simplification and handholding’, ‘funding support and incentives’, and ‘industry-academia partnerships and incubation’. Simultaneously, MSME (Micro Small Medium Enterprise) also encourage idea-stage startup with the support of 15 lakh pre-

seed funding support through an established incubator ecosystem startup. Currently, there are more than 2500 agri-startups registered with Startup India.

The “National Agriculture Innovation Fund” of ICAR provides systematic ethos to technology transfer and commercialization. With this support mechanism, ICAR-NAARM is promoting agribusiness while handholding agri-business incubators by inter-alia developing modules, guidelines and other forms of learning material for capacity building.

The Council strives to accelerate development of entrepreneurial companies from idea stage towards self-sustaining successful business. To specifically cater to the need and modalities for agribusiness promotion, a revamped “Rashtriya Krishi Vikas Yojana - Remunerative Approaches for Agriculture and Allied Sector Rejuvenation” (RKVY-RAFTAAR) was launched in 2017-18 with a component for innovation and agri-entrepreneurship.

Under this scheme, RAFTAAR Agribusiness Incubators (RABIs) has been created. Under the scheme 5 knowledge Partner, IARI, MANGE, NIAM, AAU and US Dharwad, and 24 RABIs were established. The funding support was also given up to Rs. 5 Lakh for pre-seed stage startups and Rs.25 lakhs for seed stage startups.

A similar kind of effort has been done by NABARD and DST to establish the R&D labs for startups. More than 2500+ agri-startups have been trained to address problems in the agriculture sector like small farm size, poor infrastructure, low use of farm technologies and best farming techniques, decrease of soil fertility due to over-fertilization and sustained pesticide use.

The National Agricultural Research and Education System (NARES) has also geared up to create an ecosystem for the handholding of these startups. There are seven Technology Business Incubators (TBI) supported under the National Initiative of Development and Harnessing Innovations (NIDHI) scheme of the Department of Science and Technology, 50 Agribusiness Incubators (ABIs) in the Indian Council of Agricultural Research, and 29 ABIs in the State Agricultural Universities. Incubation is a critical driving factor in the success of startups.

‘Startup India Seed Fund

On 16 January 2021, Prime Minister Narendra Modi announced the launch of the ‘Startup India Seed Fund’ worth INR 1,000 crores to help startups and support ideas from aspiring entrepreneurs. The environment has been created to grow the startup ethos in India, as a result of this, agri-startup came into the picture like, Ninjacart, Dehatm Bijak, Intello Lab, Fyloo, Bighaat, E FAARM, Absolute etc. Last year, agritech startups raised close to \$684 Mn across 47 deals. In total, the agritech sector has raised \$1Bn in funding between 2014 and 2021. This is a huge breakthrough for Indian startups and these figures will inspire young entrepreneurial minds of our country to seek the direction of agricultural technology.

Under RKVY-RAFTAAR alone, more than 2500+ agri-startups have been trained to address problems in the agriculture sector

like small farm size, poor infrastructure, low use of farm technologies and best farming techniques, decrease of soil fertility due to over-fertilization and sustained pesticide use. Currently, it is reported that growth rate of startups is 25 per cent every year by NASSCOM. A wave of Agritech startups has emerged in the last few years in India.

Agri-Startups: The Way Ahead

A 19-point “Startup India Action Plan” was launched in January 2016, which led to the introduction of several policy initiatives to build a robust ecosystem for nurturing innovation and startups (GoI, 2016). This led to a tremendous surge in incorporating new companies with innovative ideas in almost every sector- agriculture, healthcare, biotechnology, engineering, fintech, transport, fashion, environmental science, legal services, logistics, IT services, marketplace, etc. The technology-led startups, alias tech startups, are also growing.

It has been found that around 3-4 tech startups are born each day in India (Indian Startup Ecosystem, 2020). The major hurdle in growth of startups is market access. Innovation needs to be matched with proper markets. Collaborative work in startups in emerging economies is determined by awareness of the role of the environment, the size of the market and the context where the market is developing.

For effective decision-making, the government should stimulate these companies in joint effort to continue exploring different interactions among all stakeholders, which allow a market for mutual benefit between company and farmers. Following points should be considered by policy makers and researchers to further boost the growth of Agri startups in India.

1. Increase awareness about the Agri-startups among the farmers and other stakeholders
2. Provide funding support to up-scaling of Agri-startups
3. Technology backstopping and handholding by ICAR Institutes/SAUs
4. Testing and validation of innovations for certification/technology incubation by ICAR
5. Increase networking and market linkages among Agri startups for out scaling of goods and services
6. Promote business collaboration between public and private firms for creation of new market space in Agri-startups

Encouragement of startup growth in agriculture sector paves opportunity for youth employment in rural farm and non-farm sector. Not only employment of youth, but it further creates job opportunity for different stakeholders in rural ecosystem.



IRRI (International Rice Research Institute) South Asia Regional Center, Varanasi (ISARC) is a state-of-art research facility in all of South Asia to collaboratively work with the national system on varietal development/breeding, seed system strengthening, aspects of grain quality, value chain propositions, and seed-to-seed management practices, capacity building, etc.

In the light of strong support provided by the UP government to ISARC, Dr. Jean Balié, Director General, IRRI, had a courtesy meeting with UP Chief Minister Shri, Yogi Adityanath in the presence of Shri Surya Pratap Shahi, Minister, Agricultural Education and Research; Dr Devesh Chaturvedi, Additional Chief Secretary, Agriculture, Agricultural Education and Research, Agricultural Marketing, International Agricultural Trade and Export Promotion, UP.

Dr. Jean Balié was accompanied by Dr Ajay Kohli, DDG-R, IRRI; Mr AJ Poncin, Chief of Staff, IRRI, and Dr Sudhanshu Singh, Director, ISARC. Dr Balié expressed gratitude to the CM for the constant support provided to IRRI for enhancing R&D activities in the state.

He drew special attention to the identification and development of quality, nutritious and climate-resilient rice varieties by ISARC. He also updated the CM with future plans of IRRI such as establishment of an incubation center for promoting agribusiness opportunities and addressing the challenges in rice-based systems of the state. Dr Balié sought the support of UP govt for gearing up with bigger steps to transform agriculture as an engine of growth for the state and the country.

UP CM Urged For Greater Knowledge Sharing, Capacity Building

Applauding the work being done by IRRI & ISARC, Shri Yogi Adityanath offered full support of the state government in a collaborative manner towards shared goals of farmers' welfare. He congratulated IRRI for the MoU signing with four agriculture universities in the state.

Referring to the agro-ecological zones of UP favoring the scope of research, he urged more such collaborations with universities and agricultural institutes to promote knowledge sharing and capacity building. Presenting his vision of developing UP as a leader in rice cultivation, he welcomed support from IRRI to help UP make massive productivity gains by developing more sustainable practices and varieties better suited to agro-ecology and climatic challenges of the state. He also advised doing more research on natural and organic farming practices. The CM gifted the IRRI delegation with mementos promoting "One District, One Product" (ODOP).

Thanking him for his valuable suggestions and time, Dr. Jean Balié presented the CM with IRRI souvenirs and cookies made from Kalanamak Rice developed by scientists at ISARC.

IRRI delegation led by DG Dr Jean Balie meets UP CM Shri Yogi Adityanath

Sustainability And The Dairy Industry



Most dairy manufacturing plants are now working towards a “Zero discharge” policy wherein the water utilized in processing is recycled and reused within the plant itself

Mr RS Sodhi
President, Indian Dairy Association
Former Managing Director, AMUL

GOI has introduced some very healthy reforms in the union budget for promotion the co-operative sector in India.

The establishment of a separate ministry last year was a welcome initiative, recognizing the contribution of the co-operative business model in India’s growth story and the potential that is yet to be realized. The total outlay for the ministry of co-operation was increased. The introduction of new tax reliefs for the co-operatives is a key announcement made in the Union budget.

Nationwide Database Grid

A nationwide database grid is being prepared for the mapping of all small and big co-operative business units in India. GOI has announced an additional investment of Rs. 2516cr to enable the computerization of 63,000 Primary Agricultural credit societies (PACS). These PACS have been formulated in a way that they can function as multipurpose societies assisting the small and marginal farmers.

GOI has also announced setting up of a massive, decentralized storage capacity to help farmers store their produce and realize remunerative returns for the same. The overall allocation for the Animal Husbandry sector has been increased from 3000cr to 4300cr, with a separate agricultural sector fund of Rs. 20lakh cr for the upliftment of the India’s rural economy. By extending support to the co-operative sector, the government is now headed towards more inclusive growth in the country.

New Consumer Preferences

FY 2022-23 is coming to an end and the last year saw a lot of volatility. The demand for milk and milk products kept soaring high with the supply of milk hitting several roadblocks. Consumer preference started evolving with the onset of the pandemic. The normalcy that followed the lockdown era saw the waning impact of certain preferences on one hand and some trends growing stronger than ever on the other.

One such trend that we saw among consumers was the increased awareness of the climate crisis. People, now more than ever, were cognizant of the deteriorating climatic conditions and wanted to contribute towards saving the environment. Consumers’ growing awareness of the climate crisis is prompting them to re-evaluate their purchasing habits and seek out brands that are actively addressing sustainability issues. In 2018, the WMO issued a statement that read – “We are the first generation to completely understand climate change, and probably the last generation to be able to do something about it.”

All-Round Sustainability Of Dairy Industry

Dairying as an industry has always been at the receiving end of misconceived notions. The sector is always wrongly linked with environmental damage whereas the actual carbon footprint of dairy products is significantly lower than as compared to the

common perception. The dairy co-operatives of India have been at the forefront of innovation and in promoting sustainable ways of operation. And when I use the word sustainability, I mean all-round sustainability – environmental, social, and economic.

Role Of Village Co-Operative Societies

The business of milk is one of the toughest businesses with respect to logistics and maintaining the quality of milk from cows to the final consumer. For the longest time, co-operative as well as private players have cracked the code of optimum logistics. Right from identifying the potential of milk procurement in a particular area to demand estimation and finalizing the perfect product mix to minimize the energy, manufacturing and logistic costs.

At the level of milk procurement many village co-operative societies are now opting for solar panel installations for the BMCs. The solar panels not only fulfil the demand of electricity at the district collection centers but also benefits from the surplus electricity that is sold to the grid. Another major initiative undertaken by the manufacturing plants is the development of bio-gas plant as a source of renewable energy.

Apart from processing, transportation of milk and finished milk products accounts for a significant share in fuel consumption. Most dairy manufacturing plants are now working towards a “Zero discharge” policy wherein the water utilized in processing is recycled and reused within the plant itself. Dairies are now investing in in-house RO water treatment plants to gain long term incidental benefits from treated water, thereby resulting in increased energy and hydraulic efficiency.

Dairies are now moving from traditional methods of operations and are moving towards end to end digitization. There is reduced manual intervention at every level of operation and reduction in the use of paper, resulting in reduction of carbon dioxide emissions.

Dairies are now more focused on capturing data for livestock management from each level of operation in the field to analyze the macro picture and plan for the upcoming years. For the past couple of years, many dairies have introduced path breaking technological interventions for capturing livestock data that has helped in providing timely farmer support in the present, planning for the future and also helped in anticipating and mitigating disastrous outbreak of diseases among livestock.

Dairying in India has been contributing immensely towards the food security in India and has been a source of affordable nutrition for millions of consumers. All round sustainability is the mantra to ensure that the sector serves a larger customer base and empowers many more producers. With these and many other initiatives, the Indian dairy industry is now moving towards appropriate strategies of creating a long lasting, truly incentivizing and an environment friendly sector in India.

Indian Agriculture

EXCITING TIMES AHEAD

We shall see transformational changes over the next few years.

Low dosage and safer crop protection products that degrade faster will replace the old, toxic pesticides. Micro irrigation systems will facilitate fertigation of nutrition products thus minimizing soil damage. There is nothing new in these changes which have been moving at a very slow pace. Now the speed of change will be rapid due to the demands of the situation. Governments will incentivise farmers to use sustainable agricultural practices.

A related change would be the carbon credits system which the farmers who adopt sustainable farming practices will be able to use and achieve financial gains. These markets will be brought closer to the farmers so that they can access them easily and take advantage of them.

Digital Technology

Digital technology which is transforming urban lives will also touch agriculture in a big way during this decade. Some of the agri tech enterprises will make it easier for soil testing, water use monitoring, farm data collection and delivery of farm specific advisory. Some of the digital applications will provide the farmer access to input and output markets, provide warehousing and warehouse receipt based credit facilities, facilitate easier lending and insurance offerings to farmers.

Satellite based imagery will help in more accurate crop estimates, pest and disease assessments and other data based services. Open access Digital Public Goods will be providing platforms for seamless offering of digital services to farmers. These DPGs will be developed under PPP projects keeping the farmer as the centre of the model.

Biotechnology, through both GM and Non-GM tools, will make a huge difference to the development of seed varieties that can withstand even pests and diseases and high temperatures, reduce the use of chemical inputs and produce nutrition enhanced food and feed that suit changing food basket of consumers. These changes can enhance the quality of agriculture, reduce the impact on environment and improve consumer experience.

Local trends

India's population will cross 150cr during this decade and the demand for non-cereal foods, chemical free safe food, organic food, traceability of food, plant based foods, etc will grow multi fold. Conserving natural resources like water and soil will play a major role in agriculture in this decade and beyond.

India will see a major shift in the crop portfolio with the need to increase edible oil production. Emphasis will be more on increasing yields and acreages in crops like Mustard, Soybean, Sunflower, Pulses, Cotton, Maize, Forages and Vegetables in order to meet the growing demand for these products.

While rice and wheat acreages may not come down dramatically, the emphasis on increasing the yields of these crops along with reducing the use of water in the cultivation of rice will come to the centre stage. Emphasis on new agronomic practices like Direct Sown Rice (DSR) will gain traction in order to reduce water consumption.

In Cotton too, India will step up deployment of science and technology to boost yields and meet the growing demand for the fibre from domestic textile industry. Increased production will also help the country to meet the growing demand in the International markets. High Density Planting System (HDPS) system of cultivating Cotton will be scaled up aided by the enabling technologies including seed varieties.

Mechanization And Digitization

Use of drones and tractor mounted boom sprayers for application of Crop Protection chemicals will be a huge change that we will see on a big scale in this decade. But the key is to create business models through which these machines will be made available to farmers when they need and at a reasonable cost.

We should see a scale up of custom service business models to meet this demand. Farmers will have access to a multitude of digital applications which they can use to reduce their drudgery and to improve the efficiency of their work. This would be similar to the details mentioned above under the global trends. But one of the major benefits for farmers would be in the seamless flow of financial services like credit and insurance. This should reduce the grip of private money lenders on the farmers and also mitigate many of the risks that he faces. This is a transformational change for the Indian farmer.



Clusters of production areas in horticultural crops and other crops will come up in a big way as a part of the value chain development efforts. This will help in adding value to farm produce and connect them to both domestic and export markets in a significant way

Structurally Important Game Changers

Farmers will get connected to markets, both physically and digitally. This is inevitable. This will play a key role in increasing the efficiencies of the entire supply chain system and help the farmer in discovering better prices. Rural aggregation centres will come up in a big way to cut down the length of supply chains.

Clusters of production areas in horticultural crops and other crops will come up in a big way as a part of the value chain development efforts. This will help in adding value to farm produce and connect them to both domestic and export markets in a significant way. Contract farming will be the way to capture such value chains. Each state will try to become a centres of excellence for specific crops. Organic and chemical free production will be developed as one such centre of excellence.

FPOs will scale up in number and will become stronger with robust systems and commercial operations. Such collectivization will help in increasing the bargaining power of the farmers and improve their economic benefit.

All the above three game changers will help in improving farmers price realization and consequently the profitability of farming operations. This would be good for the farming community.



Mr Ram Kaundinya

Director General

Federation of Seed Industry of India (FSII)

AIF REVITALIZING THE AGRI SECTOR



Mr Samuel Praveen Kumar
Joint Secretary, (Extension, AIF, Investments
& Price Support)
MoA&FW, Government Of India

As a result of brilliantly nurtured proactive initiatives undertaken since 2020, Agriculture Infrastructure Fund (AIF) is now embarking & flying on a rock-solid drone. It is poised to reach new heights with a vision to broaden investment horizons and transform the agriculture landscape through the development of cutting-edge post-harvest infrastructure. AIF shall increase farmer income to unprecedented levels. This shall broaden the scope of AIF and encompass more farmers and agri-entrepreneurs under the umbrella of AIF.

“ Many programmes were conducted in physical mode to spread awareness about AIF, providing handholding support and interactions with stakeholders. Eight AIF State Conclaves were conducted in Kerala, Telangana, Punjab, Odisha, Tamil Nadu, Maharashtra, Uttar Pradesh, and Rajasthan

This year, four new activities brought under the ambit of the scheme, viz: Integrated Spirulina production and processing units, Sericulture processing units, Honey processing units and Plant quarantine units. The scheme has been perennially improved to meet the needs of its stakeholders and to make it more acceptable to all. As a result, more players have been brought into the ecosystem, thus enabling the program’s objectives to be achieved.

Helping Farmers, Helping Nation

This transformative AIF scheme has created 27,440 projects at a staggering cost of Rs 38,485 crore, with a sanction of Rs 22,618 crore. The result has been the generation of over 4.35 lakh manpower, the saving of 1.5 LMT of food grains and 22.7 TMT of horti produce annually. In addition, farmers have benefitted from better price realization by about 20-25%.

The remarkable growth in loan sanctions by Lending Institutions, which increased by 127% during the third financial year, is a testament to the proactive initiatives undertaken during 2022-23. The exceptional ability of the leadership to take initiative and drive positive change that was recognized and appreciated by various stakeholders made a significant impact on the brilliant success of AIF. Implementation of effective strategies, identification and addressing potential challenges to effectively navigate obstacles and achieve positive results and proactively seeking out opportunities for pitching in AIF at every possible forum did wonders.

There have been hundreds of virtual interactions with different stakeholders to keep afloat millions of farmers’ hopes for better price realization for their hard-earned produce. The initiatives include FPO & PACS workshops, workshops for State officials, 30 Master Trainer sessions for Banks and State Government officials, training sessions for Bank branch officials, potential customer forums, and sessions for DDMs/LDMs.

AIF State Conclaves

Many programmes were conducted in physical mode to spread awareness about AIF, providing handholding support and interactions with stakeholders. Eight AIF State Conclaves were conducted in Kerala, Telangana, Punjab, Odisha, Tamil Nadu, Maharashtra, Uttar Pradesh, and Rajasthan. This increased the flow of applications through the Portal to a large extent.

Sensitisation programmes were undertaken by conducting CII Agri-Business Conclave, setting up Stalls in all the relevant Exhibitions, and pitching AIF at various events and hundreds of Workshops by State level PMUs. Skill development programmes were undertaken at Bankers’ apex-level Training Colleges and high-level “Banker as Anchors” programme was also organised in Mumbai involving Training Heads and top Executives of various Banks.

Boosting up Agri-Entrepreneurs

Through various outreach programmes, AIF has been able to connect with lakhs of agriculture entrepreneurs and farmers, over 30,000 bank officials, over 10,000 state and district officials, over 5,000 primary agricultural cooperative societies, 2000 FPOs & CBBOs, as well as over 500 APMCs and state marketing boards. Mrs Shobha Karandlaje, Hon’ble Minister of State, MoA&FW has been a leading light in boosting and promoting AIF Scheme during her tours all over the country.

Annual AIF Award ceremony was held in Delhi July 2022, graced by our visionary Hon’ble Minister for Agriculture and Farmers Welfare Sh. Narendra Singh Tomar and Hon’ble MoS Agriculture Sh Kailash Choudhary to honour the best performing Banks and States under AIF financing which acted as a great source of motivation to all stakeholders.

To further accelerate progress, two special campaigns were launched among Banks NOBOL (Nation-wide One Branch One Loan) and BEST (Bankers Enabling Sustainable Transformation in Agri through infrastructure) during 2022-23 with a view to put the Bankers on a mission mode and inculcate a competitive spirit which yielded rich dividends by way of adding extra sanctions under AIF. Shri Manoj Ahuja, Secretary, MoA&FW has been instrumental in pitching AIF at every possible opportunity during his interaction with various stakeholders in different fora.

‘Main Bhi Krishipreneur’

Presently, #Mainbhikrishipreneur is on roll from 10th April to 8th July 2023, showcasing the success stories of all the agripreneurs/ framers/FPOs/SHGs who took AIF loans for creating post-harvest infrastructure & are now thriving.

The objective of this campaign is to highlight the hard work behind the project and how it has not only benefitted an individual or a family but also positively impacted the surrounding areas by creating multiple employment opportunities. It is also expected that next generations will choose to become Krishipreneurs aka Agripreneurs, in helping the nation grow with their innovation, and this name will be pronounced confidently.

With this in mind and in order to attract the newGen towards agriculture, state-of-the-art technology and sensor based Agriculture Drone and intensive use of Internet of Things (IOT) and AI in agriculture are being promoted on a wide scale. Shri Abhilaksh Likhi, Addl.Secretary, MoA&FW stands as an unwavering pillar of support in nurturing and handholding the Scheme resulting in the scheme reaching newer heights during 22-23.

Agriculture Infrastructure Fund as a real game changer is poised to become the harbinger of blissful change in the life of the farming fraternity and others engaged in agriculture by making the sector more vibrant and resilient through innovation and novel initiatives.

Repurposing Agricultural Education NEP 2020 through NAHEP Interventions



Dr RC Agrawal
Deputy Director General (Agricultural Education)
and National Director, National Agricultural
Higher Education Project (NAHEP), Indian Council
of Agricultural Research (ICAR), New Delhi.
Dr Anuradha Agrawal is National Coordinator,
NAHEP, ICAR, New Delhi

NAHEP is a flagship program of the ICAR supported by GOI and World Bank on a 50:50 funding basis, aimed at transforming agricultural education in India. NAHEP focuses on several key areas such as student and faculty capacity development, infrastructure development, and experiential learning.

‘Out-of-Box’ initiatives under NAHEP

To make agricultural education more “aspirational”, some new initiatives undertaken by NAHEP since 2020 are enumerated.

International Conference on Blended Learning Ecosystem for Higher Education in Agriculture (ICBLE 2023)

This global event was organized by ICAR and World Bank at New Delhi during March 21-23, 2023. It brought together policy makers, educators, academics, researchers and practitioners from the field of agriculture education from 10 nations, to discuss and exchange ideas on the use of blended learning in higher education.

Blended learning refers to a teaching approach that combines traditional face-to-face classroom instruction with online learning. The conference explored the challenges and opportunities of implementing blended learning in the agriculture sector, and to share best practices and innovative strategies for enhancing the quality of higher education in agriculture through technology-mediated instruction.

A ‘Delhi Declaration on Modernisation of Agricultural Education System’ was issued jointly by ICAR and the World Bank, as the major output of the conference, in alignment with the NEP 2020. The document highlights the need to incorporate digital resources and tools for effective and accessible teaching and learning in agriculture.

ICAR 75 Lecture Series

The Azadi ka Amrit Mahautsov (India@75 celebrations) during 2021-22 commemorated the hard work, innovations and enterprises of Indians and served as a platform to collectively plan for creating a better tomorrow.

ICAR held a massive outreach campaign entitled ‘ICAR 75 Lecture Series’ supported by NAHEP, under which lectures were delivered by the eminent experts from various domains related to agriculture, science, spirituality, sports and several others.

The lecture series were held during Covid pandemic period, and delivered through virtual or hybrid mode and were attended by > 1.1 lakh participants. A publication covering useful recommendations and strong points from the best minds which would help the country to progress towards ‘Atma Nirbhar Bharat’ (self-reliant India) has also been brought out.

(<https://nahep.icar.gov.in/pdf/NAHEP-LectureSeries.pdf>)



NAHEP has brought about significant changes in the agricultural education system, particularly in the areas of curriculum reform, faculty development, infrastructure development, experiential learning and promoting industry-academia collaboration

Brainstorming Session on Mainstreaming Agricultural Curriculum in School Education (MACE)

ICAR organized this meeting on June 14, 2022 with an aim to deliberate on the need and modalities to mainstream and scale-up agriculture as a core subject at primary, secondary and higher secondary school levels. Discussions were also held on the requirement of the desired policy support required to promote agricultural education through State and Central education boards, as well as the framework for development of vocational teaching pedagogy at school level. The meeting was graced by Shri Narendra Singh Tomar, Hon'ble Minister of Agriculture & Farmers Welfare, Government of India, who applauded the initiative. He mentioned that this is a first but firm step towards development of students' knowledge and understanding of agricultural enterprises, practices and skills required in refining the "farm to fork" value chain. and creation of employment opportunities in the times to come. The brainstorming session witnessed representation from key educational bodies like Central Board of Secondary Education (CBSE), National Council of Educational Research and Training (NCERT), State Council of Educational Research & Training (SCERT), Principals and Teachers from public and private schools from National Capital Region, Delhi, subject matter experts from ICAR and its research institutes. Subsequent to MACE, a committee has been formed by the government for developing curriculum

for agriculture in school education. Details about MACE and proceedings can be seen URLs below.

(<https://nahep2.icar.gov.in/MACE.aspx> <https://nahep.icar.gov.in/pdf/MACE%20Proceedings%20and%20Recommendations.pdf>)

KRITAGYA Hackathons

To provide an opportunity and encouragement to students, faculty, entrepreneurs, innovators and other stakeholders to showcase their innovative approaches and technology solutions in various domains of agriculture, three KRITAGYA hackathons were organized by ICAR. The acronym KRI-TA-GYA denotes KRI for Krishi (Agriculture), TA for Taknik (Technology) and GYA for Gyan (Knowledge). The hackathons facilitate enhancing the learning capabilities, disruptive solutions, employability and entrepreneurial drive amongst the participants. All the three hackathons received tremendous response across the country, and 1,189 teams (3,884 participants) actively participated in the events. Each year four teams have been awarded cash prizes of Rs 9 lakhs each (for year 2022 prize distribution is awaited). The hackathons have infused greater spirit of innovation and brought to forefront, some disruptive technologies developed by youth which will go a long way in contributing to significant improvement in Indian agricultural ecosystem.

(<https://nahep.icar.gov.in/Kritagya.aspx>)

Year	Topic	Objective
2020	KRITAGYA 1.0 Promoting innovation in farm mechanization	To promote potential technology solutions for enhancing farm mechanization with special emphasis on women friendly equipment
2021	KRITAGYA 2.0 Innovations for precision and economical animal farming	To give boost to technology adoption in livestock sector
2022	KRITAGYA 3.0 Speed breeding for crop improvement	To promote speed breeding for crop improvement to ensure overall sustainability and resilience in crop production

Promoting Industry-Academia Collaboration

NAHEP is striving to remodel and invigorate agricultural education in India to align with recommendations of NEP 2020 and address the changing needs of the sector. Overall, NAHEP has brought about significant changes in the agricultural education system, particularly in the areas of curriculum reform, faculty development, infrastructure development, experiential learning and promoting industry-academia collaboration.

Transforming Villages. Ensuring Prosperity.

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Mr Kesavan
Group President
TAFE (Tractors and Farm Equipment Limited)

JFS - F2F Custom Hiring Platform

(A CSR initiative of TAFE through TAFE Foundation)



All Stakeholders



India needs participation of various stakeholders to build Atma Nirbhar Bharat. Successful public-private-partnership initiatives like Jfarm Services can be deployed in various aspects of public delivery in order to achieve desired results

The role of farm mechanisation sector, the core of agri-tech mission, is undisputable in the development of agriculture economy in India. Small and marginal farmers hold more than 80% of land holdings. They may not be able to afford ownership of tractors or implements. Renters/machinery owners are not willing to provide service to BPL farmers as they are not able to give immediate cash.

The usual practice is that the farmers pay the renters after the harvest is completed. While the SMAM scheme (Sub Mission on Agriculture Mechanization) provides Rs 2000 per ha per operation, many state governments have not initiated this mostly due to implementation challenges.

New Revenue Model

Today there are 85 lakh+ tractors of 15 year old or less, operating in India. These tractors operate for around 750 to 1000 hours average in a year and most of the tractor owners do not actively rent to fellow farmers, especially if they are BPL farmers. Even if less than a third of these tractors can be rented for an additional 100 hours, we have a ready capacity of 25 crore hours per annum. This comes out of existing tractor population. There is no need to spent even a single rupee additional in capex.

At the rate of Rs 1200 per hour, this can put an additional revenue of more than Rs 30,000 crore in the hands of renters/tractor owners (1,20,000/Renter @ 100 hours per annum).

About JFarm Services

In order to establish the last mile extension of farm mechanisation to small farmers, TAFE under corporate social responsibility mode, developed a mobile based platform/application called Farmer to Farmer (F2F) Custom Hiring Platform. This platform brings together farmers needing mechanisation with farmers owning tractors and equipment, in their local area via a mobile application and a call centre. These are available on a free/zero user-fee basis for farmers.

This aggregation platform connects tractor owners and CHCs operated by tractors and equipment owners directly to farmers seeking farm mechanization solutions, thereby facilitating a fair and transparent rental process while focusing on quality, dependability and timely delivery.

Farmer entrepreneurs having any brand of farm machinery can register themselves and provide services under this platform. JFarm Services does not collect any service fee/charges from either the rental service providers or the farmers seeking the services. In view of supporting a majority of farmers from rural India on their digital journey, in addition to the APP, JFarm Services also uses a multilingual call-center to enable farmers to access rental services without a smartphone. JFS also has feet on ground to help farmers in the inception to hand hold and support.

JFarm Services, during the course of its operations, has so far successfully enrolled over 74,00,000 farmers on this platform. To date, the platform has serviced more than 82,00,000 orders and

over 157,00,000 hours of mechanisation. Direct revenue of over Rs 1310 crore has been earned by farmer entrepreneurs through the platform.

Operational In 16 States

Currently, JFarm Services is operational in 16 states. These are Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Odisha, Rajasthan, Tamil Nadu, Telangana and Uttar Pradesh. By collaborating with respective Government departments, nodal agencies, FPOs, JFarm Services is continuously working on creating awareness on effective farm equipment usage and providing enhanced farm mechanization access to farmers at large.

Most Pro-Farmer Rental Model

The JFarm Services platform is well regarded a stellar example of the Digital India initiative, tailored to benefit the Indian agricultural landscape. The services offered by the platform foster digital empowerment of Indian farmers while creating a breed of new-age rural entrepreneurs and significant job opportunities for farming community, which is critical for new India. In a short span of time, JFarm Services has been largely accepted by farming community in majority of the States with orientation towards agriculture led economy.

In Madhya Pradesh, the state government in partnership with the JFarm Services has launched the Haldhar Yojana, through which assistance was provided for deep ploughing activity to small & marginal farmers.

The said partnership was successful and greatly appreciated by one and all as a PPP model for effective delivery of services to critical masses, wherein JFarm Services platform was used for promotion, identification and facilitating direct benefit transfer to the beneficiaries. MP Government directly transferred the rental fee to the renters on completion and digital verification within ten days of completion of the operation.

Support Through DBT During Pandemic

To mitigate the impact of the pandemic on small and marginal farmers and to support the farming community, JFarm Services during 2020 & 2021 had provided a free tractor rental scheme through the Jfarm Services platform across Tamil Nadu, Rajasthan and Uttar Pradesh. The initiative was focused towards sustaining the livelihoods of farmers to tide over the crisis caused by the pandemic.

Towards this initiative, TAFE has brought together a large group of its Massey Ferguson and Eicher tractor owners & their farm equipment and offered free-of-cost rental services to small & marginal farmers with land holding of up to 3 acres, in close partnership with State Governments in the aforesaid states. The renters offering hiring services through Massey Ferguson, Eicher Tractors and implements have been paid directly by TAFE through direct benefit transfer.

India needs participation of various stakeholders to build Atma Nirbhar Bharat. Successful public-private-partnership initiatives like Jfarm Services can be deployed in various aspects of public delivery in order to achieve desired results.

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Secondary Agriculture adds high value, creates jobs, reduces pollution, improves farm economies rapidly, builds rural agro-industries, increases international trades, adds quality to life of rural population.

Secondary Agriculture

ENSURING FARMER PROSPERITY



Dr SN Jha
Deputy Director General (Agricultural engineering, ICAR) & President, Indian Society of Agricultural Engineers
Bihar Agricultural Science Academy

Indian Agriculture has reached an era of surplus in most of the agricultural commodities. The focus continues to be on raw produce. Despite various schemes, incentives and support programs, the farmers, especially small and marginal, are not generating enough returns from agriculture for a decent livelihood. The returns from agriculture sector are declining overtime.

Therefore, the youth is not inclined to continue in agriculture profession. The challenge is to make agriculture profitable and attractive. One possible way is to add value in agricultural commodities through processing, packaging and branding of main commodities as food items. The other is making high value products of crop/commodities' residues to nonfood items like cosmetics, pharmaceutical, nutraceutical and industrial use items to augment farmers' income.

Focus On Main Produce

The existing agricultural production system yields many raw materials, but focus remains primarily on main produce such as grains, fruits, vegetables, milk, etc. Byproducts such as rice/wheat straw, peels/seeds of fruits and vegetables, are not considered remunerative products and disposed at a very low price or thrown in many cases.

Research on properties and elemental analysis (tertiary and quaternary level processing) of these byproducts has shown that there are many compounds in them which have high value in pharmaceutical, nutraceutical, cosmetic, food and other chemical industries. Their effective utilization would not only substitute import, but also offer a great potential for export and earn foreign exchange.

These very high-value products would fetch manifold higher prices, make agriculture more remunerative, generate productive employment opportunities, and shall prove game changer in transforming agriculture sector.

Misunderstanding Over Secondary Agriculture

Often Secondary Agriculture (SA) is misunderstood as it is all post-harvest processing and value addition. Even many have started calling, bee keeping, floriculture, poultry farming etc. as part of secondary agriculture. In fact, all these are part of the main or primary agriculture.

Activities leading to making main agricultural produce consumable in any form as food are mostly part of primary, secondary and tertiary processing, and should not be called as Secondary Agriculture. However, those products may be a feeder raw material for SA units.

High Value Addition To Primary Agriculture

Secondary agriculture is high value addition to primary agriculture for bridging the gap between urban and rural economies of India. Secondary Agriculture adds high value, creates

jobs, reduces pollutions, improves farm economies rapidly, builds rural agro-industries, increases international trades, adds quality to life of rural population, makes agriculture internationally competitive and finally it can play an important role in searching import substitutes and make India self-reliant (Atma Nirbhar).

Secondary Agriculture is defined as "All practices and processes which increases farmers' income by converting agricultural residues and byproducts into high value commodities for pharmaceutical, industrial, medicinal and specified food uses by using efficient technologies, market intelligence and global preferences". High value product extraction from complete biomass of a particular crop, rural industrialization and marketing are the main element of the Secondary Agriculture (NAAS policy paper #119).

Opportunities In SA

Unlike primary agriculture and processing, the Secondary Agriculture activities and processes are entirely different. This is mainly because the outputs of the Secondary Agriculture may not directly be used for human consumption and animal feed. The primary users of the products obtained through Secondary Agriculture are for specialized industries, such as pharmaceutical, nutraceutical, gums and adhesives, food supplements, electronics, etc. Therefore, the Secondary Agriculture needs holistic approach.

The avenues of Secondary Agriculture may be categorized into three types:

Segregation and conversion of bio-mass/byproducts in dense and storable form through primary unit operations (sorting, drying, pulverization, densification, packaging). The units for crop residues will be of small capacities, designed for handling multiple biomass to ensure round the year operation, and established in the production catchments. Establishing call center or Ola/Uber type models may be tried for collection, transportation of raw materials from villages to processing centers. This can be an independent enterprise at block or panchayat level.

Secondary processing units for high value compounds production: Relatively large capacity extraction units to separate high value components from the biomass/byproducts with feed/composting units. These enterprises will get the raw material from the feeder units and have facility for processing multiple biomass. There is a need to establish agro-processing units near the collection centers at block or district level.

Specialty product units: Enterprises that separate high value compounds and prepare products as per the demand of consumers of domestic or global markets. These enterprises will be the main customer base for secondary agriculture outputs.

Main important element of success of SA is flow of raw materials from villages to panchayat to block to district and then finally to Enterprises of Secondary Agriculture (ESA).

Establishment of ESA and their inter-linked feeder chain will make help in development of agri-industrialized rural economy and shall prove a game changer for Indian Agriculture.

Rethinking Indian Agriculture

Diminishing Returns of Green Revolution



Mr. Ravi Pokharna

Executive Director of India's leading thinktank, Pahle India Foundation. He is all India Coordinator of Swadeshi Shodh Sansthan, an umbrella organisation of about 25 nationalist research and policy institutions across the country



India will have to do its own assessment and derive its own formula as regards the switch to chemical-free farming. But with the poor carbon content in soil, depleting water table and abnormal rise in cancer cases, the time to take the decision is now!

India's Green Revolution, which was initiated in the 1960s, was a period of agricultural development and innovation that led to a significant increase in agricultural productivity and output. It transformed India from being a food-deficit nation to a food-surplus nation. This was achieved through the introduction of high-yielding crop varieties, the use of chemical fertilisers, and improved irrigation and other agricultural practices.

However, over time, the Green Revolution has started to show diminishing returns. There are several reasons why this is happening.

Soil degradation: The intensive use of chemical fertilisers and pesticides has led to soil degradation, including soil salinization, alkalization, and nutrient depletion. This has led to a decline in soil fertility and productivity, which has reduced the yields of crops.

Water depletion and pollution: The intensive use of irrigation in the Green Revolution has led to groundwater depletion, which has adversely impacted the availability of water for drinking, irrigation, and industrial use. The use of chemical fertilisers and pesticides has also led to water pollution, including contamination of drinking water sources.

Decline in biodiversity: The emphasis on high-yielding crop varieties in the Green Revolution has led to a decline in traditional crop varieties, which has resulted in a loss of biodiversity and reduced the resilience of the agricultural system.

Public health risks: The use of chemical fertilisers and pesticides has been linked to several public health risks, including respiratory diseases, cancer, and reproductive health problems.

To address these issues and overcome the diminishing returns of the Green Revolution, there is a need for a more sustainable and equitable approach to agriculture in India. This involves promoting sustainable agriculture practices, such as organic farming, conservation agriculture, and agroforestry. It also involves investing in agricultural research and development to identify new and innovative solutions to the challenges facing Indian agriculture.

While organic farming has several potential benefits, many agriculture scientists in India caution against moving to organic farming due to several challenges and limitations associated with it. Some of the reasons why agriculture scientists warn against moving to organic farming in India include the following.

Limited productivity: Organic farming relies on natural inputs such as compost, manure, and biofertilizers, which can be expensive and time-consuming to produce. Additionally, organic inputs may not provide the same level of nutrient availability and crop yields as synthetic fertilisers.

Pest and disease management: Organic farming relies on natural methods of pest and disease management, such as crop rotation, intercropping, and biological control. However, these methods may not be as effective as synthetic pesticides and fungicides, and may result in lower crop yields and quality.

Limited scalability: Organic farming is often practised on a small scale and may not be suitable for large-scale commercial agriculture. Additionally, there may be limitations on the availability of organic inputs, which may restrict the scalability of organic farming.

Cost: Organic farming can be more expensive than conventional farming due to the cost of organic inputs, labor-intensive practices, and the cost of organic certification.

Food security: Organic farming may not be able to produce enough food to meet the growing demand for food in India. Additionally, organic farming may result in lower yields, which could negatively impact food security.

Case Study of Sri Lanka

Viyath Maga was a movement in Sri Lanka to go Organic. In 2016, some academicians and civil society members of Sri Lanka launched a movement called Viyath Maga. Out of other things the movement pushed for a change in the way agriculture was practised in Sri Lanka and urged everyone to go back to organic farming.

Once the movement started picking pace, it started attracting political attention. Three years later in 2019, Sri Lankan President went on to make this as one of his poll promises. After getting reelected President Gotabaya kept his promise and ordered all the 20 lac farmers to go organic on the fateful day of April 29, 2021. The decision was also taken because Sri Lanka was already reeling under pressure due to its depleting foreign currency reserves.

Fertilisers constituted one of the principal imports at 10% of the total foreign currency usage. But the suddenness of the decision came as a shock as till this day only around 3% farmland was under organic farming. In the absence of timely support and education, the absence of fertilisers delivered a body blow to Sri Lanka's agriculture.

Bhutan on the other hand practices 80% organic farming and is well on the path to soon achieve a cent percent target.

India will have to do its own assessment and derive its own formula. But with the poor carbon content in soil, depleting water table and abnormal rise in cancer cases, the time to take the decision is now!



IndG.A.P Certification For Andhra Pradesh

First State In Country To Achieve This Honour

Andhra Pradesh has become the first state in Union of India to get the IndG.A.P Certification from Quality Council of India (QCI).

Andhra Pradesh has established about 10,778 Rythu Bharosa Kendralu (RBK) in all Gram Panchayats across the state which are acting as One Stop Centres for Farmers to get all the farm input and agri & allied sector services. Through the RBKs, the state has been implementing the Farmer Field School (FFS) program through which farmers are being trained on Good Agricultural Practices (GAP).

The state under the tripartite MoU with Food and Agriculture Organization (FAO) and Indian Council of Agricultural Research (ICAR) has been implementing a Technical cooperation program. The program is titled "Strengthening Capacities of the Government of Andhra Pradesh to support Farmers to adopt sustainable agri-food systems".

Through this program, field officers and farmers have been trained on Good Agricultural Practices and sustainable agri-food systems practices. The syllabus for GAP & FFS was developed by the State Agricultural University and State Horticultural University.

Farmer Field School (FFS) Initiative

FFS are being organized to empower the farmers to study and

analyze the agro-ecological factors existing in the field for taking viable and economical decisions for reducing cost of production through optimization of inputs, and enhancing crop productivity as well as output quality. This is done by employing Integrated Crop Management (ICM) technology that contains Integrated Pest Management (IPM), Integrated Nutrient Management (INM), Integrated Weed Management (IWM), Water Management and Farm Mechanization as its core components.

- FFS are organized in 14 sessions in an extent of 25 acres with 30 farmers to transform the farmers into the best decision makers through transfer of Integrated Crop Management technology in major crops.
- Two FFS programs, one in Kharif season and the other in Rabi are organized by VAA at each RBK level.
- The VAA conducts FFS on a fixed day in a week for 14 weeks
- Need based Bio-pesticides and Bio-Fertilizers are supplied to the FFS farmers in the demo plots.
- At the end of the season, a field day is organized duly inviting maximum no. of other farmers in the village to discuss the outcome of the FFS.

The Approach of the FFS is educating the farmers through 'learning by doing' approach on field diagnostic techniques like AESA (Agro ecosystem analysis) and productivity boosting

technologies like Integrated Crop Management (ICM) practices. The purpose is to build the capacity of farmers for proper decision making that result in reduced cost of cultivation and enhanced productivity in Agriculture.

Key activities performed in FFS

- Pre-evaluation test to know the knowledge of the farmers before Polambadi
- Base line survey to explore production gaps and evolve suitable strategies
- Agro ecosystem analysis is to make comprehensive analysis of the field conditions from ecological perspective and to reach to the point of decision making.
- On-farm PAR experiments like defoliation, de-tillering, predation experiments etc., to strengthen the concept of Polambadi.
- Off-farm PAR experiments (Method demonstrations) like seed treatment, seed germination, NSKE preparation etc., at RBK level to showcase their method of application.
- Special topics on ICM technologies (INM, IPM, IWM, water management etc) to leverage the technologies for productivity enhancement.
- Group dynamics to break monotony and to refresh the farmer groups.
- Field day at the end, to assess the variability in cost of cultivation, yields, gross and net incomes in Polambadi plot in comparison with non-polambadi plots.
- Post evaluation test to know the knowledge levels of farmers enhanced with Polambadi.

During last four years about 54,531 Farmer Field Schools have been conducted involving 16.35 lakh farmers who were basically trained on Good Agricultural Practices.

Impact Analysis of FFS

- The impact analysis of FFS was done independently by the State Agricultural University and State Horticultural University. It revealed that the cost of cultivation has been substantially decreased due to adoption of the Good Agricultural Practices when compared with Farmers practices adopted on their own. Cost reduction is found to be ranging from 5 to 15% in different crops like Rice, Maize, Cotton, and Groundnut crops. Cost reduction is



APSOPCA was granted IndG.A.P certification in April 2023. Through this, individual or groups of farmers of Andhra Pradesh can get their produce Certified under IndG.A.P and access premium markets across the globe

mainly attributed to significant decline in the intensity of usage of chemical inputs like fertilizers and pesticides.

- The impact analysis also gives a positive inference on the dynamics of yields. Integrated Crop Management (ICM) Technology adopted in FFS plots has contributed to significant increase in yields ranging from 9 to 27% when compared with Farmers practice in the above crops.

Andhra Pradesh established the AP State Organic Product Certification Authority during April, 2022 and notified as a certification body for GAP and Organic Certification. APSOPCA submitted application to QCI during October, 2022 for IndG.A.P Accreditation.

After technical evaluation by QCI, APSOPCA was granted IndG.A.P certification on 18 April, 2023. Through this, individual or groups of farmers of Andhra Pradesh can get their produce Certified under IndG.A.P and access premium markets across the globe.

The Future is Green

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Advances in the fields of microbiology, biotechnology, genetic engineering space, High-tech Agri-Inputs, Farm Mechanization, communication technology, Digital Technologies, IOT and related IT enabled technologies have propelled the farm sector into an era of precision agriculture



Mr Rajesh Agarwal
Managing Director
Krishi Rasayan

Indian agriculture is based on a highly diversified agri production situations comprising 15 agro-climatic regions based on similarity in soil type, climate and captive water resources. ICAR has further segmented these regions into 131 Zones based on suitability of resources for targeted agri production- with such a diverse agro-climatic situation, country is able to produce almost all the crops cultivated in any other part of the globe.

With a rich inherent biodiversity, it is not a surprise when horticulture sector is outpacing food grains production and several non-conventional crops have been introduced successfully in one or the other part of the country.

Technological advances

Advances in the fields of microbiology, biotechnology, genetic engineering space, High-tech Agri-Inputs, Farm Mechanization, communication technology, Digital Technologies, IOT and related IT enabled technologies have propelled the farm sector into an era of precision agriculture. Equipped with multidisciplinary solutions/ decision support systems, crop nutrition and crop protection sector is now fairly equipped facilitate farm sector in meeting future food & nutritional requirements without losing its focus on ecological sustainability.

Focus Of R&D Efforts

Development of new products should be specific to crops and situations, therefore, R&D efforts should be (i) need based and problem solving on the one hand and (ii) validating advanced technologies for adoption as per agro-ecological situations on the other. While adopting a crop cluster-based approach, not only the production prospects are enhanced but post-harvest linkages could also be strengthened.

Alignment of High-tech Agri-inputs, technology including Artificial intelligence techniques and food processing to focused production clusters will add significant value and can appear as big game changer in Indian agriculture.

Leveraging Peri-Urban Agriculture

Cultivation of crops in the city outskirts or perimeter of the urban areas is growing with the expansion of existing cities and towns. The farmers are engaged in large scale production systems by setting up polyhouses, animal husbandry, horticulture, beekeeping, mushroom cultivation, agro-forestry, etc.

Most of highly perishable seasonally and regionally available vegetables and fruits are cultivated and sold under this system. It is also noticeable that peri-urban agriculture system is generating significant employment opportunities, helping in recycling urban wastes and strengthening cities' resilience to climate change.

Company owned retail outlets can play a significant role in offering access to inputs, technology and information and facilitate peri-urban farmers.

Farmers-Led Extension: Reaching Progressive Farmers

These farmers are always looking for newer products and practices and can be located in almost every production catchment. This target group will accelerate adoption of technologies and demonstrate realize their impacts resulting into a long-term association. These target groups will help in motivating other farmers to adopt the proven technologies.

Bonding with FPOs

Fragmentation of land holdings has made them economically unviable-farmers operating on such smaller units are not able to make use of advanced tolls and technologies.

Formation of FPOs is being seen as a way to tackle the issues of small and marginal land holders by aggregating their resources and efforts.

There are several mature and vibrant FPOs in most of the states which are/will offer a more meaningful engagement with farming community for agri input as well as crop produce centric organizations. FPOs along with Agri-input companies, financial institutions, and crop produce processing / trading companies and agri-extension education organizations can be a big game changer in Indian Agriculture.

Evidence-Based Production (EBP)

Every farm is unique; soils and farming capabilities are different. EBP is set to have a major impact on the productivity of agricultural supply chains and is defined as "farming that embraces technology and utilizes data to inform production". EBP involves agronomists, advisors, input suppliers, processors and retailers using data to optimize performance; both at the farm level and within their individual businesses.

Evidence-based agronomy seeks the transparent integration of all relevant data and resulting recommended practices with local farm conditions and associated data sets. It has the potential to make the science supporting soil fertility and nutrient management more agile and credible and can increase the impact of the data of nutrient science in a big data ecosystem.

The prevailing extension system in India is inadequate (in terms of skill and resources) leaving a large section of farmers to adopt a "biased advisory" offered by agri-input dealers. Agri input companies are doing fairly well but the agronomists / farm advisors employed also need to be equipped and trained to carryout EBP driven by latest/relevant technologies.

Complete Farming Solution - One Stop Platform

Establishment and operation of efficient one stop solution platform from where farmers can not only get complete farming solution including quality agri-inputs and location and situation specific technology to decrease cost of production and increase crop / livestock productivity.

This will help to integrate inputs, technology and resources for having efficient farming system and be a big game changer in Indian agriculture. Considering the diverse socio-economic fabric of rural setting and its implications on agriculture, a general recommendation is not effective.

Agro-ecological situation-based customized approaches should be evolved using relevant data and scientific tools. Having one stop complete farming solution can play a vital role in in doing so.

There are many more potential game changes which have potential to transform Indian agriculture. All associated stake holders including government and Industry need to work in coordination and support to farmers to convert above mentioned high potential game changers into real game changers of Indian agriculture.



Dr Maninder Kaur Dwivedi, IAS
Managing Director
SFAC



The Millet Surge

Supply and Value Chains are Crucial

Nutritionally, millets are equivalent or superior to wheat and rice. Agro-climatically, they make more sense to grow, as they require less water and practically no fertilizer or pesticides

Quinoa was a little-known grain outside its native Andean region before 2013. The year 2013 was declared as the ‘International Year of Quinoa’ and then quinoa literally captured worldwide cuisines. By 2014, it was cultivated in over 70 countries, had become synonymous with healthy eating and rebranded as a superfood. The International Year of Quinoa was a campaign that dealt with each aspect and acceptable to all strata and its repositioning as a desirable food commodity, instead of the fall back when nothing better was available.

Historically, governments have done similar campaigns to mainstream foods for mass consumption, over the ages for multiple reasons. Louise XVI of France wore potato flowers in his buttonholes and Marie Antoinette in her hair, to make the new tuber acceptable as food. Potato had been newly imported from South America, was growing profusely but people feared the strange tubers offered as food, alien as they were to the produce in the pantry. Potato flower is non-descript and hardly inspiring, but the royal association made it easier to accept the exotic vegetable and assimilate it into the French cuisine.

Year Of Millets

Year 2023 has been declared the ‘International Year of Millets’, on India’s proposal. The various hardy crops classified as millets, were India’s staple diet, long before the green revolution replaced the diversity in food with wheat and a few varieties of rice. Nutritionally, millets are equivalent or superior to wheat and rice, some are low GI and all are gluten free. Agro-climatically, they make more sense to grow, as they require less water and practically no fertilizer or pesticides. They all have shorter period to maturity and harvest than wheat and rice, so the climate change risks are better with millets.

Need To Popularise

First is the availability of quality certified seeds. India was the first country to bring out hybrids of bajra, over two decades ago. This addressed the anxiety of farmers about less yield. Now, certified millet seeds are available in the market, National Seed Corporation alone has certified seed for 9 millets.

The documentation of traditional seed banks, truthful label seeds, as they are called and their propagation and research will yield manifold results. Shift to millet cultivation may be hampered by farmer’s comparison to yields and MSP of wheat and paddy. So, though millets are good for consumer and good for the planet, they need to be made ‘good for the farmer’ also, in terms of economic returns, which can be supported through new released varieties of seeds.

Secondly, mechanization for cleaning, grading, primary and secondary processing of millets needs to be made affordably and easily available. The millets with husk-like kodo require equipment

for decorticating. Anyone who has tried doing this the traditional way would immediately understand why the women must have been delighted with the wheat and rice becoming popular with green revolution.

Thirdly, the value addition in the supply chain simply must produce end products that are easy to assimilate into daily diets. For instance, ragi and fox tail millet flakes to replace all breakfast cereals. Even partial replacement in wheat flour, a minimum admixture that may be mandated, for packaged flours. Malted powders for drinks or porridge, kheer, kichri and pongal mixes, mixes for idli and other batters can also mainstream millets.

Marketing & Branding

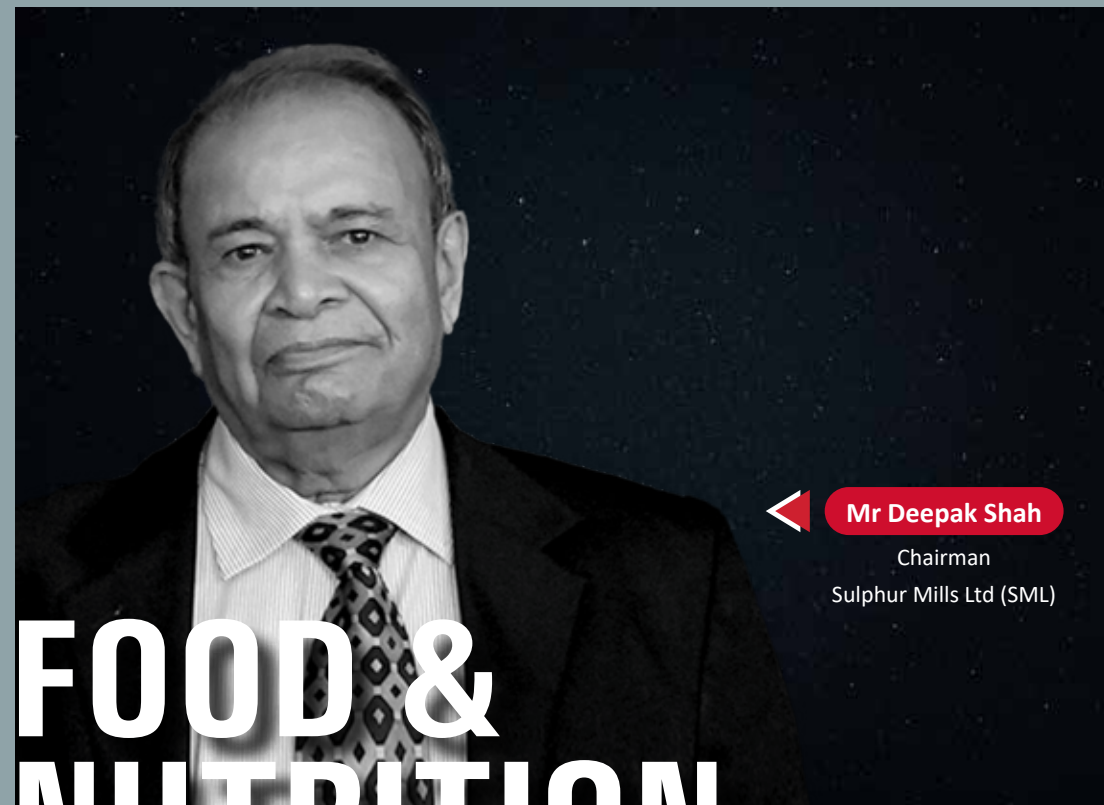
Fourthly, branding and marketing millets as specialty foods — for instance ragi-based baby foods, bajra-based diet/ weight loss mixes, malted millets as health drinks, jowar and ragi as convalescent foods, kodo and barnyard as diabetic friendly (not all millets are diabetic friendly) etc. Millets each have unique properties, taste, and benefits. The branding and marketing should highlight the USP of each millet, instead of an omnibus approach that does little to distinguish them from the current popular staples.

Fifthly, including millets in PDS with assured MSP is a common suggestion one hears. It’s a quick fix solution to increase the net sown area but needs a nuanced approach. It can be tried in areas where paddy is to be discouraged due to depleting water table but must be linked with end use of the procured stock. If PDS, then processing facilities should be locally and cheaply available. Post processing, the form in which it is to be distributed or locally consumed should be acceptable to the cuisines and palates. This can include dishes and drinks served in anganwadi centres or school mid-day meals. Besides the government subsidy programs, the traditional uses need revival sans the drudgery of processing and cooking millets.

The Way Ahead

So, what is the likelihood of millets ‘doing a quinoa’ on worldwide cuisines? It depends on how seriously the issues are addressed. What gets assimilated into food is based on taste (millets definitely score higher than quinoa), ease of cultivation (they have been grown for centuries without any state support, so government support now can result in a quantum jump), higher productivity (needs sustained efforts), improved and widespread processing facilities (work in progress with many schemes now supporting) and most critical, the ease and access for the consumer (being addressed by start-ups, industry and platforms like ONDC).

Millets can outdo quinoa as the superfood of the world. We are the cusp of a new culinary phase where the purity of millets, sans pesticide and fertilizer residues of other crops, can feed ‘Shree Ann’ to the masses.



◀ **Mr Deepak Shah**
Chairman
Sulphur Mills Ltd (SML)

FOOD & NUTRITION SECURITY

Protecting and Securing the Country's Future



Ms Komal Shah Bhukhanwala ▶
Director
Sulphur Mills Ltd (SML)

“ Policy initiatives such as distribution of subsidies to seeds which assimilate higher nutrients, higher Nutrient Use Efficiency fertilizers and bio-fertilizers can change agricultural productivity and health of the nation

India is a global agricultural powerhouse. We are the world's second largest producers of wheat and rice and the largest producers of fruits like mango, banana, papaya. The green revolution brought in practices to make the country food secure, but agriculture today faces challenges of degrading soil health, climate change, sustainability, food security and a declining quality of food.

Agricultural practices, particularly, the use of nitrogenous fertilizers, contribute to more than 65% of the nitrous oxide emissions, a major greenhouse gas which makes even a larger impact on temperature and climate change. We, as a country have the largest subsidy in the world for bulk fertilizers (22 billion US Dollars, or 180,000 crore Rupees), which incentivizes farmers to continue adopting an unbalanced nutrition practice.

These practices degrade soil health and contribute to climate change. On the other hand, the nation has budgeted around INR 20,000 crores under Poshan 2.0 to combat malnutrition, but last year, Poshan Abhiyaan, which focusses on nutritional security and outcomes, utilized around INR 3700 crores. And the budget needed to fight malnutrition is around 40,000 crores or even more.

Micronutrient Deficiencies

More than 80% of the Indian population today faces at least one micronutrient deficiency (in terms of zinc, iron, folate, Vitamin B12, Vitamin A, Vitamin D). The country suffers from a GDP loss of 28,000 crores due to micronutrient deficiencies in the country in terms of poor health and loss of productivity. About 50% of the children below the age of five across 10 or more states of country suffer from stunting, wasting, poor cognitive development due to lack of vital nutrients in their diet. The Indian Dietetic Association claims that 84% of the diet across the Indian population, lacks adequate protein. More than half the women in the country and more than 3/4th of Indian children suffer from anaemia, which impacts daily functioning and productivity.

Poor Soil, Poor Crop Quality

The above data in terms of poor nutrition and loss in the country should not come up as a surprise, when one looks at the state of soil health in the country. More than 33% of the country's cultivable soil (about 960 lakh hectares) is degraded, largely due to excessive cultivation and the excessive use of largely two bulk fertilizers. More than 50% of the soils in the country are saline, due to weathering, erosion, and the excessive use of water-soluble fertilizers. Not only is it a challenge to get good farm yield and productivity in saline soils, but these soils do not allow adequate uptake of all nutrients in the crop, leading to poor quality and non-nutritious crops and food. To bring serious

attention to the gravity of the problem, since 50% of the soils are saline, one could extrapolate and say at least half the food we consume today is nutritionally inadequate.

While the government is making serious efforts to popularize and advocating natural farming, one must also note that farmyard manure is the second largest contributor to greenhouse gases including methane. It is also pertinent to note that the animals have been raised and fed crops which have grown with the same agricultural practice of synthetic fertilizers over the last several decades, and thus the manure will not meet the soil health and crop requirements.

As per research publications from the Indian Institute of Soil Science and Indian Agricultural Research Institute, fodder grown in soils which carry all vital nutrients, including iron, copper, zinc, manganese, the final fodder had lower levels of micronutrients when grown with the recommended synthetic fertilizer practices prescribed today as against without these synthetic fertilizers.

Balanced Nutrition Management Approach

Addressing and achieving food and nutritional security is an even greater challenge in the face of degrading soil health and climate change. There is a need to achieve both food and nutritional security together. Not only do we need to improve productivity and quality, but we need to do this with lesser land and lesser inputs, to tackle climate change. The green revolution only sought to address food security, and completely ignored the impact on the environment and the quality of the food produced.

To address the subject of food and nutritional security on a war footing, a closer look towards a balanced nutrition management approach must be considered. To enable this, government, academia, research institutes and private industries fostering innovation, must collaborate to drive forward these solutions.

Policy initiatives such as distribution of subsidies to seeds which assimilate higher nutrients, higher Nutrient Use Efficiency fertilizers and bio-fertilizers, which foster and allow for food and nutritional security outcomes in tandem, can change the agricultural productivity and health of the nation. The government can seriously promote balanced nutrition by deploying a lower GST to secondary and micronutrients (which today have a GST of 18% vs. urea which carries a GST of 5%).

For India to remain a global powerhouse in agriculture and feed its growing population and jump ahead in terms of losses due to malnutrition and healthcare, there is need to have a radical approach of looking at policy for fostering nutrition smart agriculture, which can spear head the country's trajectory in terms of productivity, quality, health and income for all.

DIGI TECH GAMECHANGER FOR AGRI BUSINESSES



Mr RS DIXIT
Chairman
Ananda Group



Digital technologies are reducing the need for intervention as well as cutting down the transaction cost. Internet, mobile technologies, devices, data analytics, artificial intelligence, digitally-delivered services and apps are changing the agriculture sector

Digital technologies have helped in creating a multiplier effect in the agriculture sector. This is especially true for agri-businesses which need a robust supply chain. The principle of Minimum Government, Maximum Governance, has supported the agri-business sector. Most of the digital technologies currently being used help create a supply chain that can support the farmers, distributors and, ultimately, the consumers.

Going Futuristic

Digital Technologies are reducing the need for intervention as well as cutting down the transaction cost. Internet, mobile technologies, devices, data analytics, artificial intelligence, digitally-delivered services and apps are changing the agriculture sector. Traceability technologies and digital logistics services offer the possibility to streamline agri-food supply chains. Data collected from satellites is bound to improve accuracy and reduce the cost of monitoring crop growth and the quality of water supply.

Leveraging Digi Tech For Strong Supply Chain

Cloud-based technologies ensure that there is visibility in the supply chain processes. Optimizing the inventory can be possible for agribusiness companies. They can have better access to the markets if they leverage software for order management. Industrial IoT technology offers real-time and accurate monitoring of production conditions.

IoT-based devices can help ensure that the end product is up to the mark. Supply chain management can be fortified with the help of platforms that utilize AI that offer actionable insights. Supply chain managers can use software for demand and supply planning, distribution requirements planning, inventory optimization and more.

Role Of Government

With its emphasis on Digital India, the government has facilitated the adoption of digital technologies. E-NAM provides single window services for all Agricultural Produce Market Committee (APMC) related services and information. Both buying and selling raw agricultural produce is possible through this portal. E-payment settlement is done for transactions done.

It has created a unified national market for agricultural commodities. The access of farmers to the market has been improved with this initiative. E-NAM portal has enabled farmers to sell their products through their nearby markets and facilitate traders to acquire it easily. This has cut down the involvement of intermediaries and the possibility of farmers being cheated. The farmers can get the best price for their produce as it ensures a transparent auction process. Agribusinesses have also benefited from the common online market platform as they can procure raw materials from the farmers.

Schemes that enable the linking of farmers with agri-businesses and the market for ensuring remunerative prices for agri-produce have been launched. The Ministry of Food Processing Industries has engaged technical agents to assist farmer groups. They are responsible for the preparation of business plans, detailed project reports, capacity building etc.

Better Forward And Backward Linkages

Technology has helped in plugging the gaps in the supply chain in terms of the availability of raw materials and linkages with the market. Transaction costs in effecting the linkages are not significant. An apt example of this is the collaboration of Ananda Dairy and SBI, a public sector bank, for providing loans to dairy farmers who want to supply raw milk for processing plants. The farmers do not have to depend on moneylenders. Applying for a loan is not as challenging with the online loan application process.

The paperwork to be done to get loans cleared is minimal. Loan is credited to the bank account of the farmer. Ananda Dairy is helping many farmers realize their goal of having an assured and stable income.

Sensors Can Provide Real-Time Data To Agribusinesses

Data Analytics is being used by agribusinesses to ensure that the end product meets all the quality standards. Real-time data can be provided to agribusinesses with the help of sensors. Ananda Dairy uses sensors in its milk processing plants to collect crucial data like microbial activity, salinity, toxic substances etc., which can affect the quality of the end product.

Reaching The Targeted Market Is Possible

Commercially viable business solutions are required for an agribusiness to thrive in the market. All agribusinesses have a goal to have a pan-India presence. They require distributors in every city. Mobile applications can help them to realize this goal.

Ananda Dairy has launched applications for facilitating distributors. Orders and payments for the purchasing of products in bulk can be made through these applications. Earlier, it used to be a cumbersome process, with the distributors having to make the payments at a bank. As the process has become easy, more distributors have joined Ananda Dairy making its quality products available for consumers in all regions of India.

Reduces Spoilage

Digitalizing the logistics system will help reduce wastage. Technologies can be leveraged to ensure that consumers get quality products. Digitalization of agriculture improves the overall efficiency of the entire supply chain. Online marketplaces connect farmers directly with processors, reducing the number of intermediaries and transit nodes. This will reduce the possibility of loss and waste as the transit time is less. It also eliminates the requirement of intermediaries boosting the income of farmers.

Ananda Dairy uses digital technology to track the raw milk right from the collection centres at the village level till it reaches the processing plants. IoT is used by Ananda Dairy to eliminate the possibility of untested raw milk reaching the processing plant.

Sustainable Livelihood

Ananda Dairy has created an extensive network of dairy farmers with the help of digital technologies. Digitalization is helping Ananda Dairy right from procurement to secure payments. Mobile apps inform the farmers about the collection centers.

Tech Mech

The Road To Farmer Prosperity



Mr Hemant Sikka
President
Farm Equipment Sector
Mahindra & Mahindra



We have developed global technology Centres of Excellence in Finland, Japan and Turkey, based on acquisition over the last decade, from where we are currently rolling out product solutions for the Indian and global markets.

Globally mechanisation has been one of the key components of high agricultural growth and higher food security, with several studies suggesting a direct relationship between increased yields and farm mechanisation.

And while India is Tractorized and is the largest tractor market in the world, as a country we are under mechanised, with far lower levels of non-tractor farm equipment compared to developed countries. India's farm equipment market is 7 per cent of the global market, with more than 80 per cent of the value contribution coming from tractors.

At Mahindra we have been the leader in the tractorisation of India for several decades, with a strong tractor portfolio, and are building skillsets beyond tractors through alliances and acquisitions in global agri tech companies and start-ups over the last decade, with the idea of taking technologies used in large land holding farms around the world and making them affordable and accessible to small land holding farmers.

We are now determined to be leaders in overall mechanisation of India's farmlands, with an aim to grow our farm machinery business by 10X in 5 years.

Besides GoI's ambition of doubling farm mechanisation by 2030 has led to the introduction of several schemes and policies to support greater mechanisation of Indian farmlands.

Serving The Complete Agri Value Chain

At Mahindra we make products across the complete agri value chain from Land Preparation – Sowing & Transplanting – Harvesting – Post Harvesting / Material Handling, with a robust (F'23 YTD Q3) growth of 40%, with multiple growth levers and 15 new products being developed in-house at our FM plant in Pithampur.

We will be soon roll out products like the new generation harvesters, boom sprayers, loaders etc.

At Mahindra FES we have planned an investment of Rs. 3400 cr across the FES business for F22-24.

Our new farm machinery plant in Pithampur is Mahindra's first exclusive farm machinery manufacturing facility. It is strategically situated in the industrial city of Pithampur with access to a diverse

supplier base, enabling us to manufacture durable, high-quality, affordable and accessible 'Made in India, for India' farm machinery, marketed in both the Mahindra & Swaraj brands.

The new plant has well-planned lay-out, capable of rolling-out a series of new products designed at Mahindra's global technology Centres of Excellence in Finland, Japan and Turkey. The new plant is spread over 23 acres and has a capacity to manufacture 1,200 combine harvesters and 3,300 rice transplanters per year. The Pithampur plant, along with its dedicated supplier park, is eventually expected to provide employment to 1,100 persons. The plant will also manufacture products for export to global markets in Asia, Africa, Europe and Americas.

Global Technology Centres of Excellence

We have developed global technology Centres of Excellence in Finland, Japan and Turkey, based on acquisition over the last decade, from where we are currently rolling out product solutions for the Indian and global markets.

Our latest acquisition of Gamaya will enable us to develop and deploy next-generation farming capabilities, such as precision agriculture and digital farming technologies, giving us access to hyperspectral imagery analytics, artificial intelligence and machine learning, which captures and interprets useful information on the state of crops for the farmers.

We will continue to explore partnerships in this space, to introduce the best technologies for the Indian farmer.

Pioneering Differentiated Farm Machinery Products

Besides introducing new FM products from our CoE's and setting up our new FM plant in Pithampur, we are rethinking our whole tractor channel of 2220 tractor dealer network selling Mahindra and Swaraj tractors, to market pioneering differentiated farm machinery products as well, to increase our sales and service reach for these products. We will also have some independent farm machinery dealers.

Besides we are also thinking of what we will do by way of improved exports of farm machinery products.

Key Acquisitions & Partnerships

33% stake in **Mitsubishi Agri Machinery** – Japan – Global CoE for light weight tractors & products across the rice value chain.

100% stake in **Erkunt Traktors & Hisarlar** – Turkey – Global CoE for farm Implements

100% stake in **Sampo Rosenlew** – Finland – Global CoE for Harvesters and Forest Machinery

Partnership with **Dewulf** – Europe – Manufacture & Marketing of Potato Planting equipment in India. Under this agreement, Dewulf will work with Mahindra to bring its renowned potato planting technology to the Indian market.

A SAFAL Journey

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Mother Dairy's fruits and vegetable processing plant at Ranchi has taken the initiative to connect to the newly formed FPOs in Jharkhand. These FPOs were being promoted by SFAC and supported by SAFAL on a shared understanding to provide market linkage to the farmers

Fruits & Vegetable Processing Plant Ranchi



Tatijharia Progressive Farmer Producer Company Ltd dispatching first lot of tomato to SAFAL, Ranchi

With the success of White Revolution under the guidance of Dr. Varghese Kurien, the then Prime Minister Smt Indira Gandhi advised NDDB to submit a proposal for marketing of fresh fruits and vegetables in Delhi Metropolitan. A humble beginning of F&V Unit (a pilot project of NDDB) started-off in 1986 from the rented cold store premises in Delhi. Subsequently, Central Distribution Facility and Storage Complex was commissioned at Mangolpuri, Delhi in 1988. A fruits and vegetable unit was set up with the objective of facilitating a direct link between fruit and vegetable growers and consumers.

Ranchi Processing Plant

Mother Dairy's fruits and vegetable processing plant at Ranchi has taken initiative to connect to the newly formed FPOs in Jharkhand. These FPOs were being promoted by SFAC and supported by SAFAL on a shared understanding to provide market linkage to the farmers. These were formed under the government's initiative of creation of 10,000 FPO across the country. Most of the members here are tribal farmers, who are engaged in farming.

SAFAL provided initial hand holding and training support to these farmers. They were trained on post-harvest managements, benefits of grading, payment system and processing quality parameters etc. They were also familiarised on improved cultivation methods, protected seedlings raising techniques and package of practices for growing tomato.

During the current processing season seven FPOs dealing in tomato from Hazaribagh and East Singhbhum districts were inducted into SAFAL supply system. These seven FPOs supplied about 660MT of tomato for processing during the period January to March. The estimated value of supplies is about Rs 38 lakh. It was much of a support to the newly-formed FPOs who were struggling to get market linkage. SAFAL has also been working on other products like sweet corn, jackfruit and mango to be sourced through FPO.

It is expected that in future, the relationship would get further strengthened.



Training to Atma Nirbhar Katkamdag Farmer Service Producer Company Ltd at SAFAL unit, Ranchi

Mangalपुरi Unit

This year the Mangalपुरi Delhi unit planned to move a step closer to the Gujrat farmers. It worked closely with Gujarat Cooperative, an apex cooperative society which has a spread of about 140 grassroots fruits and vegetable societies at taluka/district levels. For past three years, they have been largely selling their produce in the nearby local markets mostly within the borders of Gujarat.

This year the initiative was to connect to the Delhi market. To do this, the farmers had to undo the practice of packing tomato in wooden boxes. The wooden boxes during the long transit would cause about 15-20% of fruit damage leading to wastage and value erosion. Further, the farmers were also reluctant to grade the fruits believing that it is easy to sell mixed grades in a single lot. However, with constant effort of SAFAL staff, they agreed for sorting and grading.

Soon they understood its benefit through price realisation. The 'A' grade material were crated, packed and sent to SAFAL, Mangalपुरi. These were being retailed at SAFAL booths in Delhi, NCR. The operation continued through Jan-Feb wherein farmers dispatched about 516MT of tomato worth Rs 61 lakh.

Looking at the success of tomato, they also dispatched 194MT of watermelon valued at Rs 23 lakh.

Mr Pradipta Sahoo
Chief Strategy Officer (CSO) &
Head (International Business)
Mother Dairy

Maximize Your Maize Yield with STIHL's Innovative Farming Solutions

STIHL



Maize Field

MH 710 Power Weeder

Maize cultivation is an important agricultural activity in India, accounting for approximately 4% of the global maize area and 2% of the total production.

To keep up with the demand for maize, farmers require the right tools to make cultivation easier and more efficient. Among the essential tools for maize cultivation are a Power Weeder and a water pump.

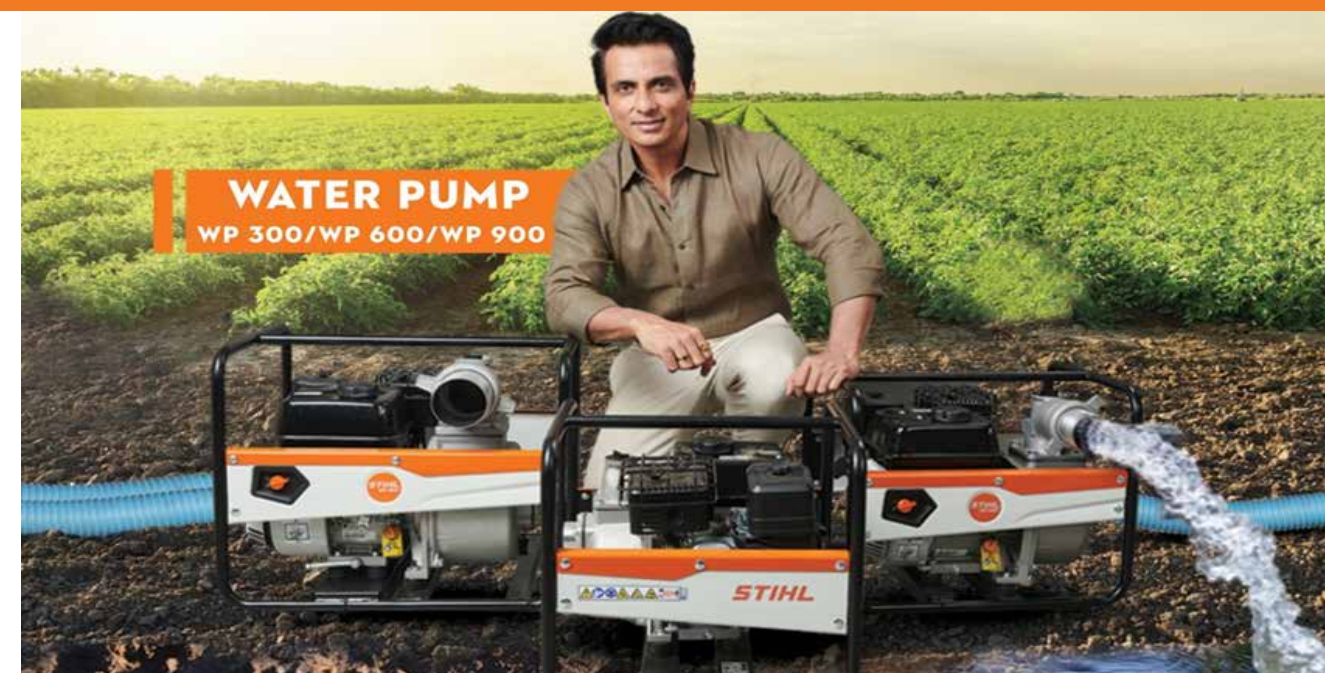
The STIHL Power Weeder MH 710 and the STIHL Water Pump WP 300 are two innovative equipment in their respective categories. The STIHL Power Weeder MH 710 is designed to prepare the soil for planting. It has a powerful engine that can turn over the soil and create a suitable environment for maize to grow. The Power Weeder should be started on a flat and level surface, and the user should ensure that they have a firm grip on the handles before engaging the Power Weeder. The technical specifications of the equipment make it suitable for heavy-duty tasks in agricultural work, where high power and efficiency are required.

To use the STIHL Power Weeder MH 710, attach the appropriate attachments to the weeder. For maize cultivation, tilling or weeding attachments are ideal for penetrating the soil and removing weeds. This power weeder's ability to operate

other gardening machinery and tools via the PTO makes it a smart investment for farmers who need a reliable and flexible machine for their farming operations.

A water pump is essential for irrigating maize crops. The STIHL Water Pump WP 300 is a powerful and reliable water pump that is ideal for irrigating maize crops. It has a high output, which means that it can deliver water to the crops efficiently and effectively. The STIHL WP 300 water pump is a robust and powerful machine designed for medium delivery volumes. It boasts a maximum output of 616 liters per minute, making it highly effective in handling larger water flows. The machine is driven by a powerful 4-stroke petrol engine, making it highly efficient and reliable. Before using the water pump, the user should ensure that the water source is clean and free of debris. The water pump should also be placed in a location that is close to the water source and the crops that need to be irrigated.

Once the water pump is in place, it can be started using the pull cord. To irrigate the maize crops, the water pump should be connected to a hose that is placed near the crops. The water should be directed towards the base of the plants, ensuring that the roots are adequately watered. It is important to monitor the water supply and adjust the flow rate as needed to avoid over or under-watering the crops.



STIHL Water Pump WP 300/ WP 600/WP 900

In conclusion, the STIHL Power Weeder MH 710 and the STIHL Water Pump WP 300 are trusted and reliable tools for maize cultivation in India. They are both efficient and designed to handle heavy-duty tasks. The Power Weeder MH 710 prepares the soil for planting, while the Water Pump WP 300 ensures that the crops are adequately watered. With the right tools, Indian farmers can

maximize their maize yields and contribute to meeting the global demand for this important crop.

To know more about STIHL products, check out their official website at www.stihl.in, or contact them at info@stihl.in or call or WhatsApp at 9028411222.

STIHL UPKARAN, LAAYE PARIVARTAN

STIHL





Prof. A. Vishnuvardhan Reddy
 Vice Chancellor
 Acharya N. G. Ranga Agricultural University



ANGRAU INITIATIVES

Transforming Farming In Andhra Pradesh



ANGRAU has made a very unique curriculum for students not just to take up a project for the purpose of degree, but to make sure that the young minds get interest in farming and also do the business through post production of the produce through value addition

India has a rich agricultural history and a significant portion of its population depends on agriculture for their livelihood. The agricultural sector contributes around 16% to the country's Gross Domestic Product (GDP) and employs over 50% of the country's workforce. India is the world's second-largest producer of food and the largest producer of spices, pulses, milk, and jute. The country is also the second-largest producer of fruits and vegetables in the world.

The agricultural economy of India faces several challenges, including a lack of modern technology, inadequate irrigation facilities, low productivity, and inadequate marketing infrastructure. The adoption of modern agricultural technologies is crucial for improving agricultural productivity and increasing the income of farmers. The government, private sector, and other stakeholders must work together to ensure that farmers have access to the latest technologies and are equipped with the skills and knowledge needed to use them effectively.

Path-Breaking Initiatives

There have been several game changers, in terms of technology, in agriculture that have revolutionized the agriculture in India, what now we are witnessing, and the notable among them are green revolution, genetically modified organisms (GMOs), Precision farming, Sustainable Agriculture initiatives etc. New innovations will keep on emerging with the advancement of technology, in the days to come.

Acharya N G Ranga Agricultural University (ANGRAU) has undertaken several initiatives during the past two years that have the potential to be game changers for farming in Andhra Pradesh towards achieving self-sufficiency in production embracing latest technological advancements.

Quality Seed Production & Distribution: ANGRAU is the leader in seed production across the country producing 94,302 quintals of seed in all major field crops worth of 84.47 crores during 2020-22 and was distributed to the farming community across India. ANGRAU has established several seed production centers across the state, producing high-quality seeds of various crops that are adapted to local conditions. This has helped farmers to access quality seeds at affordable prices, leading to increased yields and better-quality produce.

Commercial Floriculture In Tribal Areas: University has setup a centre of excellence in organic farming at Regional Agricultural Research Station, Chintapalli in 2021, and the package for organic agriculture for different crops was formulated by ANGRAU and given the crop specific recommendations. Commercial floriculture crops suitable to tribal areas viz., Gladiolus & Tulips were introduced by ANGRAU for the first time in Chintapalle area. First bloom of Tulips in South India was achieved at High altitude areas of AP paving the way for Agri-Tourism, a sustainable way for economic improvement in the tribal belts of Andhra Pradesh.



Drone Technology: University has taken initiative in technology assessment and refinement with respect to use of drones in agriculture and has developed SOPs for Drone spraying in 10 field crops. ANGRAU is the first Agricultural University in India to get DGCA certified RPTO – Remote Pilot Training Organization (15 days and 5 days courses), and around 250 members got trained in certified drone piloting since 2022. With in 2 years, more than 40,000 acres were brought under drone spraying by ANGRAU and aiming to start drone production line @ 100/month under expansion in a large scale.

RBK Linkages: Rythu Bharosa Kendrams (RBKs), a one stop Agri Service providers for the benefit of AP farming community, established across the state of Andhra Pradesh by the Govt of AP. RBKs function through 4 verticals viz; supply of pre-tested quality inputs, delivery of services, Capacity building, Knowledge dissemination, Farmer’s advisory and Call Centre and procurement operations. ANGRAU is a proud partner in this initiative, by acting as technology and knowledge provider. All the 10,778 RBKs were linked with ANGRAU and convergence activities involving students and faculty are being in vogue. All the UG students of B. Sc. (Hons) Agriculture are involved in RBK operations during RAWEP across the state. During the past two years, 2317 students of ANGRAU served the farming community of AP under RBKs, a game changing initiative taken by ANGRAU, towards Agri Centric Learning Experience.

Value Addition: ANGRAU has been promoting value addition activities such as food processing, packaging, and marketing of

agricultural produce. This has helped farmers to increase their income by selling processed and value-added products, rather than just raw produce. Millet value addition was taken up in a big way and being promoted across the state. ANGRAU got credited with 5 patents for value added products processing technology/ machinery in sugarcane and other crops during the past 2 years.

Yuva & Farming Entrepreneurship: Acceptance of refined technologies is usually high among youth, and the promotion of yuva kisans can only be possible if is attached to agripreneurship capacities, where the youth will able to implement the farm technology packages in total and also inculcating the value additions. Forward linkages from farm to product makers are vital in view of the value addition and one step ahead prices for the farm produce. In this direction, ANGRAU has made a very unique curriculum for students not just to take up a project for the purpose of degree, but to make sure that the young minds get interest in farming and also do the business though post production of the produce through value addition. It is very interesting to note that about 10% of the out-going students turning to be become farmer-cum-agripreneur. Surely, a game changer for attracting tech-savvy youth towards farming, retaining youth in agriculture, and also to make them self-reliant farmer cum entrepreneur.

These initiatives by ANGRAU have the potential to bring about significant improvements in farming practices and rural livelihoods in Andhra Pradesh, making them game changers for the state’s agricultural sector.



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Indian Agriculture Reinvigorating The Sector



GOI has launched several initiatives to promote and support agriculture in the country. The Pradhan Mantri Fasal Bima Yojana, Pradhan Mantri Krishi Sinchai Yojana, and Soil Health Card Scheme are some of the initiatives that have been implemented to provide better facilities and infrastructure to farmers



Dr Deepak Jain
Director General
Federation of Indian Industry



Agriculture in India has gone through significant transformation and several game changers have emerged in the Indian agriculture ecosystem that have contributed to the growth and development of the sector. Let us discuss the game changers in Indian agriculture ecosystem and how they are revolutionizing the sector.

Micro Irrigation Systems: Micro irrigation systems have revolutionized the way farmers use water for irrigation. These systems deliver water directly to the roots of crops, reducing water wastage and increasing crop yield. Micro irrigation systems have played a significant role in drought-prone areas, where water is scarce.

Precision Farming: Precision farming involves using sensors and other advanced equipment to monitor and manage crops. With the help of precision farming, farmers can optimize the use of resources

such as water, fertilizer, and pesticides. It also helps in reducing the environmental impact of agriculture and increases the yield of crops. Companies like Mahindra and Mahindra and John Deere are providing precision farming solutions to farmers in India.

Organic Farming: Organic farming has emerged as a game changer in the Indian agriculture ecosystem. Organic farming practices promote the use of natural fertilizers and pesticides, which are environmentally friendly and reduce the health risks associated with chemical-based agriculture. Organic farming has also provided an opportunity for small farmers to enter the market and increase their income. Organic farming involves the use of natural resources and avoids the use of synthetic fertilizers and pesticides.

Contract Farming: Contract farming is a game changer for small farmers who lack the resources to invest in their land. Under this model, farmers sign contracts with agribusiness companies to grow crops, providing them with the necessary inputs and technical assistance. Contract farming guarantees a market for the farmer's produce, enabling them to focus on farming while the company takes care of marketing and distribution. This helps in reducing the risks faced by farmers and also ensures a steady income. Companies like ITC and PepsiCo are actively promoting contract farming in India.

Krishi Vigyan Kendras (KVKs): KVKs are agricultural research and extension centres established by the Indian Council of Agricultural Research (ICAR). These centres provide farmers with technical support and training, enabling them to adopt modern farming practices. KVKs have played a vital role in disseminating information on new agricultural technologies and practices to farmers in remote areas.

Agri-Tech Startups: Agri-tech startups are using technology to solve the problems faced by farmers and are revolutionizing the way agriculture is done in the country. For instance, startups like AgroStar, Ninjacart, and CropIn are using technology to provide farmers with information on crop management, weather forecasting, and soil health. They are also helping farmers in selling their produce directly to consumers, thereby eliminating middlemen and increasing their income.

Government Initiatives

GOI has launched several initiatives to promote and support agriculture in the country. The Pradhan Mantri Fasal Bima Yojana, Pradhan Mantri Krishi Sinchai Yojana, and Soil Health Card Scheme are some of the initiatives that have been implemented to provide better facilities and infrastructure to farmers. These initiatives have not only helped farmers in reducing their risks but have also helped in increasing their income and productivity.

Neem coated urea is a very good scheme which has been initiated to regulate the use of urea and enhance its availability to the crops and also reduce the cost of fertilizer application. Soil health card scheme was introduced in 2015 to assist state governments to issue health cards to all the farmers in the country which provides information to the farmers on nutrients available in the soil along with recommendation on proper doses. National agriculture market (E-NAM) is a Pan-India electronic trading network to connect existing APMC mandis for improving the price realisation to the farmers and improving the availability of every produce uniformly in the country.

Pradhanmantri Krishi Sinchai Yojana (PMKSY) has been formulated to extend irrigation to all the fields and use of water more efficiently. The biggest game changer of all is the Pradhanmantri Kisan Samman Nidhi Yojana. Under this, the GoI aims to pay rupees 6000 per year to the farmer. This aid helps in reducing the cash crunch of the farmers and day today requirements of the farming community would be met with the launch of this scheme.

Major Initiatives For Boost

India's agriculture sector has been witnessing robust growth with an average annual growth rate of 4.6 per cent over the last six years. This has enabled agriculture and allied activities sector to contribute significantly towards country's overall growth, development and food security. Further in recent years the country has emerged as the net exporter of agricultural products, with exports in 2021-22 touching a record US \$ 50.2 billion. Recently, in the union budget, Government announced that an 'Agriculture Accelerator Fund' would be set up to encourage Agri start-ups founded by young entrepreneurs in rural area. Additionally, the government also announced that the agricultural credit target will be increased to Rs 20 lakh crore with a focus on animal husbandry, dairy, and fisheries.

Through these targeted initiatives, government aims to increase farmers' income furthermore with the focus on boosting high-value crops and allied sub-sectors. Continued focus on providing support, building proper physical infrastructure, steps to build digital Agri infrastructure, boost to Agri-tech ecosystem can further enhance agriculture in India and increase the value-added from the sector.

Agriculture During Amrit Kaal

Great Opportunity To Usher Digital Revolution

The Amrit Kaal is going to be a transformative phase of Indian agriculture. The consistent focus on digitization of farming in sync with the vision of Prime Minister Narendra Modi to empower our Annadatas will not only revolutionize the Indian agriculture during the next 25 years by easing the drudgery of our farmers, but also open up newer vistas of opportunities for rural youth and farm workers.

The Game Changer

The Centre's plan to build a digital public infrastructure for the agriculture sector is certain to be a game changer. This will work as an open-source digital public good that will support the growth of the agri tech industry and startups. The move will definitely enable an inclusive farmer-centric ecosystem with relevant information services for crop planning and help improve access to farm input, credit, and insurance, help for crop estimation, market intelligence and support for the growth of agri tech industry and startups.

Imagine a world where plants could talk to us! With the AI revolution that is taking place in Agriculture, crops can today tell as to what they feel and what they require through this wonderful tool called sensors and transmitters. In the age of Internet of Things (IoT), agriculture is at the cusp of becoming 'smart' with the seamless integration of the latest, interconnected technologies. The sensors and transmitters can monitor everything from soil and plant health to greenhouse humidity levels and the data generated can help in improving growing conditions and overall efficiency. Technology is in a way helping effectively remove the speculation from

the way crops are grown. This is an opportunity to leapfrog agriculture practices to the levels of Industry 4.0. There is immense opportunity for public-private partnerships (PPP) in leveraging the benefit of emerging technologies as the private sector is also introducing cutting edge innovation in the areas of digitization and AI.

Ensuring Efficiency Of Practices And Yields

The immense amount of data generated can be analysed to enable huge breakthroughs with respect to efficiency of practices and yields. Ultimately, it benefits the farmers to have more money in their pocket and improve their return on investment. The data can also help to predict the outcomes before you undertake them, minimizing risk and waste. In fact, today the various digital tools are tremendously helping in discovery of new molecules leading to the latest crop protection products which takes close to 11 years at a cost close to USD 300 million from discovery to commercialization. It also simulates the weather, soil and other conditions and tests the crops accordingly in the lab.

In addition to the cost savings and efficiency jumps, there are pressing global reasons for farmers adopting smart agricultural practices. By the year 2050, the world's population is anticipated to be around 9.6 billion. This means that farmers will have to increase their yields by 50 per cent to cope with rocketing demand. The Indian agriculture sector, which has witnessed robust growth with an average annual growth rate of 4.6 per cent over the last six years, is all poised to rise to the occasion. There has been a record export of agricultural products, touching US \$ 50.2 billion in 2021-22.

How e-NAM Is Helping Farmers

The pace at which India is adopting smart agriculture practices is phenomenal. The electronic National Agriculture Market (e-NAM) has hugely eased the lives of small holders. Over 1.72 crore farmers and 2.05 lakh traders have been registered on e-NAM platform along with the integration of more than 1000 grain markets of 18 States and three UTs with the digital platform. The massive penetration and expansion of the Internet and smartphones are going to metamorphose the dynamics of farming in the country. Integration of small holders in a digitally driven agri system is no longer a matter of choice but the dire need of the hour.

Use Of Emerging Technologies

A technologically highly productive and anticipatory approach to changes and challenges means better preparedness to deal with any onslaught on the agriculture and food system in any form. The use of emerging technologies such as Remote Sensing (RS), Geographical Information Technology (GIS), Data Analytics, Artificial Intelligence (AI), Machine Learning (ML), Block Chain, Internet of Things (IoT) and tools like drone does not only guarantee better farming efficiency but also less vulnerability of crops, thus better productivity and profitability.

AI along with satellite and drone imageries can not only be used in assessing crop yields and losses but also for the surveillance of pests, weeds and diseases through images acquired at different intervals.

Precision farming is no longer a distant dream as the use of tech driven tools like drones for spray of insecticide, pesticides and chemical fertilizers is gaining ground.

India is perhaps among a few countries in the world where a wholesome approach has been adopted for promoting the use of digital technologies.

A case in point is the India Digital Ecosystem of Agriculture (IDEA) framework, which is aimed at laying down the architecture for the federated farmers' database by taking the publicly available data as existing in various schemes and linking them with the digitized land records. The IDEA will serve as a foundation to build innovative agri-focused solutions leveraging emerging technologies to contribute effectively in creating a better ecosystem for agriculture in India and will help the government in effective planning towards increasing the income of farmers in particular and improving the efficiency of the agriculture sector as a whole.



AI along with satellite and drone imageries can not only be used in assessing crop yields and losses but also for the surveillance of pests, weeds and diseases through images acquired at different intervals



Dr KC Ravi
Chief Sustainability Officer, Syngenta India



Game Changers of Indian Vegetable Crops

Progressing Via Productivity



The vegetable sector has seen tremendous growth since OGL and efforts by public & private have helped boosting not only employment but also increased yields that ensured better income to our farmers

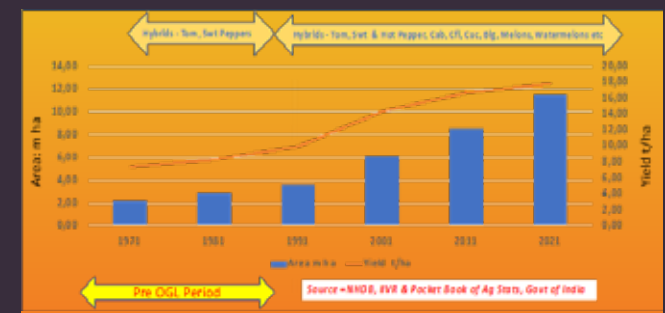
Dr Surinder K Tikoo
Founder & Research Advisor,
Tierra Agrotech Ltd

Vegetable crops are a key to nutritional security of any country and more so in India, it being predominantly vegetarian. I have personally experienced the changes in the vegetable crops in our country at ICAR- IHR (1971-1988) and in private sector (1988–present). In Fig 1, I have tried to capture the India vegetable crops scenario before 1989, when the path breaking Open General License (OGL) act was passed by the Govt of India to help farmers in India gain access to global germplasm.

The figure shows a few trends pre and post OGL. In tomato and sweet peppers, hybrids were introduced by Indo American Hybrid Seeds, followed by Namdhari Seeds, Mahyco Seeds and other companies over the period 1973-88. Post-OGL, several MNCs directly entered the vegetable market and using their global germplasm strength and locally based R&D, they delivered better yielding hybrids in tomato, sweet & hot pepper, cabbage, cauliflower, cucumbers, melon, watermelon, bittergourd, sweet and baby corn etc — approx. 70 % of the total market today.

Significant impact on productivity and area under vegetables after OGL is very apparent in Fig 1. Progress has been possible through game changing research events in public and private sector. I have tried to focus on the significant crop wise path breaking events from public or private sector that have helped the vegetable seed industry move from a Rs 40 crore market in 1988 to its current level of Rs 5,000 crore.

Fig 1: India Veg production & yield
Pre OGL (before 1989) and Post OGL (1990-2021)



Research
In table 1 are listed key developments that had significant impact on the market in India directly as a commercial variety/hybrid or indirectly as a source of new genetics that was used in breeding to create new varieties. This is an opinion based on my experience.

Table 1: Game changers in vegetable crops that helped shape the market significantly in India since 1971.

Crop	Variety/Hybrid	Trait	Source/Scientist	Year of release	Impact
Tomato	Pusa Ruby	Adaptability, Sour taste	ICAR IHR, Late Dr H.B. Singh	1966	National Variety, stability & taste
	Punjabi Chalkana	Medium firmness, white	PAU, Ludhiana, Dr K.S. Nandbani	1976	First eating variety in India, good transportability
	Arka Vikas (201)	Wide area adaptability, Sour taste	ICAR IHR, Dr L.K. Tiwari	1982	Most widely grown variety since 1987 in India
	M 86, M87	TLCV resistant (Tall green)	M&S, Meerut, Dr G. Rajeev	1988	First TLCV resistant fruit transfer from wild species, Source for future breeders
	BHR 2 & BHR 3	BBW resistant lines	ICAR IHR, Bangalore, Dr L.K. Tiwari	1990	First BBW (T) tolerant varieties in India, Source for future breeders
	7711 (Aakrit)	Indeterminate, Early F1 hybrid, High firmness	Florigen/Florigen (New B&D)	1993	First B&D (T) indeterminate hybrid, Still selling after 25 years of release
	Aravind 2 F1	TLCV and heat tolerant hybrid	Vygenix	1993	Created the high value summer segment in tomatoes
	Abhina F1	TLCV, Heat Tolerance & High firmness	Vygenix	2000	Became benchmark for long distance transportability and summer segment
	Arka Rakshak	TLCV, Early blight & WPM	ICAR IHR, Bangalore, Dr A. Sureshchandra	2013	Triples resistant hybrid, becoming popular in north east, Odisha & Karnataka
	Raja Sawaiji	First VPMV tolerant variety in India	ICAR IHR, New Delhi, Late Dr H.B. Singh	1972	Became top variety in India & later many other countries
	Arka Anandika	First VPMV resistant varieties in India	ICAR IHR - Dr D.P. Gupta, VPMV, Pathanur - Dr N. Janakia & Dr P. S. Venkatar	1987	First VPMV resistant lines developed using interspecific crosses, Source for later work
	Yasho (Sphar)	First VPMV resistant varieties in India	PAU, Ludhiana, Late Dr M.B. Thakur, M&S, Meerut - Dr B.S. Chatterjee	1988	Developed using PK as VPMV source
Onion	Sun 40 F1	Strong VPMV resistance & stability across locations	Florigen/Florigen (New B&D)	1993	First leading commercial hybrid strongly resistant to VPMV across country
	MH 82 F1	Strong VPMV resistance & good quality	Mahyco Seeds	1996	Better good quality & top hybrid for 2010
	Sun 252 F1	Strong VPMV resistance & good quality	Vygenix	2001	First over top share by 2010 due to better performance
	Spatika F1	Short internodes, mid quality	Advanta	2010	Being the market since 2018 & new benchmark
Cauliflower	Sun 252	Heat tolerance & stability, one female based hybrid	Vygenix	2000	A hybrid with very wide adaptability across India, Also long extended sowing window, High market share
Watermelon	Arka Manik	Profound yellow resistance, large fruited variety	ICAR IHR, Bangalore, Dr D. P. Gupta	1984	First pan India watermelon variety, led over 50% market share for a decade or so
Brinjal	Arka Kamal	High yield & good post stability	ICAR IHR, Bangalore, Dr A. Sureshchandra	1988	Replaced the major variety California Wonder which was an imported one
Cucumber	Budha F1	Green pods	Arka Seeds	2020	First commercial hybrids in vegetable segment globally, suitable for both seasons
	Harshika F1	Purple pods	Arka Seeds	2020	First commercial hybrids in vegetable segment globally, suitable for both seasons
	Harshika F1	Red green pods	Arka Seeds	2020	First commercial hybrids in vegetable segment globally, suitable for both seasons
Okra	QJM 42 F1	Round green pods	Arka Seeds	2018	First dimensional hybrids in vegetable segment globally, suitable for both seasons
	Devi F1	Both green & round	Arka Seeds	2018	First dimensional hybrids in vegetable segment globally, suitable for both seasons



Besides above a few more details on crops where I have seen major breakthroughs are listed below:

Peppers: The game changing improvements in hot peppers(chillies) have been development of traits like powdery mildew resistance from IIHR, Bangalore, Virus (CVMV & CMV) resistance as well as male sterility by both private & public sector. In sweet pepper the open field cultivation area had hybrids like Bharat (IAHS, Bangalore), Indira (Syngenta) helping farmers to replace the old op cultivar California Wonder, because of better yields and consistent shape & sizes.

Cucurbitaceous crops: In watermelons, the first breakthrough was the release of powdery mildew resistant, crimson sweet skin type variety Arka Manik from IIHR, Bangalore around 1985. After OGL, hybrids with more stability & yield and smaller sizes in Jubilee & very dark green skin colours from Namdhari, Chia Tai, Advanta, Syngenta have been adapted on a large scale. Recently Syngenta has introduced the first seedless hybrid in the market, which I believe will shape this market in next decade.

In melons, though several varieties with powdery mildew resistance were developed at PAU, Ludhiana, IIHR, Bangalore in the eighties, market has been overtaken by hybrids from private sector.

In cucumber, too, majority of the market is led by hybrids from research outside India like melons. In bitter gourd one of the major breakthroughs was the development of stable gynocious (predominantly female flowers) line by D Ram et al, 2002, Cucurbit Genetics Cooperative Report. Its inheritance was reported in 2006 by D Ram et al, 2006, J of Heridity, 97(3), 294-95. Similar work was reported also by Dr T K Behera at IARI, New Delhi later.

In a significant development recently, Ankur seeds have released the first F1 hybrids in cowpea and dolichos, Fig 2. Both are based on gms system (male sterile females). This is an excellent breakthrough as commercial hybridization in these crops wasn't possible before.

Fig 2: First F1 Hybrids Released in Cowpea and Dolichos



Product & Tech Development

Since 2005 companies have developed their own agronomic platforms to enable them to evaluate their new hybrids across locations and take informed decisions based on stability of performance. I had kick started this department at Syngenta & later at Advanta. This has been a game changer in helping companies to launch data driven products.

Seed Production

Besides improved seed production of indigenous hybrids by companies, India is now a global hub for contract hybrid seed production in several crops for export. These are based in Karnataka, Maharashtra, Gujarat & some sites in North. Many of these exports production areas are under high tech protected cultivation, which ensures high standards of purity and quality seeds free of seed borne diseases. These efforts have improved economies in hundreds of villages and generated huge employment potential of semi & skilled workers.

Sales and Marketing

Last four decades have seen development of skilled professionals in sales and marketing in India. These efforts have helped in moving from a push strategy to a pull strategy through field demos across country.

The vegetable sector has seen tremendous growth since OGL and efforts by public & private have helped boosting not only employment but also increased yields that ensured better income to our farmers. The next decade will see more resilient varieties/ hybrids against biotic and abiotic stress as also have higher nutritional quality.

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SUSTAINABLE AGRICULTURAL DEVELOPMENT

Science, Tech, Innovation



The development of more area-specific biofortified crops and organic farming through use of organic manures, supported by appropriate diagnosis by soil-testing to manage soil health are the areas of immediate future

In last few decades, India has successfully created a huge ecosystem of technology and innovation with good socio-economic impact. The historical experience of almost all economies shows that the share of the agriculture and allied sectors in total employment as well as in their national income falls with progress in economic development. However, it does not diminish the need to address various challenges confronting the sector since agriculture provides food for the very survival and sustenance of human life.

Times Of Greater Responsibility

Presently, the increasing population and adverse climatic conditions call upon a greater responsibility on agriculture sector to increase food productivity and production. The other major constraints viz. small landholdings, labour shortage, low soil fertility as well as extreme weather conditions including biotic and abiotic stress also results in less profitability to the farmers. The traditional methods adopted by the farmers are not sufficient enough to fulfil the requirements of community.

The other significance of agriculture is its role in supporting and improving rural livelihoods. The way agriculture is practised determines the maintenance of the agro-ecological balance, biodiversity, sustainable use of land, water and other natural resources, apart from ensuring social security. However, agriculture is both a victim of and contributor to climate change.

Therefore, it must adapt to the consequences of climate change (CC) and reduce its contribution to the CC through decreasing emissions of greenhouse gases. The traditional methods adopted by the farmers are not sufficient enough to fulfil the requirements of community. To overcome the same, innovation in agriculture automation is the only way and need of the hour.

Key Drivers For Economic Growth

Science, Technology and Innovation (STI) are the key drivers for economic growth and human development. For India to march ahead on a sustainable development pathway to include economic development, social inclusion and environmental sustainability for achieving an 'Atmanirbhar Bharat', a greater emphasis is being given on promoting traditional knowledge system, developing indigenous technologies and encouraging grass root innovation.

Despite numerous challenges, Indian agriculture offers considerable opportunities to contribute to achieve SDGs viz. reduce hunger and malnutrition, improve sustainability of resource use, reduce environmental footprints and economic growth, by aligning the crop production strategy with the accessibility of natural resources. Innovative efforts are needed to be applied to increase the pace the agri-food system is undergoing presently for achieving the SDGs, especially those related to land, water, environment and climate change.

The pace of these changes depends largely on technologies as well as policies related to not only the food production but should encompass the whole value chain including marketing, distribution, public and private investments and awareness and motivation of various stakeholders.

Need For Major Transformation

Considering the unprecedented challenges that agriculture is facing globally, especially in India, and the opportunities that exist, there is a need for a major transformation in conceptualizing and implementing the innovations in this sector for the next decade and further. Agriculture diversification can be one of the primary drivers of growth in rural incomes and higher public investment in agriculture and allied sectors is need of the hour for doubling farmers' income. The use of innovative technologies and ideas in practice is needed to meet the growing demand for food for increasing population.

The R&D efforts in National Agricultural Research System (NARS) have resulted in improved food grain production, fruit production, vegetable production, nutri- & coarse cereals, milk, meat & egg production, productivity and availability, farm mechanization, water use efficiency, nitrogen use efficiency while reducing post-harvest losses over past few decades through its technologies, however, it is time to develop and use impactful innovative technologies to meet the growing challenges of food availability and climate change.

Importance of Cutting Edge Technologies

Besides the development of numerous varieties/hybrids of different crops aim to improve productivity, focus need to be shifted for more improved varieties employing gene editing technologies for better productivity, disease resistance and climate resilience for all crops including horticultural crops.

Discovery of novel soil-friendly bioformulations to minimize the issues of resistance and water conservation technologies like hydrogel, drip/sprinkler irrigation or other innovations, including those for fisheries sector, use of drones or aeroponics technologies may help meet the future demand with shrinking resources.

The development of more area-specific biofortified crops and organic farming through use of organic manures, supported by appropriate diagnosis by soil-testing to manage soil health are the areas of immediate future. There seems to be great demand and applications of bio-engineering innovations in agriculture and allied fields including marine capture fisheries sector.

Development of smart farm machinery, irrigation systems, fertilizer applications, weed/pest control, drones for plant protection or crop health monitoring can play a significant role. Use of satellite imagery for many such applications to monitor and plan agricultural practices has already been applied by scientists.

In veterinary and animal sciences, the need for genomic selection tools, point-of-care user-friendly diagnostics and improved vaccines through novel platforms, assisted reproductive technologies like Ovum-Pickup In Vitro Fertilization (OPU-IVF) as well as animal feed and fodder technologies for improved availability and utilization efficiency are the need of the hour. Post-harvest, processing technologies and value addition in all fields of agriculture is still an area with great potential.

Processing and packaging technologies to support the improved preservation of produce are promising areas for innovations. Use of GIS for mapping farming activities, block chain transparencies for acceptable traceability, IoT and AI/ML for complete value chain not only for better marketing but also for traceability and forecasting both production and prices are being explored now-a-days by many start-ups in different sectors of agriculture.



Agrarian Economy

India's Global Leadership

India's agrarian economy revolves around 60% of the population. To reform and to reorient the growth, Amendment of Companies Act 2013 was introduced under Section 465 (1) of the Companies Act, 2013 with the provision for farmer producer company. This act was hybrid produced by crossing of merits of corporate working and cooperative working and named as "Farmer Producer Organization", which can be registered under Companies Act as well as Societies Act.

The SWOT analysis clearly explains that we are moving towards global leadership, and we will reach our destination if we move with the right approach and carry in the direction with all the intents and contents. We have rich biodiversity with plenty of young human resource having skilled, semi-skilled as well as unskilled. But their energy needs to be channelized by being generous and transparent in our approach and mindset to treat them as our partners in growth.

If we compare with our close competitor China, which has 11,94,73,200 hectares arable land with approximately 1.4124 billion population, India has 15,53,69,076 hectare arable land with 1.417 billion as of end 2022. This indicates that we have the strength to feed our people very well in comparison to China, because China consumes about 25 million MT grains for raising meat and about 15 million MT grains for fisheries. So, there is a defect as far as the food security is concerned.



Many vehicles are available, but most talked is FPOs and startups. The government is not leaving any stone unturned to make people happy through their wonderful and meticulously planned schemes

Indicators For Growth

Happiness Index: As per sustainable development solutions network of the UN's report, India ranks at 126th position with reference to Finland, which has been maintaining first position.

Hunger Index: The hunger life of Europe has evaluated India at 126th position, while China, Kuwait and Brazil are having less than five.

What Will Make People Happy: If I understand correctly, there are following type of satisfaction which normally an individual requires:

Professional satisfaction

Emotional satisfaction

Financial satisfaction

Social satisfaction

Need For Money: So, to make people happy, we need money. It is the prime component. If managed intelligently agriculture livelihood can play a major role, as it commands approximately 60-62% of the population.

Vehicles Of Growth

Many vehicles are available, but most talked is FPOs and startups. The present government is not leaving any stone unturned to make people happy through their wonderful and meticulously planned schemes. But why is the success rate low?

Suggested Interventions

All the scientific organizations, funded by the government departments should be monitored and made responsible and accountable to adhere to the project schedules.

SAU should be made free of the clutches of corruption and a creature called "COMPTROLLER" should be removed, as it is a big inhibitor in the system and precursor of corruption in the system.

Young scientists should be given clear mandates and monitored. The non-productive people should be given premature retirements.

KVKs, especially in the northern states, have stopped going to the fields except for the little compulsive targets to be submitted to ICAR. They are working at 10% of their efficiencies.

The appointments should be clean, transparent and procedure should be well defined.

The politicians should be kept away from appointments, as these days it is a big interest for politicians to hang around the Vice Chancellors and influence them for favours in selections and award of work.

The line department heads as well as the senior administrative officers are busy in fulfilling their appetites at the cost of development and they are depending upon their subordinate channels for the entire family management.

The schemes should be circulated for feedback from the beneficiaries and regular reviews should be done for the continuous changes and upgradation and impact assessment should be done periodically.

Outsourcing pattern at the government level should be stopped as it is good option for siphoning huge money and making departmental officers non-productive. We should trust our people and upgrade their skills and make them accountable.

Removal from job should be made transparent and effective in case of non-performance.

Govt schemes should be revised annually for their norms with reference to costing norms and technologies. To understand, the NHB's schemes and modus operandi can be studied.

All the agriculture promotion boards should be merged with Department of Agriculture and it should be centralized because as on today, they are just to facilitate the senior officers.

Technocrats with strong credentials with past track record should be involved in the functioning rather clerks in handling critical policy issues.

Private university's higher studies programs should be critically monitored.

No farmers' unions, political associations should be encouraged and strict enforcement policies should be implemented without considering them as VOTE BANKS.

The caste indicating second name should not be allowed to use if we are serious about our country. Otherwise, we will be at the mercy of nature to correct us.

We are the country to lead the world and guide the world for better life and happy living. But we need to understand and correct our own mindset rather than trying to correct others. India is a blessed country, and it is destined to lead the world.

Dr Satyen Yadav

Horticulture Produce Management Institute

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The detailed proposal for International Year of Millets along with background, nutrition, multiple uses, resilience to climate change, sustainable production systems, harvest and postharvest operations with broad objectives was developed by Dr Malhotra



Dr Suresh Kumar Malhotra
Project Director, DKMA
Former Commissioner Agriculture,
Government of India

BIG Breakthroughs in Agriculture R&D

Dr. Suresh Kumar Malhotra is a competent R&D manager with more than 33 years' experience in Research and Development in agriculture. Presently, he is working as Director, ICAR-Directorate of Knowledge Management in Agriculture, New Delhi. He has served in top leadership positions in last 10 years, as Agriculture Commissioner, Horticulture Commissioner, Assistant Director General (Horticulture) in the Ministry of Agriculture and Farmers Welfare, with responsibilities for policy planning, administration of R&D activities in Agriculture. He has performed at management & operational level with governing bodies, Center & State Governments, Agriculture Universities & partner organizations for furtherance of agriculture. Few of prominent breakthroughs made by him are depicted here.

Evolved new varieties of seed spices crops

As a researcher, spices breeder, developed first nascent varieties of India such as Anise (NRCSS Ani 1), Celery (NRCSS A Cel 1), Nigella (NRCSS AN 1), Ajowan (AA 1 and 2) and Dill (NRCSS AD1 and AD 2) were developed & identified for release. First ever, Stem gall resistant variety of coriander ACr-1 is unique and has been widely accepted and proved with high degree of resistance across the country, now it is base for cultivation in the stem gall hot spot areas. Out of 15 varieties developed by him, the other prominent Six varieties varieties with specialty characters are ACr-1 Coriander, Ajmer Fgr3 and Fgr4 (high diosgenin), dill NRCSS AD 2 (high dillapiole, drought tolerant) and ajowan variety NRCSS AA 73 (high thymol 82%), Ajmer Nigella 1 have been notified in CVRC Gazette of India notification No. 2878 dated 6.12.2016 and the

Gazette of India Notification No. 1369 dated 7.4.21 for large scale cultivation in semi-arid regions of country. The large scale adoption of these varieties have led to increased production and productivity and income of the farmers in Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh and Haryana.

Developed International CODEX standards of Okra, Brinjal, Potato & Datepalm: Provided leadership to four international projects as project leader and Chairman Shadow committee of India – FAO Codex Committee on Fresh Fruits and Vegetables (CCFFV) for developed harmonized quality standards for Okra, Brinjal, Potato, Datepalm. Dr. Malhotra, led the international electronic working group. The standards developed by him included information on minimum provisions concerning quality & maturity requirements; provisions concerning sizing and quality tolerance limits for defects; provisions concerning presentations such as uniformity and packaging; provisions concerning marking or labelling, consumer packaging, non-retail containers, food additives, contaminants and hygiene for international trade. These standards were discussed under his chairmanship at FAO-WHO 18th CCFFV (Phuket Thailand 24-28 Feb 2014) for okra, 19th CCFFV (Ixtapa, Mexico 5-9 Oct 2015) for aubergin, 20th CCFFV (Kampala, Uganda 2-6 Oct 2017) for Potato and CCFFV (Monterrey, Mexico 7-11 Oct 2019 & 25 April to 4 May 2022 virtual) for Datepalm. All standards evolved by Dr. Malhotra have been accepted and approved by the Intergovernmental body jointly established by FAO and WHO i.e. Codex Alimentarius Commission to protect the health of the consumers and ensure fair practices in the international food trade. His leadership role brought India pride.

Initiator for International Year of Millets 2023

Dr. Malhotra is the key person who took the idea of initiation of proposal for International Year of Millet when he was nominated by GOI to attend Committee on Agriculture (COAG) meeting of FAO at Rome. He got the agenda approved for consideration for discussion in COAG. The detailed proposal on background, nutrition, multiple uses, resilience to climate change, sustainable production systems, harvest and postharvest operations with broad objectives set for International Year of Millets were developed by Dr. SK Malhotra, He took the lead role in presentation of IYOM proposal at FAO COAG (4 Oct 2018) and FAO Council (3 December 2018). He succeeded in convincing the house and finally UNGA declared the year 2023 as IYOM. He has succeeded in bringing prestige to nation for taking lead role globally for observance of this year. An ICAR tableau on International Year of Millets 2023- Powerhouse of nutrients prepared in his guidance was showcased on 26th January 2023 at Kartavya Path was applauded. As a member of core committee, he is involved in discussions for planning and implementation of action plan for observance of IYOM.

Introduced Biostimulants regulatory system in the country

Dr. Malhotra introduced a new regulatory system for plant biostimulants a new category of crop inputs. As Agriculture Commissioner, he chaired the in-depth discussions after analysis of all facts, the recommendations were submitted that FCO provisions would be more appropriate to regulate biostimulants. Accordingly, gazette notification S.O. 882 (E) on 23 February was brought out to amend the Fertilizer (Control) Order, 1985. It was also established through this notification that “biostimulant” means a substance or microorganism or a combination of both whose primary function when applied to plants, seeds or rhizosphere is to stimulate physiological processes in plant and to enhance its nutrient uptake, growth, yield, nutrition efficiency, crop quality and tolerance to stress.

As per the proposed guidelines set under his guidance, biostimulants will have to be registered with FCO 1985 and should also be notified under “Schedule VI” before introducing the market. It was decided that proposal from manufacturers or importers, distributors will be evaluated by the assessment body, i.e. Central Biostimulant Committee (CBC) under the Chairmanship of Dr. Malhotra. With this landmark decision, India has proven to be a pioneer country in developing biostimulant regulation in an agile manner with well-defined criteria/definition, data requirement/guidelines, and enforcement measures. This decision has spurred the Indian biostimulant market is assessed a CAGR of 16.49% to reach a total market size of US \$180.95 million by 2023, increasing from US \$71.23 million in 2017.

Making & Launching of New National Bee and Honey Mission

The call of the Hon’ble prime Minister to double farmers’ income in a farmers gathering on 17 September, 2017 at Amreli in Gujarat to take up honey farming for bringing Sweet Revolution in the country on the lines of White and green Revolution. The recommendations of a taskforce chaired by Dr. S.K. Malhotra, then Agriculture Commissioner, launched National Beekeeping and Honey Mission (NBHM) for overall promotion and development of scientific beekeeping to achieve the goal of ‘Sweet Revolution’. This mission promotes holistic growth of beekeeping industry for income and employment generation.

Concerted efforts through this mission, increased honey production (77000 MT, 2018-19 to 1,30,000 MT, 2022-23), whereas export of honey has also increased from 43000 MTs to 60000 MTs (2021-22), taking the revenue earned through export to more than 700 crores. Now India is among the world’s top five honey producers. Madhukranti portal was developed for online registration/traceability system for source of honey launched under his guidance. He has contributed for formation of 100 FPOs, 14 NAFED Honey Corners to provide market support. Credit goes to Dr. Malhotra for establishment of Integrated Beekeeping Development Centers (IBDCs) and three Regional Honey Testing Labs (IARI, New Delhi; IIHR, Bengaluru and IIVR, Varanasi) and 28 mini labs in the different agro-ecological regions.

New initiatives as Chairman Registration Committee of CIBRC

As Chairman brought speed in according registration to new efficient safe chemistry of pesticides for use in agriculture. Conducted 54 pesticide registration committee meetings and registered 32 new molecules of fungicides, nematicides, weedicides and pesticides. During his tenure bio pesticides and biocontrol agents got the boost and more than 20 such isolates got registration. Biopesticides led the market accounting for the largest share of over 56% in last few years and likely to expand further.

Banning of pesticides

There is process of evaluation of risk of the pesticides when used in long run to human health or to the environment time to time for banning or phasing out on the basis of level of risk and feedback. Accordingly, GOI constituted a high power expert committee under the Chairmanship of Dr. S.K. Malhotra, Agriculture Commissioner in the year 2017 for evaluation of 66 pesticides. Considering the recommendation of this committee, Govt. Gazette Notification published and implemented for banning and phasing out 18 pesticides. This was a landmark decision in the endeavor of protecting health of people, animals and environment.

As Chairman CFC

As Chairperson of Central Fertilizer Committee in last 6 years under Fertilizer Control Order 1985, took several decisions which were helpful in improving operative efficiency for fertilizer industry for introduction of new customized fertilizers, renewal of existing grades, addressing the problems of fertilizer industry both at regulatory and import level and specifications. Introduced 24 new grades of site specific customized fertilizers for chilli, maize, rice, sugarcane, cotton, oil palm, FCV tobacco for Karnataka, Tamil Nadu, Maharashtra, Andhra Pradesh. It was his landmark decision as Chair where Nano urea product – first nano input of country deliberated & cleared for registration based on the facts proving biosafety.

As Chairman Central Seed Certification Board

Guided for setting the seed certification system of country. Two big policy decisions were taken under his Chairmanship and were published as Indian Minimum Seed Certification Standards- Part II. (ISBN 9788171642694) and Indian seed certification working manual (ISBN-9789354450433) for setting the common harmonized seed certification procedure for whole countries. Both decisions have been accepted GOI and implemented uniformly in all 28 states. The committee under his chairmanship analysed the impact of BG cotton on soil microorganisms in India and after thorough examination report was submitted that BG cotton does not have adverse impact on soil microorganisms.

Real time information system for agriculture

Niti Ayog constituted a sub-committee under Chairmanship of Dr. S.K. Malhotra to work out Real Time Information System for assessment of energy requirement in Agriculture (2018-19). Report submitted to NitiAyog and system is in practice to work out energy requirement such as petrol, diesel, solar for irrigation and agriculture machinery in India. Accordingly, as Chair of another committee, a Real Time Information System for assessment of production of food grains, pulses and oil seeds (2018-19) was developed.

IndGap certification standards

As Chairman of the Technical Committee of Quality Council of India, drafted common minimum standards for IndGAP and bench marking has been successful with Global gap to set a control and compliance system of certification of crop production for traceability and environmental protection. It will help in enhancement of export, reputation in the international market and removal of Technical Barriers to Trade (TBTs). His efforts led the country to have our own certification system now called as IndGap.



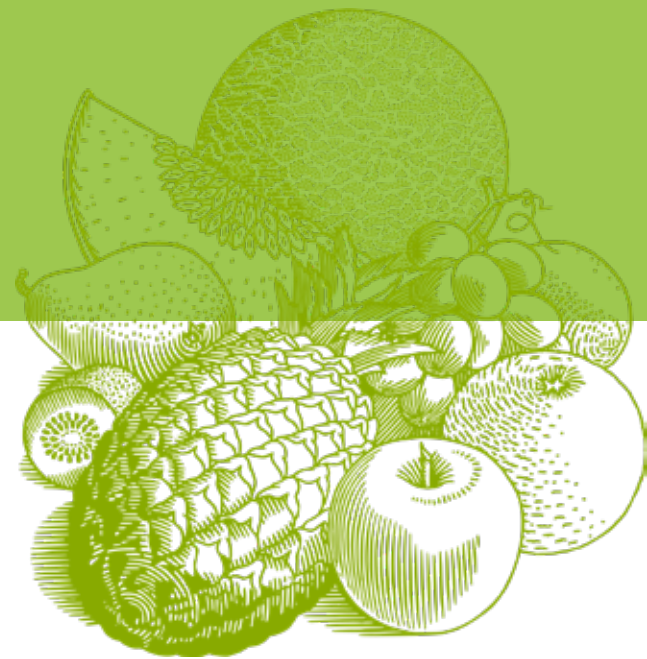
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Record production of food grains

While serving at important leadership positions, he took many new initiatives, formulated and implemented new programs, policy and regulation proved as his land mark decisions. He revamped the National Food Security Mission Program which ensures the food security of the country. He successfully implemented Mission programs (with 8 sub-missions on rice, wheat, pulses, nutri-cereals, coarse cereals, oilseeds and commercial crops), in 28 states. The weekly weather committee regularly chaired by him make the country to take necessary steps of adoption of interventions to resolve the technical issues and prepositioning of inputs such as seeds, machinery, fertilizers, pesticides, biofertilizers, biopesticides, postharvest handling, storages. Therefore, country succeeded in achieving the ever highest record food grains increased from 252 to 323 million ton in 7 years. His concerted efforts made India self-sufficient in pulses production (27 million ton). As Agriculture Commissioner he worked out roadmap for brining self-sufficiency in pulses. He established 150 seed hubs for increasing availability of quality seeds and introduced seed minikit distribution, cluster frontline demonstrations, integrated nutrient management and pest management, targeting rice fallow areas for pulses. With concerted efforts pulses production has increased from 16 million ton (2016-17) to 27 million ton (2021-22) and country has reached to almost self-sufficiency.

INDIA HORTICULTURE FUTURE FORUM 2023

A Bayer CropScience Initiative



Dr D Narain



India's horticulture export is marginal in the case of most commodities. Even today, customs tariffs protect many commodities from more competitive imports. Post-harvest losses are also very high by global standards



Mr Simon Wiebusch



Mr Rajvir Rathi

The Indian horticulture sub-sector is highly significant and contributes to about 33% of the agriculture Gross Value Added (GVA). Apart from ensuring nutritional security of the nation, it provides and facilitates alternate rural employment opportunities, diversification in farm activities, and enhanced income to farmers. India is presently producing about 334 million tonnes of horticulture produce which has surpassed the food grain production, that too from much less area (27.16 million ha. for horticulture against 127.6 M. ha. for food grains).

World Leader For Many Fruits

India has also emerged as a world leader in the production of a variety of fruits like mango, banana, guava, papaya, sapota, pomegranate, lime and spices. India is the second largest producer of fruits and vegetables globally, contributing to 11.2% share in world Horticulture production. In the last decade, horticulture production in India has been growing at a CAGR of 3.5% (2009-2018).

Nevertheless, the sector is yet to tap latent potential. India's horticulture export is marginal in the case of most commodities. Even today, customs tariffs protect many commodities from more competitive imports. Post-harvest losses are also very high by global standards.

In this setting, there is a dire need to enhance competitiveness in the sector, targeting quality and conformance related issues, as well as other constraints related to use of quality inputs, provision of quality advisory services and development of adequate post-harvest storage infrastructure etc.

Horticulture Future Forum 2023

In order to leverage this positive momentum around F&V, Bayer CropScience along with Economic Times organized a national seminar in April titled 'Horticulture Future Forum 2023' to deliberate upon the future of Indian Horticulture. Grant Thornton Bharat LLP served as Knowledge Partner for this event.

Essentially, the national seminar focused on developments

and opportunities in the Horticulture sector. The event involve presentations as well as panel discussions on successful policies and schemes, implementation models, programmes and approaches oriented towards development of the Horticulture sector. The specific themes included "Health & Nutrition, Value chain development, Ag-Tech & Export Opportunities in Horticulture"

Distinguished speakers at the event included senior officers of the government, leaders in the private sector, representatives from multi-lateral development institutions, subject matter experts, policy makers & farmers/ FPOs.

Horticulture Future Forum 2023 provided an important platform for continued dialogue/engagement for stakeholders.

Dr D Narain

"To unlock and release true potential of the Indian horticulture segment it is important to solve for the issues at scale. This is only possible by creating a collaborative ecosystem of all stakeholders across the value chain to support and leverage the Government's endeavors and initiatives. Providing real time access to integrated

solutions to the smallholders would be key to make India the fruits and vegetable capital of the world."

Mr Simon Wiebusch

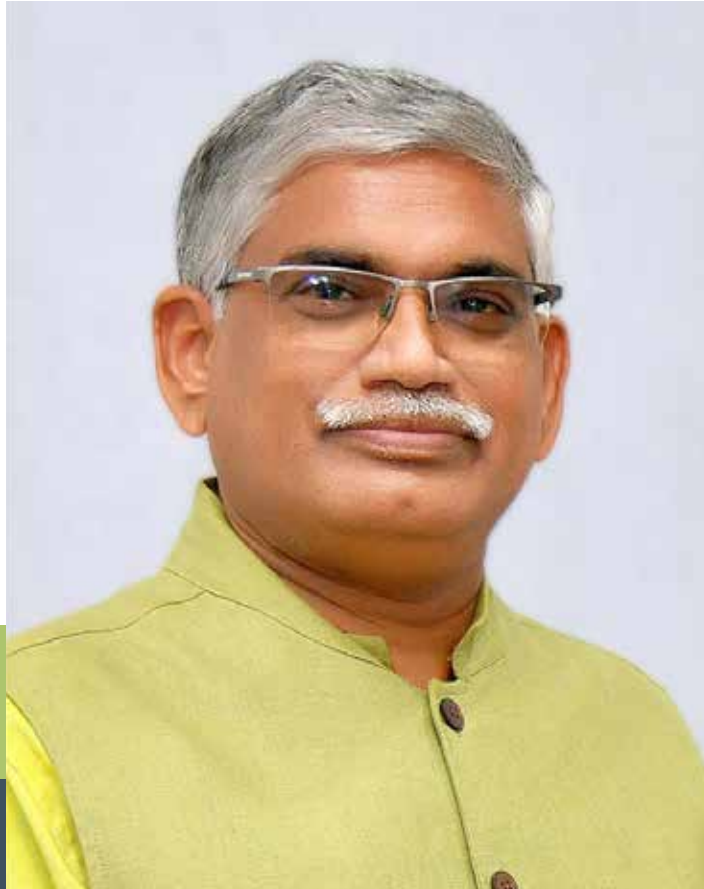
Horticulture segment's importance is multi fold. With India becoming the world's most populous country, managing the domestic nutritional need would be very crucial. The second aspect is the export potential which is a huge opportunity from a macro economic perspective for India and last but not least, the segment's development will also address the doubling farmers' income agenda that is core to a lot of Government's initiatives in the agri segment.

Mr Rajvir Rathi

A host of initiatives and programmes have been introduced by the Government to address the needs of the smallholders and the agri sector at large. But public - private partnerships across the value chain would be mission critical in ensuring that our small and marginal growers actually get access to this array of advisories and solutions to truly transform the horticulture segment.

THE PATH TO GLORY

Contribution of Agricultural Education



Dr Tolety Janakiram
Vice-chancellor
Dr YSR Horticultural University
Venkataramannagudem, West
Godavari District, Andhra
Pradesh



India's remarkable achievements in the field of agriculture have been possible because of the investment by GOI on agricultural education and research, the model which Africa is emulating

Agricultural education plays a significant role in boosting economy and speeding up the development process. It can create a landmark in achieving food security and sustainability. It is crucial to ensure food security in order to meet the demands of a rapidly increasing population density. Education does not mean just teaching, it is a way of sustainability. People who are involved in agriculture should be equipped with all the requisite skill sets to ensure maximum productivity from this sector.

Agriculture provides employment and enterprises to approximately 52% of labour. Its share to GDP is between 14 and 15%. India has achieved remarkable growth in agriculture, milk, fish, oilseeds, fruits and vegetables growing to green, white, blue and yellow revolutions. All these revolutions have brought prosperity for the farmers.

Career Scope

The budgetary allocation in the Union Budget 2023-24 for the Ministry of Agriculture and Farmers Welfare, including Agricultural Education and Research, is about Rs 1.25 lakh crore. Atma Nirbhar Clean Plant Program with an outlay of Rs 2,200 crore to be launched to boost availability of disease-free, quality planting material for high value horticultural crops.

Agriculture sector is not only about scientific research and development. It provides roles for students with business backgrounds as well. The emerging sectors include agribusiness, food processing, financial sector, retailing, rural marketing, international trade, rural credit and insurance, warehousing & commodities, NGOs and KPOs.

Almost half of all the professionals within the agricultural sector have got business related roles. The non-scientific roles include marketing, technical sales, merchandising, economists, accountants, finance managers, commodity traders, communication & education (social services).

Agriculture As Profession

1. Start-up business will help entrepreneurs and rural poor.
2. Agriculture in developing world has become vibrant with effective innovations.
3. The trend of youth choosing agriculture is growing.

Agriculture is a good way that can tackle the issue of youth unemployment, which is all over the world, as agriculture has shown its readiness to facilitate youth-preneurship.

Specific Contributions To Education

Improved crop varieties and practices: Agriculture education has led to the development of new crop varieties and better agricultural practices.

Transfer of technology: Agricultural education has facilitated the transfer of technology from research institutions to farmers.

Training and capacity building: Agriculture education has provided training and capacity building to farmers, extension workers, and other stakeholders in the agriculture sector.

Research and innovation: Agriculture education has fostered research and innovation in the agriculture sector.

Entrepreneurship and value addition: Agriculture education has encouraged entrepreneurship and value addition in the agriculture sector.

Significant Landmarks

Adoption of genetically modified crops: Since their commercial introduction in the 1990s, genetically modified (GM) crops have been widely adopted around the world.

Development of precision agriculture: Precision agriculture technologies, such as GPS, drones, and sensors, have enabled farmers to optimize inputs, reduce waste, and increase yields in horticulture.

Growth of organic farming: Organic farming has gained popularity as consumers have become more interested in healthy and sustainable food choices.

Increasing emphasis on climate-smart agriculture: As climate change has become a pressing global issue, agriculture has come under increased scrutiny for its environmental impact.

Development of vertical farming: Vertical farming, which

involves growing crops in vertically stacked layers, has emerged as a promising technology for urban agriculture.

Adoption of block chain technology in agriculture: Blockchain technology has the potential to revolutionize the agriculture sector by improving supply chain transparency, traceability, and efficiency.

Emergence of Agtech Startups: The Agriculture Technology (Agtech) industry has seen rapid growth in recent years, with a large number of startups developing innovative technologies to improve farming practices and increase yields.

Landmarks In Horticulture

Development of plant breeding techniques: Plant breeding techniques have played a significant role in the development of new crop varieties with improved traits such as disease resistance, increased yield, and better taste.

Adoption of greenhouse technology: Greenhouses allow for the year-round production of high-quality crops, regardless of the climate.

Introduction of hydroponics: Hydroponics is a soil-less method of growing crops that uses nutrient-rich water solutions.

Emphasis on sustainable farming practices: Sustainable farming practices, such as organic farming, integrated pest management, and conservation tillage, have become increasingly popular in horticulture.

Development of value-added products: Horticulture has seen the development of numerous value-added products, such as jams, jellies, and pickles.

Landmarks in Agricultural Engineering

Development of irrigation systems: Irrigation systems have played a critical role in agricultural production, particularly in arid regions.

Development of post-harvest handling technology: Post-harvest handling technology, such as cold storage and processing equipment, has played a critical role in preserving the quality and freshness of crops after harvest.

Adoption of renewable energy technology: Agricultural engineering has played a key role in the adoption of renewable energy technology, such as solar, wind, and bioenergy.

Emergence of autonomous machinery: Autonomous machinery, such as self-driving tractors, tillers, planters, harvesters and drones, has the potential to revolutionize agriculture by increasing efficiency and reducing labour costs.

India is the second largest wheat and rice producer, the largest millet producer, 4th largest oil-seeds producer, second largest cotton producer, second largest fruit and vegetable producer, and largest spices and plantation crops producer. All these achievements were possible because of the investment by the Indian government on agricultural education and research, the model which Africa is emulating.

Rejuvenating Small Grain Production



Mr Ashok Anantharaman
Chief Operations Officer
ACE



Traditional harvesting methods for millets are labor-intensive and time-consuming, limiting productivity and efficiency. The need for mechanization in millet harvesting is vital to enhance production, reduce labor costs, and improve food security

Millets are a group of small-seeded grasses that are highly nutritious, drought-tolerant, and cultivated across diverse regions worldwide. As staple food crops for millions of people, millets play a crucial role in global food security and sustainable agriculture.

Traditional harvesting methods for millets are labor-intensive and time-consuming, limiting productivity and efficiency. The need for mechanization in millet harvesting is vital to enhance production, reduce labor costs, and improve food security.

Hand Harvesting

Hand harvesting is the most common traditional method for millet harvesting, involving cutting the panicles with a sickle, followed by manual threshing and winnowing. This labor-intensive process is time-consuming, leading to low productivity and high labor costs.

Animal-driven methods, such as bullock carts or donkeys, are also used for transporting harvested millets, but these methods are slow and inefficient compared to mechanized options.

Partial mechanization, such as the use of reapers, has been adopted in some regions but has not significantly improved efficiency, as threshing and cleaning still rely on manual labor.

Advances In Mechanization

To address the unique challenges of millet harvesting, researchers and manufacturers have developed specialized combine harvesters with modifications, such as smaller cutting and threshing components, to efficiently harvest millets.

Innovations in machinery design have led to the development of millet-specific threshers and cleaners, which can process millets more efficiently and with less grain loss than traditional methods.

Precision farming uses advanced technologies like GPS, IoT devices, and sensors to optimize agricultural practices by collecting and analyzing real-time data. This helps farmers make informed decisions about when and where to harvest.

IoT-enabled machinery, such as smart harvesters and drones, can monitor crop health, yield, and quality, facilitating timely and efficient millet harvesting.

Benefits Of Mechanization

- A. Increased efficiency and productivity
- B. Reduction in post-harvest losses
- C. Labor cost savings and improved working conditions
- D. Enhanced value chain and market opportunities

Further Advancement

To address the unique challenges of millet harvesting, researchers and manufacturers have developed specialized combine harvesters with modifications tailored to the specific needs of millet crops. These modifications include smaller cutting and threshing components, adjustable header heights to accommodate various millet plant heights, and gentle handling mechanisms to minimize grain loss during harvesting.

The introduction of millet-specific combine harvesters has resulted in significant improvements in the efficiency and productivity of millet farming. In addition to reducing the time required for harvesting, these machines also decrease grain losses during the threshing and winnowing processes.

Tech Integration

Precision farming techniques can be applied to determine the optimal time for harvesting based on factors such as crop maturity, moisture content, and weather conditions.

IoT-enabled machinery, such as smart harvesters and drones, can monitor crop health, yield, and quality, facilitating timely and efficient millet harvesting.

Additionally, integrating GPS technology into millet harvesting machinery enables precise mapping of fields, ensuring that the machinery operates within designated boundaries and minimizing the risk of crop damage or wasted resources. GPS technology also allows for the creation of digital records of harvested areas and yields, which can be used for crop planning, insurance purposes, and other farm management tasks.

The ongoing development of automation and robotics in agriculture has the potential to further revolutionize millet harvesting.

Maximizing Harvesting

1. One of the most significant benefits of mechanized millet harvesting is the increased efficiency and productivity it offers. Mechanized harvesting reduces the time taken for the entire process, allowing farmers to harvest larger areas in a shorter period. This increased efficiency leads to higher overall yields, enabling farmers to meet the growing demand for millets and contribute to global food security.

2. Post-harvest losses are a significant issue in the agricultural sector, particularly for small grain crops like millets. By using mechanized systems, farmers can significantly reduce grain loss during the harvesting, threshing, and cleaning processes.

3. Mechanized millet harvesting equipment is designed to handle the delicate millet grains gently, minimizing breakage and loss. Additionally, the precise operation of these machines ensures that only mature grains are harvested, reducing the number of immature or damaged grains that would otherwise contribute to post-harvest losses. The reduction in post-harvest losses ultimately leads to higher overall yields and increased income for farmers.

4. Mechanization reduces the reliance on manual labor for millet harvesting, lowering labor costs for farmers. The reduction in labor requirements can be particularly beneficial for small-scale farmers, who often face labor shortages during peak harvesting seasons. In addition to labor cost savings, mechanization also improves working conditions for farm workers.

5. Mechanized millet production can improve the overall value chain by streamlining the harvesting process and increasing efficiency at each stage. This enhanced efficiency can lead to better quality millet grains, resulting in higher market value and better prices for farmers. The adoption of mechanized harvesting can also open up new market opportunities for millet producers.

6. The integration of GPS and IoT technologies in mechanized millet harvesting can contribute to more sustainable farming practices. Precision farming techniques help farmers optimize their use of inputs, such as water, fertilizers, and pesticides, reducing their environmental impact and promoting sustainable agriculture.

Furthermore, mechanized harvesting can also help reduce the carbon footprint of millet production. By streamlining the harvesting process and reducing labor-intensive activities, mechanization can contribute to lower greenhouse gas emissions associated with human and animal labor.

7. Women will start playing a significant role in the cultivation of millets in the coming years due to increase in mechanization.

INITIATING

The Positive Shifts



In order to give farmers a better price, improve the supply chain, reduce wastage, and establish a unified national market, it is therefore evidently necessary at this point in time to unify the markets at both the state and national levels

Mr Debabrata Sarkar
Chairman & Managing Director
MicroAlgae Solutions India

India is an agricultural powerhouse – more than 60% of the country’s population is employed in the sector, and the country is the world’s second-largest producer of food.

In recent years, there has been a growing movement of innovative farmers who are using traditional knowledge and modern technology to develop sustainable farming practices that are having a positive impact on both the environment and the economy.

Smart Farming

India has adopted technology in all spheres of life. Through technology and innovation, smart farming practises are being adopted in the agriculture sector, which could change the game in the future by significantly increasing farmers’ income.

India’s agriculture sector has progressed by leaps and bounds over the past few years. Compared to sectors such as finance, education, automobile, etc., it is only recently that agriculture has seen a technological revolution.

Indoor Vertical Farming: As global population rises, the demand for quality food naturally increases. Indoor vertical farming is one of the best ways to increase food production & expand agricultural operations. India is still in the nascent stages, but its increased adoption can facilitate sustainability and substantial production in the long run.

Precision Agriculture: It boosts profitability, crop yield, and sustainability by using an IT-based farm management system that analyses and manages the variability by conducting crop production practices at the right place and time.

Pervasive Automation: Comprises of any technology with minimal operator workload. Increasing the productivity, efficiency, reliability, and accuracy of agricultural machines, pervasive automation if implemented effectively can go a long way in reducing operational costs and risks and improving overall productivity.

Internet of Agricultural Things: It’s well known that IoT has been a game changing technology across industry verticals and agriculture is no exception. By connecting physical resources on the farm to the internet, IoT in agriculture allows remote farm monitoring, saving time and labor, enables informed decision making through data analytics, gauges quick insights based on real time data, and boosts efficiency in terms of minimizing food wastage and increasing traceability for a sustainable agriculture ecosystem.

AI, ML and Data Science: Today they are at the core of several businesses, and the agriculture industry, too, is catching up to this. AI & ML allows farmers to garner real-time data on multiple aspects such as weather, sunlight, the migratory pattern of birds and soil quality, fertilizers required etc. to improve agricultural efficiencies.

Blockchain technology: Blockchain can be utilized to consolidate data on the quality of the farm inputs, track the crop’s growth and record their harvest. Equitable deployment of such technologies can work wonders in bridging the gap at all levels of the agricultural value chain.

Satellite Imagery: The integration of geospatial data into the agriculture ecosystem brings about a host of innovative solutions across the globe, allowing the sector to function smartly and more sustainably.

Farm Mechanization

Another area where technology has made a significant impact on Indian agriculture is in the field of mechanization. With a vast population, labor has traditionally been cheap and readily available in India. However, the use of machines and automation has made farming more efficient and productive. Mechanization has also helped farmers reduce their dependence on manual labor, which has become increasingly difficult to find in some parts of the country. As a result, farmers are now able to harvest their crops more quickly and efficiently, which has increased their profits and reduced wastage.

National Agriculture Market (NAM)

The current agri-marketing system presents several challenges, including the fragmentation of the state into multiple market areas, each of which is run by a separate APMC (Agricultural Product Marketing Committee), the multiple levying of mandi fees, the requirement for multiple licences for trading in different APMCs, and licencing barriers that can be overcome by integrating agriculture markets across the nation through a platform. In order to give farmers a better price, improve the supply chain, reduce wastage, and establish a unified national market, it is therefore evidently necessary at this point in time to unify the markets at both the state and national levels.

Indian electronic trading portal known as the “National Agriculture Market” (NAM) is has great potential for boosting agricultural growth.

Agriculture Entrepreneurship

Agribusiness owners can aid and assist the government in promoting its policies and initiatives. The local agricultural entrepreneurs can be used by many large private businesses, including big basket, Reliance Mart, and start-ups like Agri 10 X and Dehaat, to access the local community for a variety of goods and services. Farmers’ incomes can be doubled in India thanks to agricultural entrepreneurs who can transform agricultural productivity in every village.

Farmer Producer Organizations (FPOs)

Many initiatives that were either motivated by history and ideology or by the future and analysis in the past changed the game in agriculture. The FPOs is currently one of these projects, driven by analysis and the future. The “FPOs” is the key idea that has been repeatedly discussed as the Central and State Governments have made policy in recent years.

FPO has the potential to change everything, transform smallholders’ livelihoods, end the cycle of poverty, and promote economic prosperity.

Solar Power

If used wisely, solar energy is one of the most adaptable sources of power and has limitless potential. Solar energy has the potential to revolutionize the agricultural industry by conserving precious water resources, lowering reliance on the grid, and even providing farmers with a new source of income.

The game changer for Indian agriculture has been a combination of these factors, which have helped to address the challenges faced by Indian farmers and bring about positive change in the sector.



There is a need to adopt new farm mechanization technologies which can act as gamechanger for modern farming and can revolutionize agriculture to the next level



Mr GS Grewal
Managing Director
KUBOTA India



Revvving up

Mechanization

When we (Kubota) entered the Indian market with Compact and Light-weight 4-Wheel drive tractors in 2008, we heard comments like – *“These tractors will not work in India”, “Indian customers want Heavy-weight, low cost, 2-Wheel drive tractors”, “Who will buy these expensive 4-Wheel drive compact(small) tractors”*. At that time, the market was mainly dominated by heavy-weight, 2-Wheel drive tractors and no 4-Wheel drive tractors in the mid-HP segment. The segment of high spec compact tractors did not exist. It did seem we were doing something very different from what the industry was doing.

Again in case of Rice Transplanters, the impression in the farming community was that they are not successful, thanks to the low quality imported transplanters which had flooded the north market and did not work as per expectation. This was just before we launched Kubota rice transplanters, which were based on Japanese technology.

Our third product —Track type Harvesters — also had very limited market in south India, which also was mainly dominated by a single brand. Many farmers were facing difficulty in harvesting paddy in wetland areas using conventional tractor on top (TOT) harvesters. Despite this it was not easy for a new brand to establish and expand in this market.

Focusing On Customers

In this situation I was reminded of the quote by Catherine Devyre: *“The six most expensive words in business are: We’ve always done it that way”*. So, we took it as a challenge upon us to look beyond the conventional ways of farm mechanization and introduce these modern agricultural machineries for Indian agriculture. Instead of focusing on what the other competitors were doing, we focused on the Indian farmer’s requirement. We focused on our customers.

We found that crop protection done using hand-held sprayers or tractor mounted sprayers have their own limitations. The manual spraying activity had limited and uneven coverage which adversely affects yield. On one side the tractor mounted sprayers have limitation in entering the field due to the large size of conventional tractors.

Using the narrow and compact Kubota B-series tractors, farmers could enter the narrow rows between horticulture crops like grape and pomegranate. The compact tractors had the narrow width to enter row crops where big tractors could not enter. In sugarcane, with the advent of 4-feet row spacing, customers could use our Kubota A211N narrow tractor, which is less than 3 feet in width to do interculture operations.

Tech Boost

Soon customers could understand how new technology products could help in conducting farming activities which were quite difficult using conventional tractors. This was big boon to farmers doing row crops like Sugarcane, Cotton, pomegranate and grape vineyards. The higher PTO power despite the compact size

helped customers to use high capacity, low volume sprayers which helped increase productivity and even lead to record exports of grapes from key markets grape growing districts like Nashik.

In case of our light weight 4-wheel tractors could work without cage-wheels, which helped save the soil structure and avoid damage to the sub-soil. The lightweight tractors can do the puddling operation in one round, while it took 3-4 rounds using heavy tractor with cagewheels. This was very much appreciated by customers in coastal rice belts where conventional heavy weight tractors used to get stuck in sinking soil and such incidents even lead to fatal accidents.

The cost of manual labor is going up with rural employment guarantee schemes and increasing urbanization, which will not only impact the cost of farming, but also the timely availability of labor during the critical season requirement.

The farmers in north areas, especially Punjab were reeling under this severe labour shortage during peak rice transplanting season. It took quite a bit of effort to encourage farmers in Punjab to understand the benefit of Rice transplanters.

New Markets In Eastern States

In case of track-type harvesters, we could create new markets in eastern states, where farmers were struggling to harvest paddy in wetlands. Soon it became one of the biggest markets for Kubota harvesters (Harvesking). The lightweight of Harvesking and its easy maneuverability was much appreciated by the farmers and agricultural contractors.

We also ensured that customers could get prompt service and spare parts support, which was earlier a major issue with many imported machines. The vision is to provide “unmatched customer experience”.

Today, Kubota is the No.1 growing brand in Tractors among key players in the tractor Industry. We are consistently the No.1 brand in sales of Track-type Harvesters and Rice Transplanters for more than five years now.

Adopt New Technologies

We understood that unless we take a holistic view of mechanizing the complete farm operations, the target to be the largest producer of grains maybe difficult to achieve. India has the largest land area under rice cultivation in the world, but we are number two as far the rice production is concerned. The uniformity of farming activity cannot be assured with the use of farm labour, which leads to uneven cropping and plant growth.

This game-changing approach to being the total solution provider for activities has helped Kubota become a well-respected and trusted brand in India.

Hence, there is a need to adopt such new farm mechanization technologies like 4-wheel drive tractors, rice transplanters etc which can act as gamechanger for modern farming by reducing dependency on labor intensive activities and can revolutionize agriculture to the next level improving yield and improving the life and livelihood of the farming community.

Trade in Fruits & Vegetables

Overcoming Heterogeneity, Trust and Credit Challenges

The trade of agricultural produce presents unique challenges due to their inherent heterogeneity in terms of size, color, texture and other parameters.

This complexity is exemplified by the historical Mendel-Fisher controversy, where the renowned statistician Ronald Fisher questioned Gregor Mendel's results. Mendel conducted extensive experiments with peas and flowers, and some authors attribute the controversy to the difficulty Mendel faced in classifying the produce.

Mendel encountered challenges such as variations in stem length and color, leaf size and shape, flower position, color and size, pod shape and size, seed shape and size, and seed coat and albumen coloration. Some traits did not allow for clear separation, as the differences were subjective and difficult to define. Mendel's struggles highlight the critical nature of classification in horticultural produce.

Natural Complexities Of The Sector

In the context of trade, sorting and grading of produce are essential requirements. However, this natural complexity is further complicated by economic incentives that are intertwined with the process. Price differentials between grades can be substantial, sometimes exceeding 2x between the lowest and highest grades. Thus, the foundation of trade faces significant challenges in terms of trust and reliability.

Trust-related issues also extend to credit and price volatility concerns. Most trades involve extending a credit period, and confidence in receiving payment is a crucial criterion in deciding to transact with a party. With price volatility, buyers may reject the shipped produce under false

pretexts, such as poor quality, to avoid financial losses. The seemingly simple solution of requiring advance payment from buyers would only shift the trust issue to the sellers, who would need to deliver the promised quality, quantity, and on-time delivery.

Imbalances In The Market

The way markets have solved this is leading to issues that are visible at the macro level. One extreme case of it is when we see vegetables being dumped on the road in one part of the country when there is a good demand for it in another part of the country. With huge advances in communication, there is clear visibility of such imbalances in most cases to the traders. So, logically it would make sense to transport it to the region where it's in high demand.

The current market practices, which primarily rely on personal networks established over time, have their drawbacks. While personal networks have helped overcome some of the earlier highlighted issues and ensure market functioning, they may struggle to adapt to demand-supply mismatches and changes in production-consumption geography. Resolving disputes through ex post mechanisms such as dispute resolution and legal remedies can be expensive and challenging, given the subjective nature of produce quality and its short shelf life. Expert opinions may not be conclusive, as evident in the Mendel-Fisher controversy. Therefore, people tend to rely on ex ante evaluation, historically manifested through personal kinship networks. However, with the advent of technology and availability of data, this can be extended beyond the current restricted size.

Challenges Of Agri-Marketing

There could be many approaches that leverage data to provide cross-temporal visibility of behavior that would help in ex ante evaluation. I would like to highlight a couple of them which are popular and could help contextualize this issue. In the retail e-commerce industry, ratings and reviews are used to evaluate the quality of products and services. Similarly, in the financial sector, credit ratings are used to assess the creditworthiness of individuals and businesses. While these approaches may have their drawbacks, there is no denying that they have helped expand transactions by reducing risks. It's time we start discussing similar solutions for agricultural trade to address the complex challenges of agri-marketing.



The current market practices, which primarily rely on personal networks established over time, have their drawbacks. With the advent of technology and availability of data, this can be extended beyond the current restricted size

Mr Kartheeswaran KK
Co-founder & CEO
Ninjacart



Boosting Agriculture



Countries that can provide enough food are more stable, while those that struggle face challenges on several fronts. Therefore, investing in agriculture is essential for sustainable development and a healthier, more stable world

Mr Morup Namgail
Head Agritech
IFFCO Kisan

Agriculture is a crucial industry that has a significant impact on food security and nutrition worldwide. Countries that can provide enough food are more stable, while those that struggle face challenges on several fronts — health, economy and politics. Therefore, investing in agriculture is essential for sustainable development and a healthier, more stable world.

Agriculture is one of the major sectors in the Indian economy, currently valued at approximately US\$370 billion. According to the estimates from Ministry of Statistics & Programme Implementation (MoSPI), GVA contribution by the agriculture sector is 18.3% in 2022-23. While India's fertile land allows agriculture practice across India, overexploitation of land, shrinking farm sizes, volatile markets, and marginal incentives for producers are increasingly making it more challenging. Additionally, climate change presents a major challenge as extreme weather events and changing rainfall patterns prove to be devastating for crops leading to food shortages many a times.

Combining The AIs

To address these challenges, the government of India has introduced key policies to accelerate innovation in the sector and promote entrepreneurship and opportunities at the grassroots level. Harnessing newer technologies to drive more productivity per acre through the use of precision farming tools, machine learning to decode climate resilience could be the perfect start. The next decade belongs to 'Climate-Nutrition Smart Agriculture', where the combination of two AIs (Ancestral Intelligence and Artificial Intelligence) must complement each other to serve the dual objective of not only improving the bottom line for farmers and agribusiness but also contributing to improving the nutrition of the population.

Out of the many enthralling policies announced by the government, the 'Digital Agriculture Mission 2021–2025' holds the right ambition to support and accelerate projects based on new technologies like AI, blockchain, remote sensing, and GIS technology, and use of drones and robots. The ambitious plan to form 10,000 Farmer Producer Organizations (FPOs) if coupled with the power and might of 'Agri Infrastructure Fund (AIF)' can potentially transform them into 10,000 strong Agribusinesses, and shall further strengthen the mission of Primary Agricultural Credit Societies to deepen its reach up to grassroots.

Clear Legal Framework

Further, regulators and governments can support the development of technology by providing a clear and predictable legal framework for innovation. This can include laws and regulations that protect intellectual property rights, establish standards for



product safety and quality, and support fair competition in the marketplace. In addition, they can also play a role in supporting the adoption of new technologies by providing incentives, funding, and other forms of support. This can include grants and tax breaks for companies that are developing new technologies, as well as programs that help individuals and businesses to access and use new technologies.

The combination of government policies and technological advancements has already shown promising results in startups and agri-entrepreneurs. A decade ago, what was only possible for a corporation is now performed by individuals/startups, and social impact work performed only by governments earlier are now being increasingly performed by corporates. This transformation is leading to greater innovation, increased productivity, and more sustainable practices in the agriculture industry.

Role Of PPPs

To ensure the success of these efforts, public-private partnerships can play a vital role in driving innovation and creating sustainable solutions to the challenges facing the agriculture industry. By pooling resources and expertise, these partnerships can develop innovative technologies and practices that benefit farmers and the environment. For instance, some public-private partnerships can focus on developing climate-resilient crops that are resistant to pests and droughts, while others may focus on creating fair trade systems that ensure farmers receive fair prices for their products.

Investing in agriculture is essential for sustainable development and a healthier, more stable nation. By addressing the challenges facing farmers and promoting innovation through public-private partnerships, we can ensure that the agriculture industry is well-equipped to meet the growing demands for food while protecting the environment and improving the livelihoods of farmers.



Vital To Deliver Economic And Sustainable Values



John Deere provides products for a variety of agro-climatic conditions and crop types. The product portfolio serves individual farmers, contract farmers and entrepreneurs who are in the business of custom hiring

Mr Mukul Varshney
Director CA, PR, Media & Communications
John Deere

John Deere is the world's leading manufacturer of Agriculture & Turf equipment, products & solutions also serving the construction and forestry industry. John Deere is uniquely positioned to deliver both economic and sustainable value for the customers through advanced technology and solutions. John Deere's 25 years journey in India has witnessed a transformation in Indian Agriculture. At John Deere we are truly living our Higher Purpose – We run so life can leap forward.

John Deere was the first to introduce advanced product features such as power steering, oil immersed disk brakes, planetary reduction, force feed lubrication, high torque machines and value-add technologies such as front PTO, perma clutch, AutoTrac™, PowrReverser™ and JDLink™. John Deere continues to innovate and introduce these advanced features in India which are now becoming industry standard. The farmers' outlook is progressive, and they adapt technologies when they see value and cost benefits.

Holistic Farm Solutions

John Deere remains committed to support the food security mission of the country as well as the changing dietary requirements of the growing populations. John Deere is proud to lead India from subsistence farming to Agri-entrepreneurship by providing holistic farm solutions. Inclusion of women farmers in the farm mechanization journey have been immensely valued as their family experiences pride where women farmers skill themselves and contribute to the overall economy and wellbeing of the family.

John Deere is also leading the way to bring technologies to tractors and farm equipment that lower the overall cost of farm operations by reducing the number of operations needed in the field and efficient use of fertilizers and chemicals. These are essential for additionally meeting sustainability goals and reduced emissions – both of which help meet Deere's strategic ambitions to protect the environment. For instance, technologies such as front PTO (power takeoff) and specially designed front farm implements have helped reduce the cost of some operations by more than 25 percent while also reducing greenhouse gas emissions. This resonates well with the overall vision and mission on sustainability goals of the country, minimizing the environmental impact and climate change.

Serving Diverse Needs

John Deere provides products for a variety of agro-climatic conditions and crop types, and this has been the key to Deere's growth in India. The product portfolio serves individual farmers, contract farmers and entrepreneurs who are in the business of custom hiring. The channel partners are well positioned to serve the farmers through the product life cycle.

John Deere enjoys the recognition of being number 1 in



customer satisfaction in India. John Deere Financial services leverage digital platforms well and provides transparency, speed, and convenience which is an advantage for customers. The farming communities correlate well with John Deere as "Zindagi ka best decision" due to advanced technology, gender neutral tractor features, 5-year warranty on tractors, easy access to parts, prompt product support services, encouragement to Agri-entrepreneurs and inclusion of women in farming.

Bringing In Precision And Advanced Technologies

The current environment and priorities of the central and state governments are to bring agricultural reforms and increase farmers' income. Precision and advanced technologies in the agriculture crop value chain are critical. Industry, academia, and the government are coming together to have a far-reaching impact on productivity and farmer profitability. John Deere will continue to be a leader in these efforts and work on behalf of the farming communities.

Deere continues to advocate for policy reforms in Central and State governments for Agri-Tech, Public Private Partnership, and skilling the rural youth that shall pave way to migrate conventional agricultural practices to modernized and aspirational farm practices.

The usage of electronic and electronic components is increasing in tractors. The government has taken a note of this, and the reforms are planned as needed for a well-integrated farm ecosystem. This shall help fast forwarding the precision farm mechanization technologies.

John Deere India, a subsidiary of Deere and Company USA, has been serving the Indian farmers since 1997 and has been a significant player in manufacturing tractors, harvesters and aggregates in India and export to over 110 countries globally.

Deere & Company (www.JohnDeere.com) is a world leader in providing advanced products, technology, and services for customers whose work is revolutionizing agriculture and construction — those who cultivate, harvest, transform, enrich and build upon the land to meet the world's increasing need for food, fuel, shelter and infrastructure.

TECHNOVATION THE WAY FORWARD



Smart farming includes application of technologies and tools like sensors and automated irrigation practices. Smart farming can help to integrate digital and physical infrastructure, which will especially benefit small farmers

Mr Parikshit Mundhra
Managing Director
Willowood Chemicals Ltd.

Agriculture and allied sectors are a major contributor to Indian economy. As per the Second Advance Estimates of National Income, 2022-23 released by Ministry of Statistics & Programme Implementation (MoSPI), Government of India the share of Gross value added (GVA) of agriculture and allied sectors at current prices in total economy is 18.3% whereas growth of GVA of agriculture and allied sectors at 2011 – 12 prices is 3.3%.

As per Economic Survey 2022 – 23, the agriculture sector in India has grown at an average annual growth rate of 4.6 per cent during the last six years. Based on the industry of work, the share of workers engaged in agriculture rose marginally from 45.6 per cent in 2019-20 to 46.5 per cent in 2020-21.

Growth In Agriculture Is Attributable To Following Factors

- Good monsoon years
- Various reforms undertaken by the government to enhance agricultural productivity.
- Various policies such as soil health cards, micro irrigation fund, and other initiatives has helped the farmers optimize resource use and reduce the cultivation cost
- promotion of FPOs and national agriculture market (e-NAM) extension platform have empowered farmers, improved their resources, and allowed them to get good returns
- Agriculture infrastructure fund (AIF) has supported the creation of various agriculture infrastructures
- Kisan rail exclusively caters to the movement of perishable agriculture and horticulture commodities
- Cluster development programme (CDP) has promoted integrated and market-led development for horticulture clusters
- Support for creating a start-up ecosystem in agriculture and allied sectors has been provided to the farmers

Adoption Of Smart Farming Methods

In order to continue with the success story of agriculture, we have to embrace technology in agriculture. We have to adopt smart farming methods through technology and innovation in agriculture sector, which will prove to be game changer in future to significantly and sustainably increase the income of farmers and enhance the agriculture productivity.

Smart farming includes application of technologies and tools like sensors and automated irrigation practices. These tools can help the farmers to monitor agriculture land, temperature, soil moisture and crops from anywhere. Smart farming can help to integrate digital and physical infrastructure, which will especially benefit the small farmers.

GOI is actively promoting use of drones in agriculture which can be used to monitor crops, pest infestation, spray of crop protection chemicals etc. Indian Space Research Organisation has placed dedicate satellite to monitor weather conditions of our country and Indian Meteorological Department is issuing daily weather advisories, which help our farmers to plan their agriculture practices accordingly.

There are many players who are providing app based services to detect crop diseases and also many crop protection chemical companies are providing technology based tools to our farmers to help them to adopt Good Agriculture Practices (GAP) and to

disseminate the information on proper usage of crop protection chemicals to control insect-pests, weeds, diseases etc.

The Digital Push

GOI is implementing a Digital Agriculture Mission (DAM), which includes India Digital Ecosystem of Agriculture (IDEA), Farmers' Database, Unified Farmers Service Interface (UFSI), funding to the states on the new technology (NeGPA), revamping Mahalanobis National Crop Forecast Centre (MNCFC), Soil Health, Fertility and profile mapping. Under this mission, government is promoting digital agriculture projects using emerging technologies like Artificial Intelligence and Machine Learning (AI/ML), Internet of Things (IOT), Block chain etc.

Water Efficiency

The 'Per Drop More Crop' component of the Pradhan Mantri Krishi Sichai Yojana (PMKSY-PDMC) is promoting increase water use efficiency at the farm level using micro irrigation technologies like drip and sprinkler irrigation systems.

ICAR Initiatives

Indian Council of Agricultural Research (ICAR) is actively promoting innovation, extension and education in agriculture and has released many field crop varieties for different agricultural crops, issued crores of agri-advisories to farmers through mobiles. ICAR has developed 187 mobile apps on different farm and farmer related services.

Insurance Support

Pradhan Mantri Fasal Bima Yojana (PMFBY) is a comprehensive insurance coverage to farmers in case of crop failure, helping stabilize their incomes. The scheme is implemented through empanelled general insurance companies. It is modified or revamped on a timely basis considering the prevailing policy regime and requirement of policy intervention in crop insurance in the country.

The Scheme covers all food and oilseeds crops and annual commercial or horticultural crops for which past yield data is available and for which the requisite number of Crop Cutting Experiments (CCEs) are being conducted under the General Crop Estimation Survey (GCES). The revamped Scheme w.e.f. Kharif 2020 has many features, which include voluntary participation for all farmers, selection of insurance companies by the states for three years in a go, a two-step process of crop yield estimation, use of smart sampling technique through satellite data for crop cutting experiments, etc.

Strengthening The Cooperative Movement

GOI has come up with New National Cooperation Policy with the view to strengthen the cooperative movement in the country, deepening its reach to the grassroots, and promoting cooperative-based economic development by involving the relevant stakeholders such as experts of the cooperative sector, representatives from National/ State/ District/ Primary level cooperative societies, Secretaries (Cooperation) and Resident Commissioners from States/UTs, officers from Central Ministries/ Departments. The objective is to have a policy that unlocks the true potential of the Cooperation sector.



A SWEET SUCCESS



The sugar industry is well poised and can support Indian agriculture by turning sugar complexes into bio-energy hubs and agri-processing hubs in the times to come

Mr Roshan Tamak
Executive Director & CEO - Sugar
DCM Shriram LTD

The Indian Sugar Industry plays an important role in the development of rural India being the second largest agro-industry and second largest employer in the country after textiles.

Some of its key contributions are:

- Provides direct and indirect employment to over 5 crore sugarcane farmers and around 5 lakh workers. Employment is also generated in various ancillary activities relating to transport, trade, servicing of machinery and supply of agriculture inputs.
- This sector contributes around 2 percent to the country's Gross Domestic Product (GDP). Today Indian sugar industry's annual output is worth more than Rs 1,00,000 crores.
- Contributes around 8 percent to the total agricultural output.
- The industry has also been an important source of revenues for the Central & State governments.
- It is the second largest producer of sugar in the world and accounts for over 20% of global sugar production.
- Recently, it is also a major contributor to the country's exports. India is the world's second largest exporter of sugar after Brazil.
- Ethanol blending has crossed 10% thereby reducing fuel dependency & saving foreign exchange for India
- Generates more than 3000 MW of renewable energy

Higher Standard Of Living

Apart from these, the sugar industry also helps the rural population in the states it operates to have a higher standard of living through the following measures:

- This industry is unique in a way that the sugarcane price as declared by the Government is paid directly to the farmers bank accounts and has enabled the farmers to receive prices for their sugarcane without any intermediation.
- The industry has helped to improve the roads, irrigation systems, in rural areas.
- The industry has also been instrumental in providing support to small-scale farmers in terms of better quality seeds / inputs and agri machinery.
- The sugar industry has been instrumental in the development of food and beverage industries, as well as other industries related to the sugar industry such as the paper and packaging industry.

Sugar Complexes

The industry is transforming into sugar complexes by producing sugar, bio-electricity, bio-ethanol, bio-manure and chemicals. Emerging businesses like fuel ethanol, and structural changes in global market have provided new horizons for the Indian sugar industry. The sector today has transformational opportunities that would enable it not only to continue to service the largest domestic markets but has also emerged as a significant carbon credit and

green power producer and has the potential to support an ethanol blending programme of E10 and beyond.

Sugar Industry is located in the rural heartland of India. The sugar sector is uniquely placed and can play a pivotal role in providing impetus to the country's economy by developing as food processing hubs. It has the following inherent advantages:

Sugar complexes are located exactly at the origin of agri-produce. All sugar factories have a well-oiled extension network that can be used for educating growers for the production of other crops as well and the supply chain linkage is well established.

Sugar factories have the basic infrastructure readily available for food processing, such as power, manpower, machinery and production capabilities.

The industry produces excess green power that can be used for setting up cold chain infrastructure and warehousing facilities adjacent to the existing mills.

On the market side, the fundamental market linkages for selling processed food are available, and selling other products will be an adjacency only.

Promoting Green Energy

Sugar industry has travelled a long way from being a commodity player to being a major green energy player, and in this path has contributed substantially in the growth and prosperity of rural India. Today, the industry generates 3,000MW renewable green power and also produces 2.4 billion litres of ethanol (green fuel) and transitioning to a major bio energy contributor. Government of India has come up with SATAT scheme to promote CBG capacities.

Press-mud is one of the major by-products of sugar manufacturing process which continues to be used as manure by sugarcane growers. This helps in replenishing the carbon content back into the soil thereby increasing its productivity and quality. The initiative like SATAT for setting up of compressed biogas (CBG) plants to ensure energy security and provide manure to the farmers holds immense potential. Sugar industry has a potential of adding 1800 TPD of Bio CNG (CBG) by setting up of more than 500 plants.

R&D Push Needed

In spite of all this, sugar will still remain the main source of revenue for the sugar industry and one needs to ensure that it does remain healthy & sustainable to support other ancillary off shoots. The Government of India has been very proactive in pushing these measures and ensuring that industry is sustainable. There are a couple of areas I feel require more proactive interventions like research and development of high yielding varieties and ensuring a sustainable sugar price.

The sugar industry is well poised and can support Indian agriculture by turning sugar complexes into bio-energy hubs and agri-processing hubs in the times to come. By helping to increase income of farmers, improving rural infrastructure, and promoting the use of renewable energy sources, the sugar industry is truly becoming a game changer for India's agricultural sector.



Keep Your Tractors Running Smoothly with Engine Oils

Tractors are essential pieces of equipment for farming and related tasks. These advanced machines are required to carry out demanding tasks in extreme conditions. However, they endure a great deal of wear and tear as a result. To prevent malfunctions and ensure safety, it is crucial to properly maintain and care for your tractor regularly.

One way to improve the working and functioning of your tractor is by using tractor lubricants. Typically, a tractor uses various lubricants such as engine oil, transmission oil, vehicle lubricant, reduction oil, power steering oil, and grease. Engine oil is used to lubricate the engine, while transmission oil is used to lubricate the gearbox or transmission.

Using high-quality heavy-duty engine oil ensures that the farm vehicle operates effectively and has a long life. Transmission, brake, and hydraulic oils are also essential for farming vehicles, as they must frequently stop, start, lift, drop, push, and change gears. The hydraulics, transmission, brakes, and other parts are heavily stressed by the constant lifting, braking, and gear change. High-quality fluids guarantee that friction is kept to a minimum and that heat is transferred properly.

SAVSOL offers various tractor lubricants, including SAVSOL Tractor Special Engine Oil, SAVSOL SUPER PST 20W-40, SAVSOL SUPER TURBO 20W-40 & 15W-40, API CF4, SAVSOL Ultra HD 15W-40, API CH4 & SAVSOL HD Xtra 15W-40, API CI4 Plus. SAVSOL UTTO PLUS, SAVSOL UTTO, and SAVSOL GREASE AP-3 PLUS. These are specifically designed to meet the needs of different types of tractors and machinery.

1) SAVSOL Tractor Special Engine Oil: The Swaraj tractors were the main focus when SAVSOL Tractor Special Engine Oil was developed. This engine oil comes in three different sizes: 10, 8.5, and 1-liter packets.

2) SAVSOL SUPER PST 20W-40: This engine oil is excellent for agricultural pump sets and was created with quality base stocks and additives. It is advised to use SUPER SAVSOL 20W-40 oil in

power tillers, medium and small engines, and agricultural pump sets.

3) SAVSOL SUPER TURBO 20W-40 & 15W-40, API CF4: The premium multi-grade SAVSOL SUPER TURBO 20W-40 & 15W-40, API CF4 Grade engine oil is intended for high-performance turbocharged and normally aspirated engines, diesel gen-sets, and engines working under heavy load for tractors, farm equipment, and construction machinery.

4) SAVSOL UTTO PLUS: Specifically developed with a synergistic combination of additives and synthetic base stocks to offer the best protection for tractors and off-road vehicles under extreme load conditions and high temperatures, SAVSOL UTTO PLUS is a premium multipurpose Universal Tractor Transmission Oil (UTTO) with a high viscosity index.

5) SAVSOL UTTO: It is recommended to use SAVSOL UTTO in the transmissions, drives, and hydraulic systems of tractors, agricultural equipment, and forestry equipment. SAVSOL UTTO is a premium, high-performance Universal Tractor Transmission Oil (UTTO) designed exclusively for tractors and off-road vehicles.

6) SAVSOL GREASE AP-3 PLUS: This multipurpose, premium lithium grease is designed specifically for heavy-duty trucks as well as a variety of automotive and industrial applications.

Regular maintenance and lubrication of tractors are essential for ensuring smooth day-to-day operations. It not only prevents malfunctions and safety risks but also reduces costly maintenance and timetable delays. By using high-quality tractor lubricants and following proper maintenance procedures, farmers and technicians can ensure that their tractors run smoothly and last longer. With the range of SAVSOL Tractor lubricants, this is certainly a great choice for all farmers and technicians.

To learn more about Savsol and its range of products, please visit their official website at – www.savsol.com.



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Biostimulants & Plant Growth Regulators

Essential Inputs in Bio Agriculture

Mr S Narayanan
 Director Marketing
 Greenstar Fertilizers Limited, Chennai.

Dr B Jayanthi
 Chief Research Officer
 Agripro International Pvt Ltd, Chennai



Biologically synthesized Bio stimulants (PBs) and Plant Growth Regulators (PGR) play a vital role in ensuring enzymatic and hormonal balances in the plant system

The latest agriculture technologies provide high yielding varieties, ensure nutritional sufficiency and effectively control the pest incidences in order to further increase the global food grain production. In spite of employing these technologies, the yield levels of various crops are reaching a plateau. This is resulting a gradual enhancement in the cost of food production. The enhancement of yield gap is also a growing concern that indirectly shows the gradual reduction in the metabolic efficiency of the crops to reach biological potential in terms of growth and yield.

One of the major reasons for this reduced metabolic efficiency of the crops is due to their susceptibility to physiological stress caused by the ill effects of climate change. The various studies on the impact of climate change on agriculture reports that, instances of yield reduction, reduced nutritive value of the harvests and crop failures are becoming frequent.

Role Of Bio Stimulants, Plant Growth Regulators

Why the crops that are managed scientifically through balanced nutrition and timely protection from pests & diseases are succumbing to the ill effects of climate change?

Even though the soil is fertilized as per soil test data, crops are sprayed with latest pest control molecules; the capability of the crops in the uptake, translocation and assimilation is decided by the Enzymatic and Hormonal balances within the plant system.

These Phytohormones (growth factors) plays a major role in the activation of various metabolic pathways that results in uptake, translocation (mobility) and assimilation of nutrient elements in to economically important substances called the Yield. Instances of deficiencies of these growth factors will result in the inability of the crops to reach the biological potential in terms of growth, yield and its quality.

The ignorance of plant physiology has resulted in the indiscriminate use of synthetic agro inputs to increase the yield. These unscientific practices have resulted in the deposit of hazardous chemicals in the soil and ground water sources. As a result the soil biology is altered where in the nutrient fixing, cycling and releasing microbes have become inefficient; making the soil less Productive even when they seems fertile in a soil test laboratory.

Impact At Farm Level

Biologically synthesized Bio stimulants (PBs) and Plant Growth Regulators (PGR) play a vital role in ensuring enzymatic and hormonal balances in the plant system. The inclusion of PBs and PGR in the crop production process is one of the essential tools to reverse the current situation of yield plateauing and to reduce yield gap.

The requirement of PBs and PGR to stimulate the essential

metabolic pathways in plants is very small as they work efficiently at very low concentrations. As a result the investment per unit area of land is relatively small and the benefits are multi-fold in terms of quantity of harvest made and value of the harvest due to superior quality parameters.

Benefits of Biologically Synthesized PBs and PGR

- Improves the soil biology and promotes the development and growth of beneficial microbes.
- Improves the uptake & use efficiency of water and nutrients; thereby reducing the requirement of synthetic agro inputs.
- Stimulates natural defence mechanism on the crops to tide over pest epidemics.
- Under best agricultural practices, PBs and PGR will ensure a bumper yield with nutritious harvests.
- Bounce back quickly to normalcy from the ill effects of climate change by effective scavenging of free radicals.
- The bioactive substances like L Amino acids function as carriers of micro nutrients to bring about bio fortification of the yield.
- Imparts overall resilience to the crops to march towards A Climate Smart Agriculture Production system.

The formulations that are manufactured through biological ways through enzymatic intervention process is known to contain bio active substances which are the potent active substances in the PBs and PGRs.

The recent notification of GOI on Bio stimulants has identified Botanical extracts, including seaweed extracts, Bio –chemicals, Protein Hydrolysates & amino acids, Vitamins, Cell free Microbial products, Antioxidants, Anti-transpirants, Humic & fulvic acid and their derivations. This has opened up new opportunities for combating the impact of climate change in Indian agriculture, ensuring climate resilient farming practices.

Significant contribution of PBs and PGR for Bio Agriculture

- Regular use ensures rejuvenation of soil biology and hastens detoxification process.
- Regular use makes the soil fertile and productive enough to meet the ever increasing demand of food with superior quality of produce.
- Enhances the utilization of applied nutrients and water; thereby reduces the dose of synthetic agro chemicals to sustain and increase the yield.
- Ensures superior quality foods with bio fortification of mineral nutrients & vitamins.
- Reduces the impact on Environment with respect to greenhouse gas emissions.
- Creates a biologically active ecosystem for recycling of crop residues and carbon sequestration to enhance carbon sink.



The Indian agriculture scenario has changed completely. With the advent of new technologies farming has completely been revolutionised. Further, the policy level support has contributed to the growth and transformation of Indian agri ecosystem



Mr Shantanu Pendsey
Chief General Manager
State Bank of India

Agriculture plays a vital role in the Indian economy, contributing ~15% (Basic Prices by Economic Activity at 2011-12 prices) to the GVA and providing employment to 46% of the total workforce. The country has come a long way, from a food scarce country during the pre-Independence era to presently being one of the major food exporters in the world. India's agricultural system has always demonstrated its resilience amid adversities. This is evident from the fact that, agriculture was the only sector which generated positive performance during the Covid-19 pandemic.

Today, the Indian agriculture scenario has changed completely. Now with the advent of new technologies like AI, Machine learning, Data Analytics, Satellite Imageries, Drones, etc., farming has completely been revolutionised. Further the policy level support has always been there contributing to the growth and transformation of Indian agri ecosystem.

There are several game changers behind the growth of agriculture over these decades of which prominent ones are mentioned here:

Govt Support

Over the decades, the govt has rolled out various policy level initiatives for the growth and prosperity of the agri ecosystem like Grow More Food of 1950s, Green Revolution of 1960s, National Food Security Mission (NFSM) of 2007, Rashtriya Krishi Vikas Yojana of 2007-08, Pradhan Mantri Krishi Sinchai Yojana (PMKSY), Pradhan Mantri Fasal Bima Yojana, etc. In the recent years, various measures on credit, market reforms and food processing under the Atma Nirbhar Bharat announcements has further given thrust to the Indian Agronomy. Various interventions of the government for the development of allied sectors including animal husbandry, dairying and fisheries have helped the country in tapping the potential of allied sectors, thus enhancing the welfare of the farming community.

Diversification and Commercialisation

The agriculture sector, over these decades has witnessed major transformation in terms of diversification and commercialisation. Farmers have now started viewing agriculture as a major source of income and business. The cropping patterns have seen major shifts like inclination towards high-value commercial crops, diversification towards horticultural & plantation crops, commercialization of traditional staple crops like wheat & rice, etc. Animal Husbandry has also witnessed diversification and wide scale commercialization viz., rearing of exotic breeds, commercialization across poultries, dairies and fisheries, etc.

Evolving Technologies

Science-led innovations and technologies during the Green Revolution of 1960s has saved the country from severe food crisis. Now several farmers are adopting ICT, drones, and AI-based solutions for many farm issues. Disruptions across the digital ecosystem and increased digital literacy outreach is giving thrust to innovation in agri ecosystem.

Role of Stakeholders

Financial Institutions: Adequate and timely credit at a cheaper rate of interest is crucial for establishing a successful and sustainable farm business. Major credit policy interventions helped farmers in getting affordable credit for crop farming and capital formation. Indian banking has played an instrumental role towards enhanced food production (through short-term crop loans), building the productive capacity of farms (through term credit for capital formation) and employment generation (through loans for MSMEs, SHGs, JLGs). In this direction, Kisan Credit Card (KCC) has been one of the popular and best-selling products among the farmers.

FPOs/FPCs: More than 80% of Indian farmers possess less than two hectares of land. These small and marginal farmers have limited access to technology, inputs, credit, capital and market. Aggregation of small farmers into FPOs to achieve economies of scale has spurred farm-level efficiency. Aggregation of small and marginal farmers into FPOs/FPCs has been an important initiative.

Agritechs/Agri Start-ups: By leveraging numerous technologies like Data Analytics & Machine Learning, Data platforms for pricing info, AI, Satellite Imagery, produce traceability, Robotics & Drones, etc., Agritechs/Agri Start-ups are transforming the way agriculture is traditionally being done across all stages of the value chain from Farm to Fork viz. With the adoption of new and unique business models, these start-ups are addressing the pain points across the Agri Value Chain. As of now, our country has around 3,000 Agri Start-ups operating across various agriculture fields and allied sectors.

Marketing Interventions

Major marketing interventions like Minimum Support Prices, market support operations such as procurement, building of warehouses, godowns, establishing Electronic National Agricultural Markets (e-NAMS), procurement of goods from SHGs/Farmer Collectives by Central/State Govt. agencies, etc., have improved agricultural marketing system in the country. As on December 31, 2022, more than 1.74 crore farmers & 2.39 lakh traders have been registered on e-NAM portal. A total trade consisting of 69 million metric tonnes worth Rs 2.42 lakh crores have been recorded on e-NAM platform.

Exports: Agri Export Policy (AEP) of 2018 focuses on farmer-centric approach and envisages the promotion of agriculture exports-oriented production. AEP also encourages farmers to grow exportable crops which are in high demand in the international markets. Trends of agricultural products export have been indicating upward movement since the Green Revolution. This year Union Budget, defined as the 'First Budget of Amrit Kaal', has showcased the government's strong focus towards empowerment of farmers, women and economically weaker sections. With the objective to achieve Rs 20 lakh crore of Agriculture Credit and promote prosperity across the rural ecosystem, the govt. has announced setting up of Agriculture Accelerator Fund to encourage agriculture start-ups by young entrepreneurs in rural areas.

We are sanguine with these enablers and above key drivers the agriculture sector shall scale newer heights in the coming years.

REIMAGINING *The Future*



ITC has collaborated with NITI Aayog to strengthen farming systems in 27 aspirational districts of eight states. This will bring in the capacity building of relevant government staff to create a cohort of master trainers who will disseminate sustainable agricultural practices to farmers



India's current agricultural public policy is centered on promoting innovation, entrepreneurship, and unconventional thinking in order to achieve sustainable higher growth and economic security in the farm sector. Technology has consistently supported and improved Indian agriculture by assisting in overcoming productivity stagnation, strengthening market ties, and improving farm management.

A robust, effective, sustainable agricultural and food system is envisioned with the implementation of the advanced digital technologies. The food processing industry has the power to change agriculture and provide jobs and income for many farm-based businesses.

Exemplar In Sustainability

ITC is a leading Indian enterprise with a vibrant portfolio of businesses spanning Fast Moving Consumer Goods, Agri Business, Paperboards & Packaging, Hotels and Information Technology. An exemplar in sustainability, ITC has the unique distinction of being water positive, carbon positive and solid waste recycling positive for over a decade. Its businesses and value chains support 6 million sustainable livelihoods.

Making significant progress towards a net zero economy and creating inclusive value chains that can guarantee livelihoods for both today and tomorrow are necessary for reimagining the future today. Technology and the digital revolution together can foster inclusive and sustainable growth for the agricultural sector, and are essential for making farmers' future-ready.

To significantly aid in the creation of such a sustainable and inclusive future, ITC has sharpened its focus on these areas. Over the years, ITC's involvement in agriculture has improved farm productivity and market access while facilitating sustainable farming and the enlargement of natural resources. Almost 4 million Indian farmers now have more power as a result of these actions.

Dr Bhavna Sharma
Head, Nutrition Science Division
ITC limited

ITC's e-Choupal Ecosystem

Among the prominent ventures backed by large conglomerates in India is ITC's e-Choupal, a comprehensive digital knowledge hub for farmers, which has 6,100 installations covering over 35,000 villages and serving over 4 million farmers. Launched in 2000, today this is India's largest initiative among internet-based interventions in rural India.

The first-of-its kind initiative not only benefited the farmers doing business, through a rich repertoire of Agri-based interventions but this model also has helped to transform village communities into vibrant economic organisations by enhancing incomes and co-creating markets.

ITC-MAARS – Harnessing Digital Technology For Farmers

To bring the power of cutting-edge digital technologies and unlock the potential of India's small farmers, ITC is launching a Super App, called ITC-MAARS or Metamarket for Advanced Agriculture and Rural Services. ITC-MAARS will lend new wings to ITC's pioneering e-Choupal model and create a robust 'Phygital' eco-system (a combination of physical and digital interventions) to deliver seamless customized solutions to farmers.

This application will offer a range of agtech solutions with a highly superior level of personalization to offer in the fields of Real-time Conditions in terms of hyperlocal weather forecasts, pest predictions, crop stage, farming profiles in terms of soil health & nutrition, irrigation & mechanization, & farmers training, education & progressiveness.

Some of the Technology Interventions are as follows.

Datalake & AI /ML: Delivers Analytics fueled digital journeys

Intelligent Nudge Capability: AI empowered Next best Actions & Offers

Uber Personalisation: Behavioural Insights from data drives personalization

Pluggable, Scalable Innovation: Micro Services Architecture enabling seamless plug & play by partner enterprises Partnership With Niti Aayog

ITC has collaborated with NITI Aayog to strengthen farming systems in 27 aspirational districts of 8 states. This will bring in the capacity building of relevant government staff to create a cohort of master trainers who in turn will disseminate sustainable agricultural practices to the farmers. As a part of this partnership, over 595,000 farmers were brought onto digital training platforms by forming more than 6,200 WhatsApp groups in around 18,900 villages.

ITC's Mission Sunehra Kal

Given the vulnerabilities of the Agricultural sector from the threats of climate change, it is crucial today to develop sustainable and regenerative agricultural practices. India's agriculture is particularly sensitive to climate change due to factors including an increase in extreme weather occurrences and changing climatic characteristics.

To build climate resilience in agriculture, ITC has embarked on a large Climate Smart Agriculture initiative, which has covered over 2,50,000 lakh farmers across 8,000 villages in India. ITC has also signed a technical and knowledge partnership with the Consultative Group for International Agricultural Research (CGIAR) to improve the resilience of villages and prepare farmers to mitigate climate risks. ITC also works in agricultural catchments to conserve biodiversity as well as soil and water, as these three resources are crucial natural capitals for sustainable agriculture.

ITC's Mission Sunehra Kal

ITC's Mission Sunehra Kal has partnered with reputable institutions and thematic expert organisations (IWMI, WWF India, ACWADAM, and CII) to increase a significant efficiency in agriculture.

For many years, millets have been the unsung hero of our food system. But, they have recently demonstrated their power as sustainable crops for challenging farming settings and the continued effects of climate change. Without the assistance of humans, millet crops can tolerate a variety of locations and extreme weather conditions. They use less water and emit no carbon. They do not require the maintenance of dams, reservoirs, or canal systems that harm the environment or standing water.

ITC's Mission Millet

Millets also contribute to the health of the soil by enhancing its fertility and texture and subsequently aid in raising yields. Due to its short growing season and low fertilisation needs. Millet opens the doors for tremendous agricultural prospects. The climate resilience properties of millets continue to help promote sustainable agriculture without any demand for chemical fertilizers.

Being both a climate change resistant & a highly nutritious food crop – it is extremely versatile to be used in multiple cuisines with negligible impact on the climate and the agri- value chain. ITC, thus, has decided to support the production and consumption of traditional millets in light of these numerous nutritional and environmental advantages as well as the significance of the millet revolution. ITC's multidimensional initiatives on Millets, under its "ITC's Mission Millet" is inspired by the Company's Vision to contribute in equal measure to people, planet and profit. This vision is embedded in the Company's credo of 'Nation First: Sab Saath Badhein'.

This impactful and necessary agricultural revolution in India can prove to be a boon for the farmers and the productivity of their crops. With the concept of sustainable farming coming into action, conservation of environmental resources can be done for the use of up-coming generations. ITC, however, continues to build a sustainable and more inclusive environment by setting goals and missions to encourage farmers and make them future-ready in order to take advantage of tomorrow's emerging economic opportunities.



“Farmers are motivated to adopt millet cultivation by replacing crops like cotton that are not water-efficient. They are further encouraged to sell millets by registering under the government’s Mera Fasal Mera Byora portal

Millet Magic

Ms Debika Goswami

Senior Program Lead, S M Sehgal Foundation

To promote the cultivation of millets as resilient, affordable, and nutritious cereals globally in the public psyche, the United Nations General Assembly declared 2023 as the International Year of Millets (IYM 2023). In India, millets were already rebranded as nutri-cereals’ in pre-COVID times (2018), which was followed by emergence of a number of state millet missions in states like Odisha, Chhattisgarh, and Assam, among others, to popularise millet cultivation among farmers. GOI is spearheading the celebrations of IYM 2023 by promoting it as a “people’s movement” and attempting to establish India as the global hub for millets.

To motivate farmers to adopt sustainable practices of millet cultivation and restore the presence of millets to the plates of consumers, the Department of Agriculture and Farmers’ Welfare has planned several millet-centric activities. These include food festivals/millet melas (fairs), training of farmers, awareness campaigns and workshops, and motivating Farmer Producer Organisations (FPOs) to showcase the diversity of Indian millets, among others.

Complementing rigorous efforts of the government to popularize Indian millets nationally and globally, a host of civil society organizations have adopted the promotion of sustainable millet cultivation among farmers. The primary objective is to motivate farmers to adopt millet cultivation and generate awareness about the rising global importance of millet as a prosperous and healthy cereal. Many organizations are working closely with FPOs and various state millet missions to increase millet land acres, promote post-harvest processing enterprises, facilitate farmers to sell millets at minimum support prices (MSPs), and improve local consumption to address food and nutrition sufficiency.

Sustainable Practices Of Millet Cultivation

S M Sehgal Foundation promotes sustainable practices of pearl millet cultivation in multiple states, including Haryana, and Rajasthan. Farmers are encouraged to use recommended quantity of macro and micronutrients based on an initial soil test analysis. The balanced use of soil nutrients increases soil fertility and improves the quality and quantity of yields. Besides, farmers are motivated to adopt millet cultivation by replacing crops like cotton that are not water-efficient. They are further encouraged to sell millets by registering under the government’s Mera Fasal Mera Byora portal. Since 2020 with these efforts, more than 3,500 farmers have been motivated to start growing pearl millet on 3200 acres of farmlands approximately.

Story of Change

Before 2019, in Runera village, located 32 km away from the district headquarters of Nuh, in the state of Haryana, farmers grew water-intensive crops like cotton, paddy, and pigeon pea as primary kharif crops, using water from a neighbourhood canal. The aspirational district of Nuh, as enlisted by Niti Ayog, has semi-arid climatic conditions with an average annual rainfall of 336 mm to 440 mm and saline groundwater.

Sehgal Foundation (SF), with the support of a corporate partner, started motivating farmers in Runera, who were completely unaware of the multiple benefits of millet cultivation, to adopt sustainable agricultural practices.

As part of this initiative, millets were reintroduced to the farmers as a climate-resilient and highly nutritious alternative to crops like cotton and pigeon pea. The team conducted multiple sessions with farmers and motivated them to start cultivating pearl millet emphasising its growing global and national market demand. In the beginning, only ten farmers of Runera started pearl millet cultivation. These farmers were provided with a package of practices (PoP) for demonstrations in half acre, which included micronutrients such as zinc sulphate, boron, ferrous sulphate, potassium, and magnesium.

The seed was provided for one acre. In the remaining half an acre, the farmers followed traditional cultivation practices of unabated use of Urea and DAP. Observing the success of millet cultivation in 2019, there has been increased in the adoption of the micronutrient package of practice in three consecutive years.

In 2022, without any demonstration, millet cultivation was adopted by thirty-six farmers, which is about 20 percent of the entire farm areas in Runera.

In terms of yield difference, the half-acre demonstration plots experienced a maximum of 480, 560, and 720 kilograms in 2019, 2020, and 2021 respectively; whereas in the same half-acre control plots, the maximum yields recorded were 380, 460, and 430 kilograms respectively (Average yield increases amounted to 23%, 25% and 31% in 2019, 2020, and 2021 respectively.)

Creating New Opportunities

The once-forgotten and forbidden grain is creating new opportunities and silently changing the agriculture landscape in one of the remotely located villages of the Nuh district. The increase in adoption increased area under pearl millet cultivation and replaced cotton and pigeon pea. Longer crop cycles (8–9 months) of cotton and pigeon pea incur greater costs in labor, pesticide, and irrigation cycles. Contrarily, millets require lesser inputs with shorter crop cycle (3–4 months) and are mostly rain-fed. In addition, cotton and pigeon pea are more prone to disease and weed infestation, which negatively impacts the outputs and incurs losses for the farmers. The following table shows the cost of cultivation of each crop.

In villages like Runera, millets have the potential to offer smart solutions to address local issues of malnutrition among women and children, and the requirement of cattle feed. Rizwana, a women farmer beneficiary, reports, “Intake of millets, which increased after we started growing them in our farmlands, improved digestion and controlled diabetes levels.”

The story of Runera aligns with what the FAO Director-General QU Dongyu mentioned in the Opening Ceremony of the IYM in December 2022: “Millets can play an important role and contribute to our collective efforts to empower smallholder farmers, achieve sustainable development, eliminate hunger, adapt to climate change, promote biodiversity, and transform agrifood systems.”



MILLET REVOLUTION

India at the Forefront

“

Milletts can play a big role if effectively marketed, concentrating on their high nutritional content, minimal input and maintenance requirements, and climate-resilient nature

Mrs Sharmila Oswal

Founder

Gudmomanda Millet Evangelist

Millet has the potential to be a game changer for India due to several reasons.

Nutritional Benefits: Millet is rich in nutrients, high in protein, fiber, antioxidants, and has a low glycemic index.

Climate Resilience: Millet is a hardy crop that can grow in low rainfall and poor soil conditions, making it suitable for cultivation in regions that are prone to drought and have low productivity. This can be a boon for farmers and help in sustainable agriculture.

Sustainable Agriculture: Millet requires minimal input cost and is low maintenance, making it accessible to small farmers. It can also be used to supplement animal feed and has the potential to boost rural incomes and livelihoods.

Export Potential: India can use millet as an export crop, which has a growing market in developed countries, particularly for gluten-free food products.

Milletts can prove to be a game changer, enhancing food and nutritional security, improving the livelihood of the rural population, and reducing food imports, making India self-sufficient.

GOI Thrust On Millets

The year 2023 has been proclaimed as the International Year of Millets by the United Nations at the initiative of the Indian government. As part of it, the Center has announced a plethora of activities that will take place around the country to promote the cultivation and consumption of “nutri-cereal.” To promote and raise awareness of the advantages of millets for “the cultivator, consumer, and climate,” Indian Embassies, state governments, and Union Ministries will hold events all year long.

Ensuring Sustainable Farming Practices

As the millet movement picks up speed in India, it is important to promote and spread awareness of Indian millets to overseas markets with the support of APEDA and the Ministry of Agriculture and Farmers Welfare. This will give us a special chance to raise awareness of regenerative agricultural crops which fall under the sustainable farming practices that have the potential to improve global nutrition, food security, decent jobs, and economies while accelerating climate action, and also position India as the global hub for millets.

Despite having substantial benefits for consumers and farmers, millets are not extensively consumed, mostly because they are not well recognized. At a time when the globe is battling a pandemic, climate change, as well as a serious problem of food security, millets can play a big role if effectively marketed, concentrating on their high nutritional content, minimal input and maintenance requirements, and climate-resilient nature.



Mr Kannan M
 Chief Marketing Officer
 Dhaksha Unmanned Systems

Embracing Drone Technology



Drones can have a profound impact in agriculture sector, especially in the areas of Nutrient/CPC applications, Crop Monitoring and Survey

India is a major agrarian economy where 60% of the population are directly or indirectly dependant in this segment for livelihood. Over 200 million hectare is the gross cropped area in our country. Although India has one of the largest farmland areas for agriculture purpose, the country lags behind many developed nations in terms of mechanisation, adoption of precision farming and emerging technologies. Increasing migration to urban areas and human drudgery are causing dwindling farm labour availability in rural areas. This situation is threatening to reduce the interest of farmers in taking up some of the farming activity and thus may lead to lower food production. There is a serious need to increase food production to meet the demand of growing global population.

Among the farm activities, spraying of Nutrients and Crop Protection Chemicals (CPC) are the most important actions in ensuring timely protection of crops as well as in maximizing the yield. Since the activities of Broadcasting or Spraying of Nutrients / CPC products are carried by humans and that too, in close proximity to hazardous chemicals, it poses risk to human health. This is also an increasing deterrent for farmers to find labors for spraying activity. Besides posing health risks, conventional spraying through farm labors is also time consuming and require excessive water.

Thankfully, the drone technology can be an apt solution to the current crisis in spraying / broadcasting.

Drone, which is also known as “Unmanned Aerial Vehicle” (UAV), plays an important role in various sectors like Defence, Surveillance, Mapping, Survey, Agriculture etc. Among these, drones can have a profound impact in agriculture sector, especially in the areas of Nutrient/CPC applications, Crop Monitoring and Survey. Let us see below how drones can be a game changer in agri sector.

Nutrient and Pesticide Applications

Government of India has rolled out various initiatives and policy amendments in order to make India as a Global Drone Hub by 2030. Drone Policy-2021 has paved the way for faster drone adoption in various sectors by clearly defining the parameters for drone usage. CIB & RC has made several amendments to allow pesticide spraying by drone in agriculture farms. (Herbicide is still not allowed for spraying through Drones). Crop protection chemical manufacturing companies are actively pursuing regulatory approvals for their molecules. Fertiliser companies have already launched Nano Urea and Nano DAP which are approved by regulators. These liquid fertiliser/DAP can be applied through drone spraying. Besides being precise in application, drones also have below key advantages in spraying activities over conventional method.

Drones can perform following activities:

- Spraying of Nutrients and Pesticides
- Broadcasting granular fertilizer
- Direct Seed sowing

Crop Monitoring

Drones can help in early detection of pest and other critical growth parameters. This is possible by capturing the crop images through RGB or Multispectral cameras by flying over the designated farm. These data can help in making informed and timely decisions which can help in protecting the crop and thus increasing the yield. Scientists and industry team are working together in making various advancements using drones in the area of crop monitoring.

Kisan Drones

- Drones come with different spray tank capacity. Currently, drones are available in India with 8 litre, 10 litre, 12 litre and 16 litre capacity spray tank.
- Drones are powered either by batteries or petrol engine.
- DGCA has made “Type Certificate” as mandatory for all the drones sold for commercial purpose. The buyers of kisan drone must be cautious in choosing “Type Certified” drones only. It is illegal to use a drone without having Type Certification.
- Drones are categorized into small and medium. Both are eligible for agriculture activities.
- Few Banks and NBFCs have already created exclusive drone financing products for ease of availing loans by customers.
- To fly a drone, the person must possess Remote Pilot License which is earned through completing course from DGCA approved RPTO. Minimum qualification for doing this license course is 10th Standard.
- Drones come with autonomous, semi-autonomous and manual modes which makes flying easier for anyone with valid pilot license.
- Government of India and state governments have come out with various subsidy schemes to promote kisan drone in their respective states. These schemes are covered under SMAM, RKVY and other farmer centric initiatives.
- Rural youth and village entrepreneurs can discover kisan drones as a potential self-employment opportunity. Considering the huge spraying acreage available in the country, India needs 3-5 lac drones to meet the demand in the near future.
- A crop-specific SOP has been made by an expert committee to guide proper spraying activities. This can be used by drone spraying service providers.

Description	Manual method (Knack pack sprayer)	Drone Spraying
Time taken per acre	2-3 hours/acre	5-7 minutes / acre
Hazard Level to operator	Very High	Zero
Water consumption / acre	80-100 Liter	10- 12 Liter
Pesticide Usage	100%	80%
Coverage /day	4 acres / day	30 acres / day
Number of People required	3 to 4 persons	1-2 Persons



Mr Agnishwar Jayaprakash
 Founder and CEO
 Garuda Aerospace

Drones: Revolutionizing Indian Agriculture Ecosystem

“ With AIF, drones will be funded, and pilots will be trained and equipped with the necessary skills to excel in the industry. Garuda Aerospace’s virtual skilling and training universities aim to empower 1 lakh youth by providing them with training and skilling for becoming drone pilots by creating job opportunities

The Indian drone market in agriculture will grow at 25% CAGR and reach \$1.05 billion by 2030. With the introduction of Drone Shakti in the 2022 Union Budget, GOI has shown commitment to promote startups that can facilitate Drone Shakti and Drone as a Service.

Drones in rural areas are playing a vital role. They are helping farmers access essential supplies including fertilizers, seeds, and pesticides. Farming now is far more efficient and helps save time and money by reducing travel costs.

Challenges in the Agri drone industry

The challenges that the agri drone industry is facing are mainly as follows.

- a) Lack of appropriate transport and mobility facilities for drones across farms
- b) Lack of skills related to drone operation and handling
- c) Lack of knowledge about technology and drones

Garuda Aerospace - A Game Changer In The Agriculture Industry

Garuda Aerospace is India’s leading agritech drone startup focused on disrupting two major multi-billion dollar sectors, namely Precision Agri Tech and Industry 4.0 upgradation with a vision of increasing efficiency and reducing costs.

The Garuda Kisan Drone Yatra was inaugurated by Prime Minister Narendra Modi, and 100 drones were simultaneously launched in 100 villages across the country. These drones were equipped with 4G technology, enabling live tracking, data collection, and processing.

As 5G technology is integrated, Garuda Kisan Drones will essentially become supercomputers in the villages. This development will provide rural India with equal opportunities in terms of connectivity, bringing long-awaited progress to these regions.

Aim To Manufacture 1 lakh drones by 2024

Garuda Aerospace has a firm vision of manufacturing 1 lakh ‘Made In India’ drones by 2024. It shall be the biggest positive benefactor of the PLI scheme as the scheme incentivizes indigenous drone manufacturers. Garuda Kisan Drones are eligible for Rs.10 lakh unsecured loans from the Agri Infrastructure Fund at a 5% interest and 50-100% subsidy from GOI.

Priced at Rs.4.50 lakhs, Garuda Kisan Drone is India's most affordable advanced automated Agri Drone which has DGCA-approved Type Certification in the under 25kg small category.

Garuda Aerospace is looking forward to constantly innovating and enhancing precision technology disruption using drones which can create a New Green Revolution in India by contributing employment to several lakh Indian youth.

Innovative Agriculture Solutions

As the first company to receive an AIF Drone loan, Garuda Aerospace raised awareness in the industry, and their recent

double certification has further enhanced their credibility. With MS Dhoni as the brand ambassador and shareholder, Garuda Aerospace has successfully capitalized on the former cricket captain's rural success story via a social media advertisement. The use of Kisan drones and innovative agriculture solutions in India is generating investment opportunities, emphasizing the need for modern and effective technology in farming practices. These advancements are helping to solve problems faced by farmers, and the government's focus on doubling farmers' incomes is aiding in the industry's overall expansion and growth.

Drone Yatra’s Impact On Agriculture Sector

On 6th December 2022, the Union Minister for Youth Affairs & Sports, and Information & Broadcasting, GOI, Shri Anurag Singh Thakur inaugurated India's first-ever virtual and E-learning platform for entrepreneurs who aspire to become drone service providers. Garuda Aerospace has achieved the remarkable feat of being the first to receive DGCA approvals for Type Certification and Remote Pilot Training Organisation.

With the Agri Infrastructure Fund (AIF) scheme in place, drones will be funded, and pilots will be trained and equipped with the necessary skills to excel in the industry. Garuda Aerospace’s virtual skilling and training universities will aim to empower 1 lakh youth by providing them with training and skilling for becoming drone pilots by creating job opportunities.

The UBI-approved Kisan loan is a game-changer for the agriculture accelerator fund, as it encourages agritech startups and supports young entrepreneurs in rural areas by distributing various agrochemicals to further scale their businesses. The Garuda drones are poised to play a significant role in the development of 5G-enabled applications by collaborating with government labs, thereby creating a positive impact in the agricultural sector.

Immense Potential

In April 2023, Garuda Aerospace crossed its halfway mark and covered 1,92,309 km in various states like Gujarat, Maharashtra, Tamil Nadu, Telangana, Punjab, West Bengal, Bihar etc. Garuda Kisan drones are the most affordable in the market priced at Rs. 4.5 lacs each, and have already received booking orders for 6000 drones indicating the monumental success of the Drone Yatra.

A surge in demand is due to Garuda Kisan Drones being priced nearly 50% less than most other DGCA-approved drone manufacturers and Garuda Kisan drones are eligible for both loans at a 5-6% interest rate under AIF and 50-70% government subsidy under SMAM scheme where farmers, Rural Entrepreneurs, Custom Hiring Centers and FPOs are spending only 25-50% for each drone from their pockets. Garuda Aerospace has already signed on 357 dealerships, and a total of 6398 drones have been distributed through 292 Purchase Orders. The team has conducted the demo sessions on the ground and helped farmers incorporate the drone technology and educate them to seek a brighter future.

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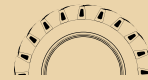
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13.6 - 28	Shakti Xtra N12
14.9 - 28	Shakti Xtra N12
16.9 - 28	Shakti Xtra N12

SHAKTI XTRA



LONGER TYRE LIFE



UNIQUE SIDEWALL DESIGN



MORE RETREADABILITY