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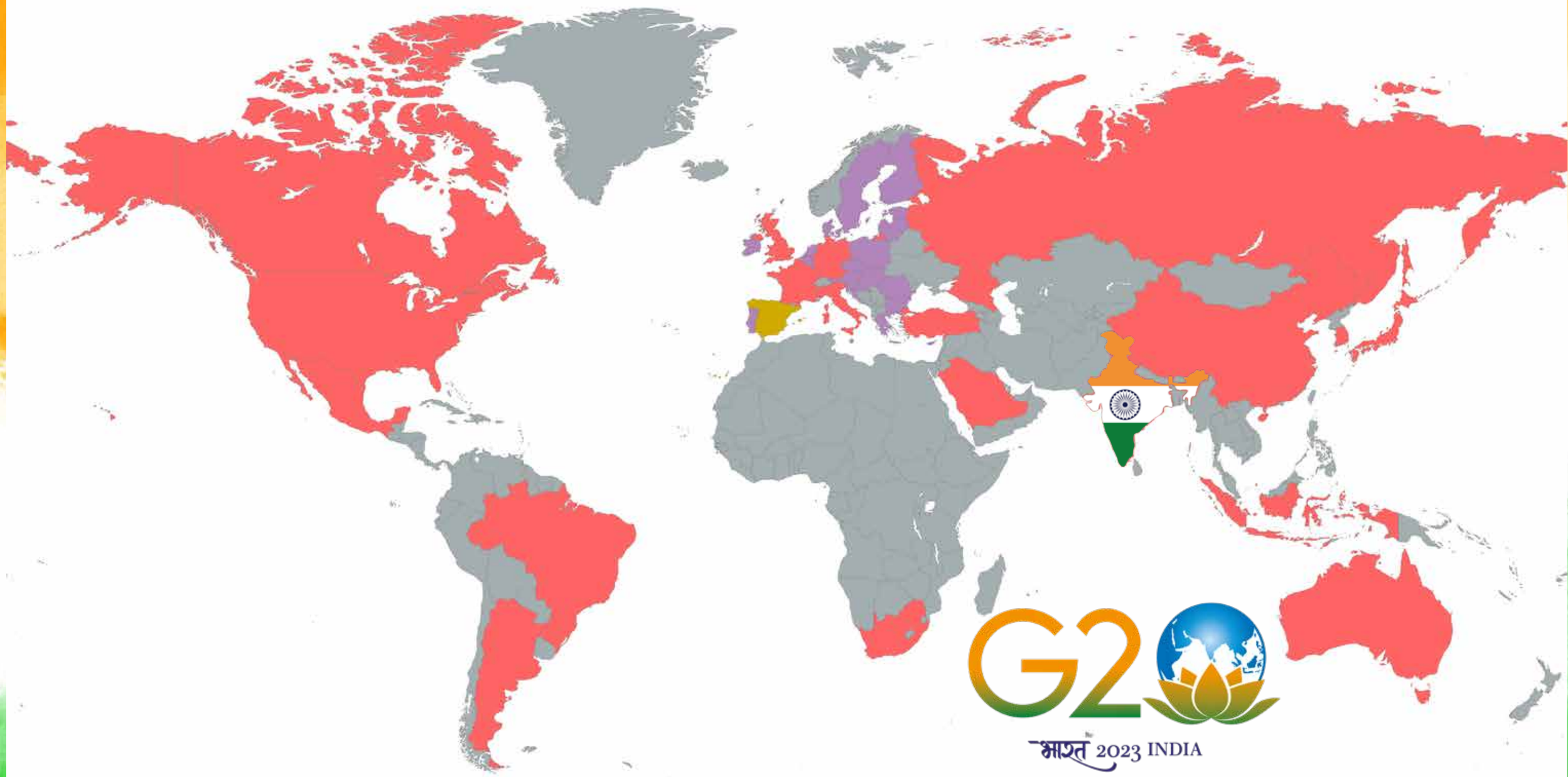
Agriculture in

G20

भारत 2023 INDIA

The Common Goals



G20

भारत 2023 INDIA

वसुधैव कुटुम्बकम्

ONE EARTH • ONE FAMILY • ONE FUTURE

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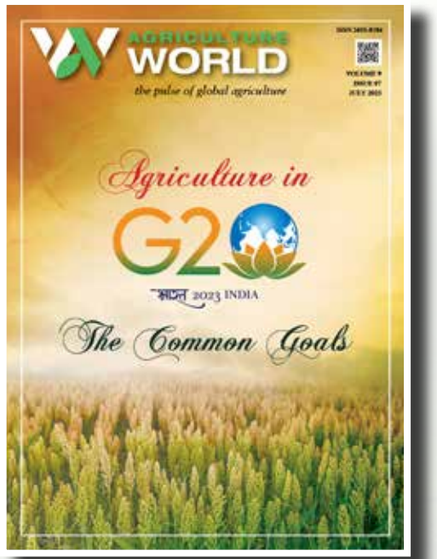

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THE VISION

Smart and Sustainable Agriculture that Serves All

India's 3S Strategy to Ensure Food Security is the Right Step Forward

Agriculture has been the backbone of Indian economy and provides direct or indirect employment to nearly 60% of the population. It also plays a significant role in reducing poverty, raising incomes and providing nutritional security. It is critical for long-term inclusive economic growth and social empowerment. Agriculture is one of the most powerful tools for achieving developmental goals and feeding a worldwide population that is expected to touch 9.7 billion by 2050.

On account of the global pandemic, war and conflict across the world, agricultural production has been hit and supply chains have been disrupted, leading to food shortages. From climate change to population growth and from water scarcity to trade barriers, food security is facing several challenges.

In these circumstances, India's suggestion for adopting the 3S strategy to address food security concern can be the way forward. The 3S strategy calls for "smart" and "sustainable" agriculture that "serves" all. From using new technologies like drone to focusing on higher yields, agriculture ecosystem must adopt and adapt to keep pace with not just the vagaries of nature, but also rising demand for food and providing them to all in a sustainable manner.

To achieve these goals, it is essential that G20 members set a roadmap that promotes sustainable agriculture, addresses food waste, makes optimum use of resources, supports smallholder farmers, encourages investment in rural development, addresses all forms of malnutrition and food price volatility and promotes international cooperation on food security.

M C Dominic
Founder & Editor-in-Chief

FROM THE MD

The Bold, Committed Voice of India's Agriculture Sector

India's agriculture sector has grown by leaps and bounds and is one of the major contributors to the economy. It is also one of the largest employers. Media has played a huge role in contributing to the success of the agricultural sector by constantly updating, publishing new findings, bringing to light new technologies, presenting facts with analysis and also setting a roadmap for the future for this sector.

In this age of selfie journalism and social media where everyone has an opinion, it is the job of a journalist to tell stories of inspiration and hope, stories of growth and development. Behind the whole clutter of politics and crime and civic issues, there lies development journalism that brings forth the unheard voices of farmers and the rural people.

We at Krishi Jagran stand with this development journalism that inspires the readers and viewers. Through our large gamut of print and digital platforms, we bring to our crores of readers and viewers the traditional wisdom of our farming sector, and also the new, emerging and path-breaking technologies. We bring to them the assessment of these technologies and the ways to adopt them to augment incomes and transform lives.

Communication is the key to success and holds a vital link in the overall growth of society. Print, electronic and digital media co-exist in disseminating information that is critical for the government, policy makers, farmers and agricultural stakeholders. Media is the catalyst to ensures that communication reaches far and wide, is accessible and effective in bringing about the positive and transformative changes in the sector.

This is what the Krishi Jagran group brings to you with honesty, integrity and total commitment. It is our constant endeavour to be the voice of the agriculture sector of our vast nation. We stand with the diverse stakeholders of the farming sector as they lead the change.

Shiny Dominic
Managing Director

EDITOR'S DESK

"India's G20 Presidency will work to promote the universal sense of one-ness. Hence our theme Vasudhaiva Kutumbakam - One Earth, One Family, One Future – Narendra Modi

As we are aware, **India's G20 Presidency** comes at a time when COVID pandemic has exposed the fragilities of global food systems under the cascading impact of climate change. Despite being the world's largest economies, food insecurity remains a significant challenge in some G20 countries. Agriculture for India has always been a priority but is now on the front burner for the entire world. India has called on G20 nations to adopt '3S' strategy - Smart, Sustainable and Serve - for the agriculture ecosystem in order to address the global food security concerns.

India's G20 Sherpa, **Amitabh Kant** reiterates the importance of 'One Health' approach that recognizes human, animal and environmental health.

In tune with the theme of G20 Summit 2023, *Vasudhaiva Kutumbakam,* Hon'ble Prime Minister, Sh Narendra Modi commended cooperation and coordination between the G20 group of most powerful countries by depoliticising the global supply of food, fertilizers and medical products, so that geo-political tensions do not lead to humanitarian crises. Creating a **roadmap for sustainable food production for the world** is one of the most important tasks before the Indian Presidency.

Aligning with India's G20 Presidency theme, the **Agriculture Working Group** (AWG) aspires to enhance cooperation among G20 nations. The summit provides the member countries with an opportunity to coordinate at the policy level to work towards achieving global economic stability and sustainable growth. Concerning agriculture, the current challenges that member nations face are food insecurity, gaps in the global value chain, crop productivity due to climate change, and employment.

India's G20 Priorities shall be Green Development, Climate Finance & LiFE; Accelerated, Inclusive & Resilient Growth; Accelerating Progress on SDGs; Technological Transformation & Digital Public Infrastructure; Multilateral Institutions for the 21st century and Women-led Development. Lifestyle for Environment (LiFE), will emphasize on environmentally sustainable and responsible choices at both the individual lifestyle and national development level with the aim of achieving a cleaner, greener, and bluer future.

Mamta Jain
Group Editor & CEO

The G20 Presidency is a matter of pride and joy for India. Vasudhaiva Kutumbakam, the theme of India's G20 chairmanship underlines the message of equitable development and a shared future for all.

Hosting over 200 meetings at more than 50 locations in the country with a participation of around 2 lakh foreign delegates, the G20 presidency will take India's global status to historical heights. Earlier, such international summits used to be held only in Delhi, Hyderabad or Bengaluru. Thanks to the vision of Hon'ble Prime Minister, Sh Narendra Modi, these meetings will showcase India's cultural and historical strength to our guests. India's traditions, values, history, specialities and diversity will reach the world.

Today, the world is facing complex challenges which are deeply interconnected and cannot be defined by borders. India is well aware of its responsibilities as G-20 Chair. Agriculture is the backbone of our country and it is the priority sector. Under the leadership of Prime Minister Narendra Modi, the yearlong deliberations of G20 under India's presidency will focus on the global challenge of climate change and its impact on the livelihood of farmers.

INTERNATIONAL COOPERATION

Fostering Mutually Beneficial Partnerships Internationally

In order to maintain the normal functioning of the global food supply chain, there is a need for close contact and cooperation between various countries for food and nutrition security

—Shri Narendra Singh Tomar, Union Agriculture and Farmers Welfare Minister, at the 8th meeting of Agriculture Ministers of Shanghai Cooperation Organization

Agriculture and allied sectors play a significant role across the world and can help reduce poverty, raise incomes, provide nutritional security and livelihoods. It can improve food security for 80% of the world's poor and is critical for long-term inclusive economic growth and social empowerment. Sustainable and inclusive agricultural development is one of the most powerful tools to achieving developmental goals and feeding a population projected to reach 9.7 billion people by 2050.

In this context, international cooperation becomes a critical component on the way to achieving Sustainable Development Goals (SDGs) and is the essence of G20's efforts to prioritize multilateralism and share solutions that promote growth and remap development plans. Prime Minister Shri Narendra Modi, on diverse platforms, has highlighted that India's G20 Presidency will work to promote the universal sense of one-ness — 'One Earth, One Family, One Future'.

Through the efforts of the public and private sectors, there has been considerable development in the agriculture sector. Growth in food grains, cereals, pulses and oilseeds have provided nutritional requirements for the increasing population. The Government of India (GOI) has been at the forefront in taking the lead in building international cooperation in order to achieve the SDGs. In consonance with the global objectives and in alignment with the G20 agenda on agriculture, there is clear emphasis on the part of GOI to strengthen resilience and sustainability of agri-food systems, support smallholder farmers and reduce food waste and loss.

Achieving Economic Stability And Sustainable Growth

India has consistently focused on agriculture and food security not only domestically, but also globally and has played a key role to coordinate among the member nations at the policy level to work towards achieving global economic stability and sustainable growth.

At the global level, agriculture is facing multiple challenges like food insecurity, gaps in the global value chain, crop productivity due to climate change, depleting water resources and crop losses, which has a cascading effect on employment. It is in this context that GOI has initiated multiple initiatives, programs and schemes that hinge upon international cooperation and offer solutions to these challenges. The aim is to tackle the interconnected challenges of climate change, biodiversity loss and environmental degradation on agriculture through the International Cooperation Division.

The efforts made by the Government of India (GOI) in the field of international cooperation align with the G20 agenda on agriculture. In consonance with the global objectives, GOI has undertaken efforts to strengthen resilience and sustainability of agri-food systems, support smallholder farmers, and reduce food waste and loss

Dr. Pramod Kumar Meherda
Additional Secretary (Farmers Welfare/ Digital Agriculture/CEO (PM.KISAN)/IC/G-20/PP), DA&FW

> The importance of international cooperation is the key to addressing the challenges as well as facilitating the journey towards achieving SDGs. As highlighted by Prime Minister Shri Narendra Modi, these endeavours align with India's G20 Presidency theme of 'One Earth, One Family, One Future'

> International cooperation becomes a critical component on the way to achieving SDGs and is the essence of G20's efforts to prioritize multilateralism and share solutions that promote growth and remap development plans

The mandate of the International Cooperation Division is to foster mutually beneficial partnerships with other countries of the world in bilateral as well as multilateral formats. Through bilateral agreements, Memoranda of Understandings (MoUs), protocols and work plans with countries of strategic interest, there is an attempt to create global, regional and national initiatives in support of food and nutritional security — 71 agreements or MoUs were signed with 66 countries. The International Cooperation Division also collaborates with the Food & Agriculture Organization (FAO) and World Food Programme (WFP) of the United Nations to address agriculture and food challenges.

Accelerating Progress Through Cooperation

The key priority of India's G20 Presidency is to accelerate progress on the SDGs through sharing ideas and creating partnerships by focusing on different aspects of progress and challenges. The G20 members have agreed upon adopting alternate grains and traditional crops to support food security and nutrition requirements. For instance, on India's initiative, 2023 is being celebrated as the International Year of Millets across the world. Under India's Presidency, the G20 members have agreed to focus on food security and nutrition, climate-smart agriculture, inclusive agriculture value chains and digitalization for agricultural transformation.

India has also collaborated with FAO for training, consultancy services, equipment and materials in the field of agriculture and allied sectors under its Technical Cooperation Programme (TCP). Some of the major projects that are under implementation in various states and across India with FAO's assistance are as follows.

It is vital to improve the capacity of national stakeholders in the spice value chains to improve the safety and quality of Indian spices. (Rajasthan, Andhra Pradesh, Madhya Pradesh, Gujarat)

Surveillance and monitoring of antimicrobials in animal health sector has been undertaken. The purpose is to strengthen the national monitoring and surveillance of antimicrobial usage in animals and share data with various stakeholders in true spirit of One Health. This is being done across India.

Assessment of SDG Indicators has been initiated to enable select states of India to implement and monitor additional SDG indicators under FAO custodianship and produce a how-to guide for other states and custodian agencies to undertake a similar innovative approach to compile and publish SDG indicators. This initiative has been undertaken across India.

Technical support is provided to farmers. The proposed TCP envisages developing forecasting/predictive techniques and tools using multiple data points and big data analytics to aid vulnerable farmers and planners to make informed decisions on crop choices, particularly in rainfed areas. The TCP proposes to train local resource persons/rural extension workers in utilizing the tool for deployment with rainfed farmers. (Assam, Himachal Pradesh, Karnataka, Maharashtra)

Enhancing Farm Livelihoods

Enhancing farm livelihoods is an important long-term objective. The purpose is to provide detailed technical guidance to the DAY-NRLM to finalize a training material on Participatory Guarantee Scheme (PGS) certification and Agri-Nutri garden as well as develop a compendium of best practices on farm livelihoods and success stories of CRPS for the use of DAY-NRLM. (Pan India)

A project has been undertaken for strengthening the capacities of the Andhra Pradesh government to develop methodology and framework for sustainable agri-food systems and build capacities of Farmer Facilitation Centres and key stakeholders in the state.

It is important for policy makers to address information barriers associated with harnessing public and private investment to scale-up priority Nationally Determined Contributions (NDC) actions and longer-term actions towards resilient and low emission agri food systems across India.

The Green-Ag initiative, where the project aims to transform Indian agriculture for global environmental benefits and the conservation of critical biodiversity and forest landscapes. It also aims to catalyze transformative change for the primary sector to support achievement of national and global environmental benefits and conserve critical biodiversity and forest landscapes. (Mizoram, Rajasthan, Uttarakhand, Odisha, Madhya Pradesh)

To design a full project proposal on Sustainable Food System and Landscape Restoration in India, a project entitled "Transforming Rice-Wheat Food Systems in India" has been implemented under GEF7 cycle. (Punjab, Haryana, Odisha, Chhattisgarh).

Improving Market Access is vital. The objective is to build the capacity of stakeholders in the spices value chain to improve the safety and quality of three seed spices (cumin, fennel and coriander) and black pepper in order to increase market access. (Rajasthan, Andhra Pradesh, Madhya Pradesh, Gujarat)

Minimising antimicrobial resistance is important to provide technical assistance to the countries in Asia to support animal health systems to minimize antimicrobial resistance. This has been initiated across India.

These initiatives have been paving the way for a sustainable, resilient, and profitable agriculture sector in India. It requires a holistic approach, involving coordination and cooperation with stakeholders at all levels in the agriculture ecosystem, to achieve the desired outcomes and to ensure the well-being of farmers, while meeting the growing food demands of the population.

The Road Ahead

Under India's Presidency, the G20 can help draft a well-defined and actionable roadmap through a policy framework to harness the potential through bilateral and multilateral cooperation. The G20 should facilitate global cooperation by engaging countries in constructive dialogue in close coordination and cooperation to address global challenges. The importance of international cooperation is the key to addressing the challenges as well as facilitating the journey towards achieving SDGs. As highlighted by Prime Minister Shri Narendra Modi, these endeavours align with India's G20 Presidency theme of 'One Earth, One Family, One Future'.

Nourishing a Hunger-Free World

G20's Multi-Pronged Approach to Food Security and Nutrition

Achieving food security and nutrition for all is an urgent global priority. Despite decades of progress, the world has witnessed a troubling reversal in recent years, with the number of undernourished people increasing significantly. The COVID-19 pandemic, cross-border conflicts, and the ongoing climate crisis have further exacerbated the hunger and malnutrition crises, necessitating a multipronged approach to address these challenges.

The G20, a group of major economies, has recognized the gravity of the situation and has committed to collective action to enhance food security and nutrition. The Agriculture Working Group aligns with India's G20 Presidency theme "One Earth, One Family, One Future", and strives to enhance global food security and nutrition, strengthen international efforts towards sustainable agri-food systems and make agricultural livelihoods inclusive, equitable and economically viable to producers.

Agri-Diversity for Food Security and Nutrition

While efforts to increase food production have been successful in reducing food insecurity, there is a need to address the availability, access, utilization, and stability of food. The over-reliance on a few high-yielding crops has resulted in crop concentration, making the global population vulnerable to food insecurity. To enhance food security, promoting agricultural diversity is crucial. The cultivation of nutrient-rich and climate-resilient crops, such as millets, can play a significant role in ensuring a more resilient and nutritious food supply. The G20 countries have unanimously welcomed the initiative proposed by India to set up Millets And OtHer Ancient GRains International ReSearcH Initiative (MAHARISHI).

G20 Maharishi Millet Initiative: A Promising Initiative For Indian Farmers

Millets, also known as "ShreeAnna", have gained significant attention in recent years due to their remarkable benefits for consumers, farmers, and the environment. These small-seeded grains, such as sorghum (Jowar), finger millet, pearl millet, and foxtail millet, pack a powerful nutritional punch. Rich in dietary fiber, protein, vitamins, and minerals, millets contribute to a well-balanced diet and promote good health.

For farmers, millets are a boon as they are resilient crops, requiring minimal water and inputs, making them suitable for dryland farming. By cultivating millets, farmers can enhance their income and reduce their dependence on high-cost agricultural practices. Additionally, millets are environmentally friendly as they have a low carbon footprint, conserve water resources, and promote soil health.

Considering the importance of Millets in providing food and nutritional security and livelihoods and their resilience to climate change effects, the year 2023 has been declared as the International Year of Millets by the UN on the proposal of India.

Adding further momentum, the G20 Agricultural Chief Scientists have endorsed to launch the Millets And OtHer Ancient GRains International ReSearcH Initiative (MAHARISHI) to promote the consumption of millets that offer nutritious diversity and are less resource-intensive, and help create a more resilient agri-food system. Millets initiative intends to foster collaboration with both public and private organizations to drive research advancements in the field of millets. The initiative would also connect researchers and institutions across the world to enhance the dissemination of research findings, and identify research gaps and needs. This provides farmers with improved access to seeds, training on sustainable farming practices, and market linkages, thereby enabling them to reap the benefits of millet cultivation and contribute to a healthier and more sustainable future.

"For farmers, millets are a boon as they are resilient crops, requiring minimal water and inputs, making them suitable for dryland farming. Millets are environmentally friendly as they have a low carbon footprint, conserve water resources, and promote soil health

Climate Smart Agriculture for Food Security and Nutrition

The pathway to food security and nutrition is not limited to one aspect but spreads across a wide range of cross-cutting issues that require increased global coordination to ensure a collective response to tackling food insecurity. As the world grapples with climate change, sustainable agriculture has become imperative to ensure long-term food security.

Climate-Smart agriculture (CSA) offers an integrated approach that helps farmers adapt to and mitigate the impacts of climate change while increasing food production. Efficient utilization of water, soil, and energy resources is essential in building resilience in food production systems.

The adoption of precision irrigation, renewable energy, and soil preservation techniques can enhance resource efficiency and climate resilience. Additionally, developing climate-resilient crop varieties that can withstand pests, diseases, droughts, and floods is crucial for helping farmers adapt to changing climatic conditions.

Government Initiatives In Tackling Climate Change

The Indian government has implemented a range of innovative initiatives to mitigate climate change and build resilience in agriculture. Broadly, these measures aim to transform farming practices, promote sustainable agriculture, and ensure food security in the face of a changing climate. GOI is promoting Climate-Resilient Farming Practices through initiatives like the National Mission for Sustainable Agriculture (NMSA). Farmers are encouraged to adopt climate-smart techniques such as conservation agriculture, organic farming, and agro-forestry.

GOI has majorly invested in agricultural R&D. For example, ICAR has developed various climate-resilient crop varieties, including drought-tolerant, heat-tolerant, and pest-resistant varieties. Government also encourages the use of renewable energy sources such as solar pumps, to reduce the carbon footprint of agriculture. These initiatives are gaining attention not only for reducing dependence on fossil fuels but also providing sustainable energy solutions to farmers, improving their productivity and income.

Additionally, initiatives such as Pradhan Mantri Fasal Bima Yojana, strengthen and support farmers by providing financial protection in case of crop losses due to extreme weather events. These initiatives set a positive precedent for other developing countries facing similar challenges. These initiatives combat the issue of climate change. They empower the farmers and build a resilient agricultural sector. However, it is important to recognize that the responsibility does not rest solely on the government's shoulders.

Farmers' Role And Responsibilities In Tackling Climate Change

Farmers are the backbone of the agricultural sector and have a major role in combating climate change. Although they are vulnerable to the adverse effects of climate change but also have the power to contribute to climate change mitigation and adaptation. Farmers across India embrace climate-smart practices and actively contribute to the collective effort of combating climate change.

Farmers can employ various practices such as conservation agriculture, efficient irrigation methods, crop rotation, and agroforestry to reduce emissions and enhance carbon sequestration. By adopting climate-resilient crop varieties and sustainable farming techniques, farmers can adapt to changing climatic conditions, conserve natural resources, and increase agricultural productivity. Through a shared commitment and collaborative approach, India can pave the way towards a sustainable and climate-resilient agricultural future.

Reducing Food Loss and Waste to Combat Climate Change and Ensure Food Security

Food loss and waste have emerged as critical global issues, not only impacting the environment but also exacerbating the challenges of climate change and food security. Approximately one-third of all food produced for human consumption is lost or wasted each year. Food loss and waste contribute to greenhouse gas emissions and environmental degradation.

Throughout the food supply chain, from production to consumption, valuable resources like water, energy, and land are expended. Addressing food loss and waste is, therefore, crucial for reducing carbon footprints and minimizing environmental impact. Beyond its environmental consequences, food loss and waste pose significant challenges to food security. With a rising global population, ensuring access to sufficient and nutritious food and providing food for all is a global concern. By minimizing food loss and waste, we can make better use of existing resources and maximize food availability.

Farmers play a key role in combating food loss and waste. By employing strategies that reduce production losses during harvest, post-harvest handling, transportation and storage can better the production process. Furthermore, embracing innovative technologies, like precision agriculture and data-driven decision-making, can also optimize resource utilization and reduce waste at the farm level. Governments support through policies like Agriculture Infrastructure Fund, incentives, and infrastructure development to facilitate proper storage, transportation, and market access.

Summary

In sum, G20 forum recognizes and acts towards the pressing need to address food insecurity and nutrition on a global scale. The G20's multi-pronged approach to food security and nutrition is a critical step towards nourishing a hunger-free world. Recognizing the urgency of the situation, the G20 has committed to collective action, aligning with India's theme of "One Earth, One Family, One Future."

By promoting agri-diversity, through initiatives like MAHARISHI, the G20 aims to enhance global food security and nutrition while creating more resilient and sustainable agri-food systems. Additionally, the focus on climate-smart agriculture and reducing food loss and waste further reinforces the G20's commitment to combating climate change and ensuring long-term food security. With the collaboration of government, farmers, and technology, we can work together to nourish a sustainable and hunger-free future for all.

Dr Smita Sirohi
Joint Secretary, G20/BRICS, SCO
Dr Sulakshana Rao
Consultant, AWG-G20 India

Sustainable Agriculture & Climate Smart Approach

Role of Millets Towards Sustainable Agriculture Globally

Ms Shubha Thakur, Joint Secretary (Crops)

Department of Agriculture & Farmers Welfare, Ministry of Agriculture & Farmers Welfare, GOI

> Millets play an important link in creating sustainable and nutrient sensitive food value chains, serving as a prominent solution for incorporating sustainable agricultural practices and achieving the three aims of climate smart agriculture – increased productivity, enhanced resilience and reduced emissions.

A renewed focus on boosting the production of millets and highlighting their benefits is critical to reducing over-reliance on more commonly grown crops, boosting diverse diets, and food security. That's especially true during periods of natural disaster when food becomes scarce, according to Dr Nancy Aburto, an agriculture expert at the Food and Agriculture Organization (FAO).

Agricultural practices and climate change are inherently interdependent on one another. As a result, unsustainable agricultural practices – including poor cropping pattern such as monoculture, excessive domestication of staple crops, excessive usage of fertiliser and intensive livestock farming – fuel environmental stress and climate change due to significant carbon emissions and degradation of soil health.

In fact, agriculture is responsible for 29% of greenhouse gas emissions, resulting in decreased crop production and quality production. In turn, agriculture is also acutely impacted by the effects of climate change, including increasing temperatures, decreasing soil fertility and poor soil health, weather variability and extreme weather conditions, and invasive pest and weed infestations, which thereby adversely impact the vulnerable food chains globally.

Due to the rising concerns of climate change and aggravating environmental stress, it is imperative to adopt sustainable agricultural practices; cropping patterns must change, natural resources must be used better, and crops that are climate resilient must be cultivated.

Millets: Cereal Crop Of The Future

In a step towards this end, millets are being explored as the cereal crop of the future through a host of efforts at the national and global levels. When compared to staple crops, millets use less resources, are drought resistant, can survive high temperatures, consume less water (needs only 350-400mm rainfall), have a lower carbon footprint (19% less than staple crops) and are resistant to pest attacks and diseases even during storage.

Further, they have shorter cropping cycles, low cost-intensive cultivation and can be incorporated into the existing crop rotations. Owing to their fibrous root structure, millets have higher water retention capacity, improve soil quality and aid in soil conservation in erosion-prone areas, thereby playing a significant role in restoring land systems.

Millets To Create Bio-Ethanol

Additionally, through an empirical study conducted with farmers in Madhya Pradesh, it was found that two types of millets - sorghum (jowar) and pearl millet (bajra) – can be used to create bio-ethanol and this millet-produced fuel could prove a significant alternate biofuel.

In addition to their climate suitability, millets provide substantial nutritional value for consumption, with huge economic and fodder benefit. Millets are, thus, highly resilient food crops and a sustainable food source for combating growing hunger, food insecurity and climate change.

Miracle Grains

Millets, the ancient food grains, are known as "Smart Food" or "Miracle Grains", due to their multifaceted benefits of being good for the climate, good for the cultivator and good for the consumer.

Millets are the cereal crops of the future in the face of rising climate uncertainties. Their benefits are being recognised globally through the United Nations General Assembly's declaration of 2023 as the 'International Year of Millets' as proposed by India and supported by 72 nations. Millets play an important link in creating sustainable and nutrient sensitive food value chains, serving as a prominent solution for incorporating sustainable agricultural practices and achieving the three aims of climate smart agriculture – increased productivity, enhanced resilience and reduced emissions.

SUB-MISSION ON AGRICULTURAL EXTENSION (SMAE)

Boosting farm productivity and improving rural livelihoods: Restructuring and Strengthening Agricultural Extension Machinery is the need of the hour

To be a farmer is to be a student forever, for each day brings something new

Agricultural extension plays a crucial role in boosting agricultural productivity, increasing food security, improving rural livelihoods and promoting agriculture as an engine of pro-poor economic growth. Extension provides a critical support service to rural producers in meeting new challenges confronting agriculture, such as transformation in the global food and agricultural system, including the rise of supermarkets and the growing importance of standards, labels, and food safety; growth in non-farm rural employment and agribusiness; constraints imposed by HIV/AIDS and other health challenges that affect rural livelihoods; and the deterioration of the natural resource base and climate change.

The Sub Mission on Agricultural Extension (SMAE) under Green Revolution–Krishonnati Yojana forms a vital part of the agricultural advisory services offered by the Government of India. It is being implemented with an objective to restructure and strengthen the agricultural extension machinery, with a judicious mix of extensive physical outreach of personnel, enhancement in quality through domain experts & regular capacity building, interactive methods of information dissemination, Public Private Partnership, pervasive & innovative use of Information & Communication Technology (ICT) / Mass Media, federation of groups and convergence of extension related efforts under various schemes and programmes of Government of India and the State Governments.

The objective of SMAE is to appropriately strengthen, expand and upscale existing Extension Schemes. The ongoing Extension Schemes include the Central Sector and Centrally Sponsored Schemes being implemented by the Extension Division/Directorate of Extension. Even in the case of Central Sector Schemes, which have been subsumed within the Mission, a greater role has been envisaged for the States through their active involvement in planning, implementation, and monitoring.

Support To State Extension Programmes For Extension Reforms Scheme

(Atma Scheme)

The Government of India's "Green Revolution – Krishonnati Yojana" is an umbrella scheme in the agriculture sector and comprises of 11 Schemes/Missions which aim to develop the agriculture and allied sector in a holistic and scientific manner in order to increase the income of farmers by enhancing production, productivity and better returns on produce.

The Government has implemented the 'Support to State Extension Programmes for Extension Reforms (ATMA)' scheme since 2005. It has now been included as a centrally sponsored component of the Sub-Mission on Agriculture Extension (SMAE) under the Krishonnati Yojana.

The Scheme promotes decentralized farmer-driven and farmer accountable extension system through an institutional arrangement for technology dissemination in the form of an

> The Kisan Call Centers Scheme was launched on 21 January 2004 to provide answer to farmers' queries on agriculture and allied sectors through toll free telephone lines. The replies to the queries of the farming community are being given in 17 local languages.

Agricultural Technology Management Agency (ATMA) at the district level. Under this Scheme grants-in-aid are released to states with the objective to support State Governments' efforts of revitalizing the extension system and making available the latest agricultural technologies in different thematic areas to increase agricultural production through extension activities, as Farmers Training, Demonstrations, Exposure Visits, Kisan Mela, Mobilization of Farmers Groups and Setting up of Farm Schools. Through these activities, latest agriculture technologies are disseminated to farmers across the country. To promote key reforms under the Scheme, ATMA Cafeteria 2018 continues to support activities in line with the following policy parameters:

Multi-Agency Extension Strategies

The ATMA scheme provides for multi-agency extension strategies. At least 10% of the allocation on recurring activities at the district level is to be used through non-governmental sector viz. NGOs, Farmers' Organization (FOs), Panchayati Raj Institutions (PRIs), para extension workers, agriculture entrepreneurs, input suppliers, corporate sector, etc. A farming system approach has been adopted. The activities specified in the cafeteria are broad enough to promote extension delivery which are consistent with the farming systems approach and extension needs emerging through Strategic Research and Extension Plan (SREP). The aim is to offer farmer-centric extension services. The cafeteria provides for group-based extension and has necessary allocation for activities related to organizing and supporting farmer groups. To supplement these efforts, a provision for rewards and incentives to the best organized farmer groups has also been provided.

The scheme also provides for mainstreaming gender concerns. It is mandated that at least 30% of resources on programmes and activities are utilized for women farmers and women extension functionaries.

Mass Media Support to Agricultural Extension

The media has a vital role to play in ensuring knowledge upgradation, suitable funding, and investment for agriculture. By creating greater awareness and sensitivity towards farm issues, the media can significantly encourage decision-makers, both at the political level and in the bureaucracy to become more actively involved in agricultural and rural innovation processes.

To ensure mass media support to agriculture extension, the 'National Public Service Broadcaster', Prasar Bharati, has been roped in to implement this Scheme. The government utilizes the countrywide infrastructure and networks of All India Radio and Doordarshan and focuses on the dissemination of latest farm practices through Radio and Television networks. Since the objective of the Scheme is to enhance and boost the Agriculture Extension system, farmers need to be informed about the latest technologies, investment, better quality inputs, real time information and all the latest know-how for sustaining commercial and cost-effective sustainable agriculture. A major shift has been witnessed in the methodology of delivering knowledge to the farmers through radio and TV. It also has the advantage of reaching a wider audience at a very low cost.

Telecast of Krishi Darshan Programmes on Doordarshan

One of the factors that determines the success of agricultural development initiatives in progressive nations is the nature and extent of use of the various mediums of mass communication and their usage in mobilizing people for development and positive change. Worldwide, it has been observed that the pace of development of agriculture is higher with the effective use of mass media.

Various developing nations across the globe have recorded higher levels of farmer awareness with knowledge dissemination through radio and television. This is especially true for a country like India where television, radio and mobile telephony usage is high, though literacy levels may be low. It is observed that through television and radio, the government is able to educate farmers about modern agricultural practices and technologies relatively faster.

With these objectives in mind, various programmes have been curated for the farming community. While a 30-minute programme is telecast five days a week through 01 National and 18 Regional Kendras of Doordarshan, 96 Rural FM Radio Stations of All India Radio are being utilized to broadcast a 30-minute programme named Kisan Vani six days a week. Apart from these three programmes – Krishi Darshan (30 minutes), Hello Kisan (60 minutes) and Choupal Charcha (30 minutes) are telecast five days a week on DD Kisan – a 24 hour dedicated channel for agriculture and farming community.

Another programme 'Kisan Ki Baat', which is on the lines of Kisan Vani, is being broadcast from AIR (Erstwhile FM Gold channel) Delhi since September 2018. Under the Kisan Vani Programme on All India Radio 96 FM/AM stations of All India Radio broadcaste 30-minute programme six days a week from 6.30-7.00 PM and each station broadcasts separate programmes in the respective dialects/languages for a wider reach.

Telecast/Broadcast of spots/ jingles advisories under 'Free Commercial Time (FCT)' on AIR and DD

With a high percentage of the Indian workforce actively engaged in agriculture, television serves as an effective medium for reach in interior areas for educating farmers about good agricultural practices and the recommended low-cost technology interventions. Through television, farmers can watch demonstrations which facilitate easy understanding of operations, technology, and the processes to be followed.

In addition to regular programmes on TV and Radio, the Free Commercial Time (FCT) available under Krishi Darshan and Kisan Vani programme is being utilized for dissemination of advisories on Rabi /Kharif season, jingles on cooperatives, spots on Kisan Call Centers, judicious use of fertilizers, safe use of pesticides, machinery and technology, farm schools, NFSM, Kisan Credit Card and Agri–Clinic and Agri-Business Centers (ACABC), package of practices available to the farmers under National Food Security Mission (NFSM), and other important flagship programmes like neem coated urea, Pradhan Mantri Krishi Sichai Yojana, Crop Insurance Scheme, National Agriculture Market, Soil Health Card, Bee Keeping, NHM, Paramparagat Krishi Vikas Yojana and Organic Farming etc, as also contingency plan developed by State Governments and emergent issues like drought and flood.

Focused Publicity & Awareness Campaign through other media platforms

The government has also initiated programs to boost the communication of agricultural information among farmers through the Focused Publicity & Awareness Campaign. An increasing rate of literacy in the country offers new promises and prospects for also utilizing print medium as a means of mass communication.

The 'Focused Publicity & Awareness Campaign', which cuts across all the Divisions of the Ministry, was launched on July 5, 2010, to create awareness about the assistance available under various Schemes of the Department of Agriculture & Farmers Welfare. This campaign is carried out in an aesthetic, professional and politically neutral manner. Video Spots and Audio spots are being broadcast/ telecast through AIR, DD, Lok Sabha TV and on private TV Channels during news and entertainment programmes. In addition to this, the Ministry is also using various multimedia platforms i.e., railway panels/ stations, bus panels, exhibitions through Directorate of Field Publicity, web based digital platforms, hoardings etc. for media campaign on the above flagship programmes.

Technical Support to DD Kisan Channel

The recently launched DD Kisan channel, a 24-hour agriculture-based television channel is catering to the requirements of the farming community. It not only broadcasts research updates, extension advisories, market rates and weather updates but is also utilized extensively under the MMSAE for dissemination of information.

Support to Community Radio Stations (CRS)

To promote agriculture extension through mass media at the community level, the Ministry of Agriculture & Farmers Welfare is also providing support for setting up of Community Radio Stations (CRS), which would make a major contribution to agricultural extension by utilizing the reach of radio transmitter. It would also help disseminate information and knowledge which is produced locally and has relevance for a specific area in local dialects/ languages. Presently, 8 CRS are operational in KVKs and NGOs under this Scheme and broadcasting agriculture programmes.

> A country wide common eleven-digit number '1800-180-1551' has been allocated for Kisan Call Centers (KCC). The replies to the queries of the farming community are being given in 17 local languages. KCCs operate from 21 locations in the country covering all the Sates and UTs. Calls are attended from 6 am to 10 pm on all seven days of a week.

Print Media/Social Media

As has been documented globally, agricultural development can be accelerated with the effective use of mass media. With this objective in mind, awareness is also created through print advertisements in leading newspapers across the country. Besides, social media platforms such as. Facebook, Twitter, YouTube etc. are also being utilized. The national and regional newspapers are being utilized, based on their circulation figures.

Kisan Call Centers (KCC)

The government is keenly aware that technical information needs to be provided to the farmers at the right time and in the right way to increase productivity. To ensure correct and timely dissemination of information to farmers, the Kisan Call Centers (KCC) Scheme was launched on 21 January 2004 to provide answers to farmers' queries on agriculture and allied sectors through toll free telephone lines.

A country wide common eleven-digit number '1800-180-1551' has been allocated for KCC. The replies to the queries of the farming community are being given in 17 local languages. KCCs operate from 21 locations in the country, covering all the Sates and UTs. Calls are attended from 6.00 am to 10.00 pm on all seven days of a week.

Mr Faiz Ahmad Kidwai
Additional Secretary
RFS/NRM/Climate Change/Extension/
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Importance of Women-Led Start-Ups In Agriculture Sector

Mr Ashish Kumar Srivastav
Joint Secretary (RKVY, RTI, M & T O & M/ PG, PC & NRM), DA&FW
Ms Rohi Choudhary, Consultant, AWG-G20 India
Mr Nishchay Mohanty, Consultant

Being the torchbearer of societal transformation, the role of women in economical as well as technological transformation is also of utmost importance. The increased participation of women in the new start-up revolution has made it possible for women to achieve an equal status in society. One such path breaking initiative is the Innovation and Agri-Entrepreneurship Programme of RKVY, an initiative of the Ministry of Agriculture.

Rashtriya Krishi Vikas Yojana (RKVY) was launched as a flagship scheme of the Department of Agriculture & Farmers' Welfare (DA&FW) in 2007-2008 to incentivize States to draw up comprehensive agriculture development plans, with emphasis on agro climatic conditions, natural resources, and technology for ensuring more inclusive and integrated development of agriculture and allied sectors.

One major aspect of this initiative is the involvement of women entrepreneurs. Unlike the conventional trends, there are more than 25% women entrepreneurs (300 out of 1176 start-ups) who are getting support through the RKVY initiative. Women-led start-ups have shown to increase productivity and efficiency focusing on providing affordable solutions, empowering rural women through entrepreneurship and training.

Development Of Innovative Approaches

Women's creativity, resourcefulness and problem-solving abilities often lead to the development of innovative approaches and practices which improve productivity and resource management. By promoting sustainable practices, such as organic farming and conservation agriculture, women entrepreneurs contribute to long-term environmental sustainability. Women-led start-ups also play an important role in empowering women in rural areas. By providing training and opportunities for women to develop new skills and knowledge, these start-ups enhance women's voice and participation.

They also help break down cultural and societal barriers that often-prevented women from engaging in economic activities outside the home. This empowerment has led to positive changes in gender relations, increased decision-making power, and greater self-esteem and confidence among women.

Training And Technical Assistance

Through the initiative of RKVY, more than 3000 start-ups have been provided the support for capacity building through training, and technical assistance. The initiative also provides the financial assistance of Rs. 5.00 lakhs at the idea/pre-seed stage and Rs. 25 lakhs at the seed stage as grant-in-aid. In the last four years, there has been a fund allocation of 159.26 crores among 1176 start-ups. Apart from such financial support the Government has also proposed to set up an Accelerator fund of 500 Crores over the period of five years, to support the young entrepreneurs to establish agri start-ups.

The RKVY initiative has the prime focus on supporting agriculture start-ups, considering the larger pie of engagement it has in livelihood. Agriculture remains an important sector which contributes to 18.3% of GDP of India and engages around 45% of the workforce. It also has a prominent role from the gender perspective as this sector engages close to 42% rural women workforce against the 35% women participation in urban areas.

The start-up ecosystem has revolutionized the entire sector, starting from sowing of seeds, management of crops, maintaining proper irrigation to harvesting the crop, and then connecting the produce to the market by managing the logistics, the entire process has seen the larger intervention of technology supported by the new startup ecosystem.

The technological development in the entire agriculture value chain has led to the birth of many startups in areas of farm mechanization, organic farming, precision agriculture including applications of sensor, ICT, AI, IoT & drone, post-harvest, food technology and value addition.

Essential Part Of The Primary Sector

There are many start-ups that are providing innovative solutions to transform the agriculture sector and have touched the horizon in terms of financial turnover. The involvement of these start-ups is supposed to increase the efficiency of the entire value chain by optimizing the operations.

This start-up revolution will be able to achieve the societal objective once the full participation and potential of women of our society will be realized. Women-led start-ups are an essential part of the primary sector in the country. Women entrepreneurs can come up with innovative solutions for everyday problems.

The potential for women-led start-ups is enormous, which comes with the challenges faced by women in agriculture, such as limited access to land and finance, lack of education and training opportunities, and inadequate market access and information.

This makes the 'Innovation and Agri-Entrepreneurship Programme' of RKVY crucial, providing supportive measures for women-led start-ups, such as access to funding, capacity building through training and market linkages.

> Women's creativity, resourcefulness and problem-solving abilities often lead to the development of innovative approaches and practices which improve productivity and resource management

Mr. Ritesh Chauhan
Joint Secretary (CEO, PMFBY/IC), DA&FW

Protecting farmers, empowering growth

Infusing Technology in PMFBY to Make Farming Profitable for Farmers

> States/UTs are now free to choose the cut-off dates for enrolments and other activities as per the cropping pattern and prevalent agro-climatic conditions in their respective states/ UTs. Further, they can also pick and choose the add-on peril to be covered under PMFBY

The agricultural sector is the backbone of India's economy, and the well-being of farmers is crucial for sustained economic growth. As farmers face advents of climate change, unpredictable weather patterns, pests, and other natural risks & perils, Pradhan Mantri Fasal Bima Yojna (PMFBY) acts as a shield against uncertainties, providing them with financial stability and peace of mind. By embracing PMFBY, farmers not only mitigate risks but also gain access to institutional agricultural credit, enhance their productivity, and foster innovation and technology for sustainable farming growth.

What are the comprehensive aspects of PMFBY, why do we need to focus on its necessity, why is the infusion of technology important, and what can be the multitude of benefits it brings to the farmers? In this article, let's unravel the transformative power of crop insurance in empowering India's farming community.

Necessity for Crop Insurance in India

The uncertainties of climate, pest and diseases can devastate farmers' livelihoods and pose a threat to national food security. PMFBY has therefore, emerged as a vital necessity in safeguarding farmers' livelihood and providing them with a safety net. By protecting against crop losses against any climatic and natural risks involving various perils, it ensures their financial stability during these challenging times and encourages risk-taking in agricultural activities. Moreover, PMFBY promotes the adoption of modern agricultural practices, thus enhancing productivity and sustainability.

Keeping in view the risks involved in agriculture and to insure the farming community against multiple risks, the Ministry of Agriculture & Farmers Welfare, Government of India introduced crop insurance in India in 1985. Several crop insurance schemes have undergone many improvements over the years based on the experience gained and views of the stakeholders, including States and farming community.

Currently, there are two insurance schemes under implementation in India - Pradhan Mantri Fasal Bima Yojana (PMFBY) and the Restructured Weather Based Crop Insurance Scheme (RWBCIS).

Considering the farmers demands, the scheme has been revamped in February 2020. Under revamped scheme, participation is made voluntary for all farmers, whereas earlier, it was compulsory for loanee farmers. The total funds released by Government of India during last 5 years under various schemes for crop insurance are as under:

Pradhan Mantri Fasal Bima Yojana (PMFBY)

Launched in 2016 as an overarching financial protection scheme for crop loss , PMFBY provides comprehensive crop insurance coverage throughout the crop cycle, protecting farmers from pre-sowing to post-harvest losses. Currently, the Scheme is being implemented through 19 General Insurance Companies including 5 Government Sector Companies across 22 States and UTs across India. PMFBY has two different variants of Insurance products viz.

I) Yield Index Based Insurance for the crops for which historical yield values are available. This variant is named as PMFBY. Yield Index Insurance scheme intends to provide insurance protection to the farmers against loss of crop yield during any given season due to any climatic or narutral risks and associated perils leading to financial losses to the farmers and compensate to the extent of financial loss suffered by the farmer/s. Yield Index Insurance had many avatars starting from National Agriculture Insurance Scheme, Modified NAIS and lastly PMFBY which was launched in 2016 and is being implemented across the states since then.

> Farmers can access insurance schemes through user-friendly mobile applications (Crop Insurance App,) and web portal (National Crop Insurance Portal) simplifying the enrollment and localized claims intimation procedures

II) Weather Index Based Insurance for all other crops which do not have historical yield values. This variant is named as Restructured Weather Based Crop Insurance Scheme (RWBCIS) Weather Index Insurance intends to provide insurance protection to the farmers against adverse weather incidence, such as deficit and excess rainfall, high or low temperature, humidity etc. which are deemed to impact crop production adversely. It has the advantage to settle claims within the shortest possible time. The scheme has further been restructured on the basis of premium structure and administrative lines of PMFBY and is available in the country from Kharif 2016 as Restructured WBCIS.

The total funds released by Government of India during last 5 years under various schemes for crop insurance are as under:

(Rs.crore)

Plan/Year	Insurance Schemes	Expenditure
2017-18	Pradhan Mantri Fasal Bima Yojna (PMFBY) and Restructured Weather Based Crop Insurance Scheme (RWBCIS)	9419.79
2018-19	-do-	11945.38
2019-20	-do-	12638.32
2020-21	-do-	13902.79
2021-22	-do-	13549.70
2022-23	-do-	10807.31

Salient Features of PMFBY

Under PMFBY, a uniform maximum premium of only 2% of the sum insured is paid by farmers for Kharif crops and 1.5% for Rabi crops. In case of annual commercial and horticultural crops, the maximum premium to be paid by farmers is up to 5%. All farmers whether sharecroppers, tenant farmers including women farmers growing crops in the areas notified by the concerned State/ UT Government are eligible for coverage under PMFBY and can insure themselves as per provisions of the scheme, subject to ownership of cultivable land or availability of tenancy contract. The scheme is completely voluntary for participation by the farmers through various enrollment channels viz. Banks, Post-Offices, CSCs, Insurance Intermediaries, Insurance Companies and Directly through the Smartphone App or NCIP Digital Portal.

Earlier, there was a provision of capping the premium rate which resulted in reduction of sum insured value to bring down the premium to capped level but resulted in low claims being paid to the farmer against the actual losses suffered. This provision has now been removed. Central Government has also made provisions to rationalize the GoI subsidy sharing in the view of high quoted premium rates in select crops and areas to ensure a detailed analysis of the reasons leading to high premium rates and to encourage crop diversification as per prevalent agro-climatic conditions and crop suitability.

States/UTs are now free to choose the cut-off dates for enrolments and other activities as per the cropping pattern and prevalent agro-climatic conditions in their respective states/ UTs. Further, they can also pick and choose the add-on peril to be covered under PMFBY. States have flexibility to have various technology adaptations under PMFBY including YESTECH, WINDS, CROPIC, various smartphone Applications. Not only this, they can integrate various digital databases and platforms including electronic land-records, farmers and crop details with NCIP directly to promote universal insurance for all farmers of their respective states/UTs.

Role Of Technology & Its Impact On Crop Insurance

How can we make crop insurance landscape more efficient, accurate, and accessible for farmers and other stakeholders?

From last few years, Crop Insurance in India has seen an advent of new technologies such as satellite imagery, remote sensing, and data analytics that to improve risk assessment and claim settlement processes. These tools can provide valuable insights into crop health, enabling early detection of diseases, pests, and drought stress and also reduce delay in claim payment to farmers. Few of the key technology initiatives undertaken under PMFBY are as explained hereunder:

I) YES-TECH (Yield Estimation System based on Technology)

The Tech-based Yield Estimation System, leverages machine learning, crop simulation, and parametric indexes to provide accurate crop yield estimations at the Gram Panchayat level. Under YESTECH, various parameters ranging from Remote Sensing Technology based indices, weather indices and crop/soil indices will be used for modelling crop yield estimation at Insurance Unit level. This will not only increase the objectivity and transparency in the whole process of Crop Yield Estimation but also increase reliability and confidence of stakeholders in the crop yield data and increase accuracy of crop loss assessment and claim compensation to farmers.

II) WINDS (Weather Information Network Data System)

The Weather-based Insurance Network and Digitization of the System, utilizes hyper-local weather data available through a dense network of Automatic Weather Stations (AWS) & Automatic Rain Gauges (ARGs) established at each Tehsil/Taluk and Gram Panchayat Level respectively. Currently, 13000 AWS and 20,000 ARG are installed in the country. Under the WINDS, additional 8000 AWS and 2,00,000 ARG will be established.

The weather data available through these AWS/ARGs will be hosted at Central WINDS Portal from which the data will be made available to various stakeholders on need basis. The dashboard and advanced analytics of weather data shall provide valuable insights and inputs to various stakeholders, especially Central & State/ UT Governments for making climate resilient agriculture policies and schemes. The weather data so available will also be used for weather-based crop insurance and inputs for area-crop specific agro-advisories along with valuable inputs for creating disaster risk reduction & mitigation and paving way for climate resilience for agriculture as a whole.

III) CROPIC (Collection of Real Time Observation & Pictures of Crops)

Collection of real-time observations & pictures of Crops, envisages collection of photographs of crops along with its lifeccyle to detect any health stress and also to measure extent of crop damage due to any localized or mid-season adversity impacting the crops. The index produced through processing these photographs through computed vision technology models will also act as crucial inputs for estimation of crop yield under YESTECH.

IV) DIGI-Claim Module

Digital Crop Insurance Claim Settlement Platform within National Crop Insurance Portal (NCIP) streamlines and expedites the claim calculation and settlement process, ensuring timely and hassle-free payments to the insured farmers. Recently, via the DIGI-Claim module, PMFBY was able to release claims of farmers in one click online, simplifying the entire process and enhancing transparency and swiftness in claim settlement.

V) Smartphone Apps

Farmers can now access insurance schemes through user-friendly mobile applications (Crop Insurance App,) and web portal (National Crop Insurance Portal) simplifying the enrollment and localized claims intimation procedures. NCIP also integrates all the stakeholders on a single platform on a real time basis and provides , enabling access to individual farmer-wise detailed data for administrative and operational requirements. NCIP has now been evolved as an integrated digital platform for auto-administration and operationalization of scheme

Under PMFBY, Crop Cutting Experiments have increased manifold. Every year, around 70 lakh CCEs need to be conducted to arrive at yield data within a short harvesting window of 15-20 days is a challenging task. Smart Sampling and Two Step Yield Estimation has been adopted under PMFBY implementation to rationalize and reduce number of CCEs to be conducted. This ensures reduction in CCE numbers without impacting quality of sampling and yield estimation results. Further, a smart ohone app (CCE Agri App) has been launched by the Govt. of India for the usage of field functionaries of State/UT Governments and Insurance companies to ensure fair and transparent crop yield estimation through physical Crop Cutting Experiments (CCEs).

Benefits of Crop Insurance for Farmers

Crop insurance offers a multitude of benefits for farmers that go beyond financial protection. Firstly, it provides a safety net against crop losses, ensuring that farmers do not bear the entire burden of unpredictable events. Secondly, insurance coverage acts as collateral for accessing short-term agriculture credit, enabling farmers to secure loans for agricultural investments from institutional sources like Banks/NBFCs. It enhances their bargaining power and opens doors for modernizing farming practices, such as investing in advanced machinery, irrigation systems, and improved seeds.

Moreover, crop insurance encourages long-term planning, as farmers are more likely to adopt innovative techniques and technologies when they have a safety net in place. Additionally, crop insurance builds trust and confidence among farmers, enhancing their willingness to take calculated risks and explore new opportunities for growth and innovation.

It is evident from the fact that more than 1.37 lakh crores of claims have been paid under PMFBY since 2016, enrolling more than 48 crores applications over the course of last 7 years. More than 15 crore farming households have utilized the scheme in these years cumulatively and more than 4.5 crore farming households have been benefitted through claim compensation. In FY 2022-23 alone, more than 11 Crore applications were enrolled covering more than 3.15 Crore farming households. This has been an increase of approx. 17% in enrollment of farmers in FY 2022-23 covering GCA of implementing state up to the extent of 32%. In FY 2022-23 one left out state Andhra Pradesh has rejoined the scheme keeping in view the flexibility and benefits PMFBY offers to the farmers and few more states are expected to join from Kharif 2023 onward. Further, there has been a considerable increase in confidence in the insurance industry owing to various technology interventions undertaken to increase objectivity and transparency in the processes and due to this 2 left-out Insurers have rejoined in the bidding process for current tender cycle of 2023-25 along with one newly empaneled Insurance Company.

Extensive awareness & IEC campaigns are also being conducted in all notified areas during with all Stakeholders viz. State Govt., Insurance Companies, Banks and CSCs etc, such as Meri Policy Mere Haath, Fasal Bima Pathshala and Crop Insurance Week to ensure the out-reach to each and every farming household across the implementing states to ensure communication and awareness about the necessity and benefits of PMFBY and also to provide a platform to the farmers to clarify their doubts and educate them about the scheme through a class-room concept using extensive network of insurance professionals of the implementing Insurance Companies.

Conclusion

PMFBY is not merely a safety net; it is a transformative tool that empowers farmers and strengthens India's agricultural sector. The infusion of technology has made crop insurance more accessible, efficient, and reliable, addressing the needs of farmers in a rapidly changing environment. By embracing PMFBY farmers gain financial stability, mitigate risks, and enhance their productivity and sustainability. It is imperative to recognize the necessity of crop insurance, harness the power of technology, and ensure its widespread adoption and scalability for ensuing the best interest of the farming communities of the country. This will in-turn increase economic wellbeing of farmers and ensure increased food productivity and food-security for the nation and the world as a whole.

Promoting CA at the local, national, and the global level through partnership among researchers, scientists, farmers and other stake holders will facilitate its faster adoption and serve as an important climate smart agricultural system

Conservation Agriculture

Sustainable Approach to Mitigate Climate Risks

Rising per capita incomes, urbanization and globalization have played a significant role in shaping consumer behaviour and bringing changes in their food preferences. As a result, the food system – both on-farm, in terms of production mix, and off-farm, in the post-harvest management of farm produce has undergone substantial alterations. The crop mix has to align with the evolving demand for food and non-food, essentially by allocating more acreage to high value crops and adopting modern agricultural practices that augment productivity. Similarly, the post-harvest management practices should ensure the quality and safety of farm produce, including efficient storage, transportation, processing, and distribution with minimal losses and assured availability of nutritious food.

Conducive Public Policy Framework

For this, a conducive public policy framework is essential which facilitates a smooth transition in the food system through provision of necessary infrastructure, research and development, and fair value of farm output at the farm gate. Yet another most indispensable policy mandate that supports a sustainable food system is mitigation of climatic risks.

Extreme and untimely weather conditions are increasingly becoming responsible for lowering the crop and livestock productivity and diminishing the nutritional quality of food. This has strong implications for loss in the food and farmers income. Concomitantly, crop cultivation and livestock rearing are responsible for nearly 20 per cent of the global Green House Gas emissions, largely methane and nitrous oxides. Thus, it is not only important to raise the farm output through better irrigation facilities, drought resilient seed varieties to meet the growing food demand, but also reduce emissions to achieve the climate goals and safeguard the environment.

Sustainable Agriculture With Climate Smart Approach

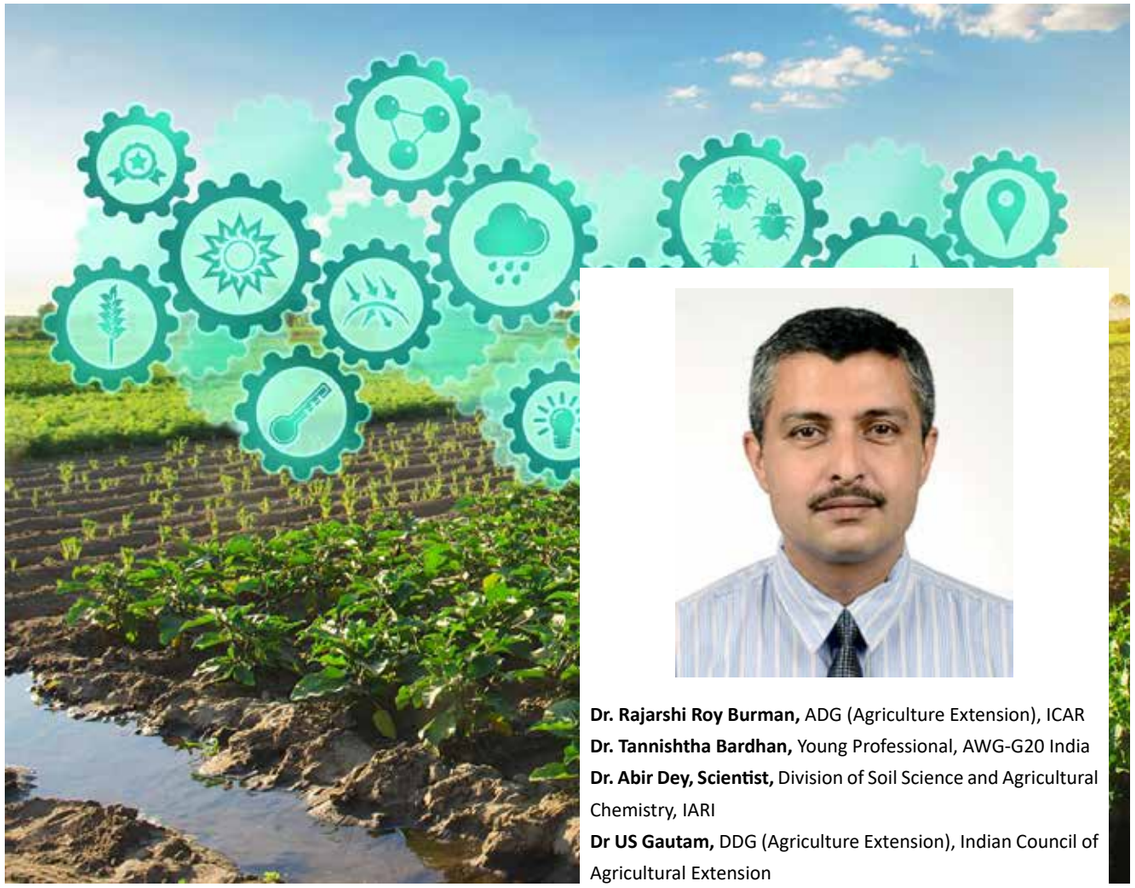
Among many agendas, the G20 platform highlights the importance of promoting sustainable agriculture with a climate smart approach viz. Conservation Agriculture (CA). The IPCC special report "Climate Change and Land" (2019) also listed CA as one of the incremental adaptation methods to mitigate climate risks.

Conservation Agriculture (CA) is a promising eco-friendly farming practice which is effective in mitigating the adverse effects of climate change. As per the Food and Agriculture Organisation, CA is a farming system that promotes maintenance of a permanent soil cover, minimum soil disturbance, and diversification of plant species. Practicing CA boosts up bio-diversity and natural biological processes.

The three underlying principles of CA viz. minimal tillage, crop residue retention and crop rotation may help in making the farming systems more resilient to climate change. CA provides many ecosystem services, including carbon sequestration, preventing surface erosion, enhanced water infiltration, increased soil fertility and curbing fuel use. These benefits minimize agriculture system's vulnerability, enhance adaptation to climate change, and contribute to mitigation efforts.

Site Specific Approaches Can Help

At present, the global total area under CA is low at approximately 205 million hectare (Mha) . In recent years, the South Asian Region has adopted zero tillage-based CA but the progress has been sluggish. Even in India, acreage under CA is barely 2.5 Mha despite an increasing policy support and awareness among farmers. A wider adoption is possible if the respective states/governments take proactive measures and come up with site specific approaches, especially among the small land holders, who are dominant across the developing countries.



Dr. Rajarshi Roy Burman, ADG (Agriculture Extension), ICAR
Dr. Tannishtha Bardhan, Young Professional, AWG-G20 India
Dr. Abir Dey, Scientist, Division of Soil Science and Agricultural Chemistry, IARI
Dr US Gautam, DDG (Agriculture Extension), Indian Council of Agricultural Extension

Regenerative Agriculture

Regenerative Agriculture, a way of farming that focuses on conservation agriculture, agro-forestry, silvi-pasture, etc. and makes the farming system more sustainable and resilient to climate change impact. In this context, key areas of policy focus include, increasing investment in agricultural research, encouraging public-private partnership for developing innovative technologies, providing financial, technical and logistic support to farmer, creating an enabling environment for adoption of sustainable farming practices and climate resilient production systems.

Adaptation and resilience to increasing extreme events can be accompanied through weather and climate related information services, early warning systems, risk sharing and transfer mechanisms such as insurance markers and index based-weather insurance.

CA, a novel paradigm for agricultural research and development mainly targets at achieving the food production goals while responding to the adverse effects of climate variability. The maximum benefits of climate change mitigation can be realized by coupling CA as an efficient and sustainable livelihood strategy to deal with the ecosystem degradation.

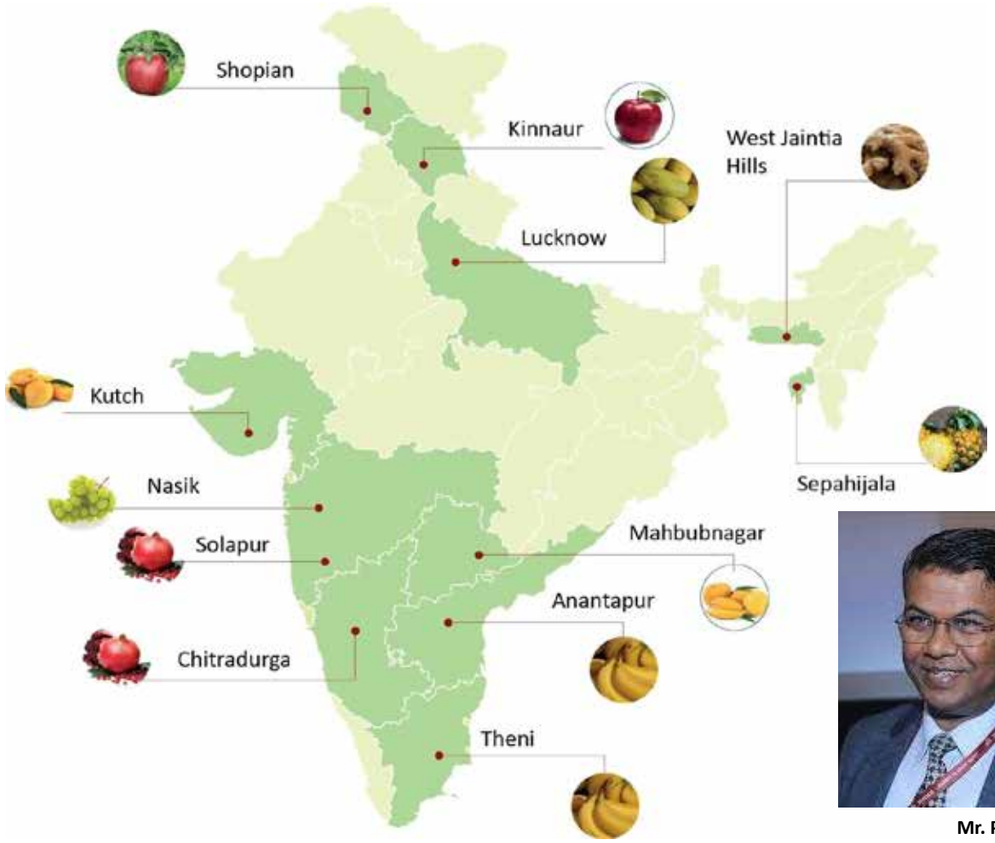
Need To Promote CA Practices Holistically

While seeing through a climate lens, it becomes apparent that small-scale farmers are among the first to feel the impacts of climate change because of their greater dependence on the natural environment. The policy makers should rethink and realign the approaches and develop demand driven, need based framework to promote CA practices holistically.

Educating the farmers about the detrimental effects of residue burning and intensive cultivation is of utmost priority. It is the need of the hour to institutionalize CA into relevant government ministries, departments, and regional institutions. Promoting CA at the local, national, and the global level through partnership among researchers, scientists, farmers and other stake holders will facilitate its faster adoption and serve as an important climate smart agricultural system.

Horticulture Cluster Development Programme

A Novel Approach for a Dynamic Sector



Mr. Priya Ranjan
Joint Secretary (INM, MIDH/ Horticulture), DA&FW

Horticulture has been an integral part of Indian Agriculture since beginning. To promote and develop the commercial horticulture in the country, National Horticulture Board (NHB) was established in 1984. However, till the year 2001, not much focus was given for development of horticulture. In the year 2001 based on the recommendation of Dr. Swaminathan Committee Report, Government of India adopted a Mission approach to promote horticulture initially in North Eastern States. Keeping in view the success of Horticulture Mission for North East & Himalayan States (HMNEH), it was decided to launch a National Mission to cover other states also. Accordingly, in 2005-06, a Mission named National Horticulture Mission (NHM) was launched in remaining states of the country.

In 2014-15, all the Individual schemes for horticulture namely, National Horticulture Mission (NHM), Horticulture Mission for North East & Himalayan States (HMNEH), National Horticulture Board (NHB), Coconut Development Board (CDB) and Central Institute for Horticulture (CIH) were subsumed into one scheme and named as Mission for Integrated Development of Horticulture (MIDH). The scheme is being implemented as a Centrally Sponsored Scheme, for holistic growth of the horticulture sector in all States and UTs. The impact of MIDH has exceeded expectations greatly and has led to the growth of the horticulture sector.

> The holistic, market led development approach of the Horticulture Cluster Development Programme make it one of the most crucial national level initiatives. Successful implementation of the programme can propel the horticulture sector forward in a sustainable, empowering and inclusive manner

Horticulture Cluster Development Programme (HCDP)

The need until the last decade for the Indian horticulture was to increase the area and quantity of horticulture produce. Today, country has marked the highest ever production of horticulture produce and the focus is now shifted to factors like increase in productivity, high-density plantations, availability of quality planting material, cluster approach cultivation, post-harvest management infrastructure etc.

To address the challenges and enhance the global competitiveness of the Indian horticulture sector, the Ministry of Agriculture and Farmers' Welfare (MoA&FW), Government of India, has launched the Cluster Development Programme (CDP) being implemented by National Horticulture Board (NHB). The intervention aims to develop specific crops in areas while leveraging the geographical specifications of the chosen region. These interventions were trifurcated into (a) pre-production & production (b) post-harvest management & value addition, (c) logistics, marketing & branding.

Pilot Phase With 12 Clusters, 7 Focussed Crops

There were 55 different crop specific clusters identified across the nation. The implementation of the program has begun with a pilot phase in 12 clusters with 7 focussed crops namely, Ananthapur & Theni (Banana), Solaupur & Chitradurga (Pomegranate), Lucknow, Kutchh & Mahabubnagar (Mango), Kinnaur & Shopian (Apple), Nashik (Grape), West Jaintia Hills (Turmeric) and Sepahijala (Pineapple). The main objectives of the programme include :

- Developing the horticulture value chain holistically
- Directly impacting and reducing the percentage of post-harvest losses
- Bring modernization to the horticulture sector
- Inculcate convergence between various government schemes operating
- Increase the capacity of the farmers at the farm level

Multiple Outreach Initiatives

Several rounds of outreach activities were conducted in the 12 pilot clusters aimed to engage and inform the main stakeholders. These activities were also catered to encourage private organizations to come and invest in the cluster as part of the program. These outreach efforts led to multiple applications to be received for each cluster, as private organizations wanted to play the role of Implementing Agencies (IAs).

Cluster Development Agencies

State Government Entities appointed Cluster Development Agencies in these 5 clusters namely, i.e., Andhra Pradesh Horticulture Development Agency (APHDA) for Ananthapur Banana Midi Cluster in Andhra Pradesh, Jammu & Kashmir Horticultural Produce Marketing and Processing Corporation (JKHPMC) for Shopian Apple Mega Cluster in J&K, Telangana State Horticulture Development Corporation Limited (TSHDCL) for Mahbubnagar Mango Mega Cluster in Telangana, Maharashtra State Horticulture and Medicinal Plant Board (MSHMPB) for Nashik Grape Mega Cluster in Maharashtra and Meghalaya State Agriculture Marketing Board (MSAMB) for West Jaintia Hills Turmeric Mini Cluster in Meghalaya.

A huge number of applications received for pilot phase clusters which went through an assessment process at multiple levels resulting final selection of Implementing Agencies (IAs) in 5 clusters. The selected Implementing Agencies are M/s Desai AgriFoods Private Limited for Ananthapur, M/s FIL Industries Private Limited for Shopian, M/s Prasad Seeds Private Limited for Mahbubnagar, M/s Sahyadri Farms Post Harvest Care Private Limited for Nashik and M/s Meghalaya Basin Management Agency (State Govt. Entity) for West Jaintia Hills.

These IAs will invest in the 5 clusters and in turn will receive grant-in-aid by the National Horticulture Board (NHB). The

beneficiaries of these 5 clusters are spread across an area of almost 50,000 Ha and cover around 55,000 farmers. The investment in these clusters is very significant which is approx. an amount of INR 750 Crores.

The concerned CDAs and IAs were invited to the India Cold Chain Conclave held in New Delhi on 19th January 2023 and have been awarded their Acceptance Letters by Shri Manoj Ahuja, IAS, Secretary, Ministry of Agriculture & Farmers Welfare.

The auspicious ceremony marked the kick off point for the Cluster Development Programme (CDP). The IAs, after consultation with their respective Cluster Development Agencies (CDAs), will commence their proposed interventions in their respective clusters. In addition to these 5 clusters, there are currently applications being considered within multiple other clusters.

Robust Growth Of Horticulture Sector

The contemporary scenario of Indian horticulture paints an incredibly encouraging picture. The sector is ripe with growth, stakeholders across the value chain have a growing interest and there is a slow yet steady shift towards export-oriented cultivation. The unprecedented alignment of these factors has been noted by policy makers who have been swift in their creation and implementation of policies to take advantage of the same.

The Cluster Development Programme heralded by the NHB is one such initiative. The vertical wise interventions selected for the provision of financial assistance will bolster the value chain of any chosen crop. In line with the holistic outlook enshrined within the Programme's core, the CDP also aims to create convergence with other schemes of various Ministries.

This includes extant initiatives such as the Agriculture Infrastructure Fund (AIF) and the Cold Chain Programme of Ministry of Food Processing Industries (MoFPI) while also aiming to integrate upcoming schemes. One such example is that of the Clean Plant Programme being initiated by the GOI.

In the recent Budget 2023-24, Smt. Nirmala Sitharaman, Hon'ble Finance Minister announced the Atmanirbhar Clean Plant Programme with an outlay of INR 2200 Cr. This programme will aim to provide ease of access to farmers for clean, good quality planting material. The provision of these planting materials will enhance the quality of produce at the farm level and will allow farmers to reap the benefits of exporting their crops as well. This will be possible due to alignment of crop production with the international standards.

The holistic, market led development approach of the HCDP programme make it one of the most crucial national level initiatives currently being undertaken. We believe that the successful implementation of the programme can propel the horticulture sector forward in a sustainable, empowering and inclusive manner.

Ananthapur (Banana)

Shopian (Apple)

Mahabubnagar (Mango)

Nashik (Grape)

West Jaintia Hills (Turmeric)

Climate Smart Agriculture Key to Sustainability

> ‘Innovation and Agri-Entrepreneurship Development’ programme under Rashtriya Krishi Vikas Yojana (RKVY) has technically and financially supported 177 ‘precision agriculture’ based start-ups and 134 ‘Waste to Wealth & Green Energy in Agriculture & Organic Farming’ start-ups to encourage environment friendly practices

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A growing global population and changing diet pattern are driving up the demand for food. Nearly 690 million (8.9 percent) of the global population are hungry . The food security challenge will be more severe by 2050 when estimated world population will be 9 billion and need for food production increases by 70%.

The IPCC report on climate change 2022 states that the increasing incidence of extreme weather and climate events have exposed millions of people to acute food insecurity and reduced water security. Economic damages from climate change have been reported in climate-exposed sectors, with regional effects to agriculture, forestry and fisheries.

Enhancing Food Security

Enhancing food security while adaptation to climate change requires the transition to agricultural production systems that are more productive, use inputs more efficiently, have less variability and greater stability in their outputs. Sustainable agriculture has been grown up as an approach in response to this global crisis. It can be attained by improving the scientific process and investment through climate smart agriculture. Climate-smart agriculture (CSA) aims to sustainably enhance food security, incomes, and also foster resilience to achieve FAO SDG goals 2030 based on four Betters; better production, better nutrition, a better environment and better life for all, leaving no one behind. These approaches include integrated farming system, green and climate resilient agriculture, climate friendly start-ups that ensures sustainability and adaptation to climatic variability and negative environmental impacts.

Integrated farming systems include compatible combination of cropping with allied activities like animal husbandry, fisheries, plantation crop, birds etc. It delivers synergistic benefits by intensified cycling of nutrients, energy and water with basic concept of “there is no waste but waste is only misplaced resource”. Recyclable use of resources in this system promotes organic farming enabling maintenance of soil health and conservation of natural resources. Among the components, livestock production constitutes a very important component in developing countries; a contribution that goes beyond direct food production to include multipurpose uses. Fisheries and aquaculture are important sources of food, nutrition and income for farmers, more so for coastal communities.

Encouraging Climate Friendly Start-Ups

Agro-ecological approaches can be synergized with integrated farming, to make agriculture more inclusive and sustainable, and conserve natural resources. Payments for ecological services (PES) may be made to small and marginal farmers towards incentives for adopting sustainable agriculture and food system. Enabling environment for climate friendly start-ups and incumbents have potential to transform agriculture towards sustainability.

‘Innovation and Agri-Entrepreneurship Development’ programme under Rashtriya Krishi Vikas Yojana (RKVY) has technically and financially supported 177 ‘precision agriculture’ based start-ups and 134 ‘Waste to Wealth & Green Energy in Agriculture & Organic Farming’ start-ups to encourage environment friendly practices.

Some of the agro-ecological based start-ups under RKVY are Bariflo Labs, a suite of precision agricultural solutions; A2P Energy Solution Pvt Ltd, a start-up to convert paddy straw into next bio-fuel; Dharaksha Ecosolutions Private Ltd, which develops biodegradable packaging material from crop stubble waste; FIB-SOL Life Technologies Private Limited, a light weight water soluble gel based bio-fertilizer start-up etc.

Lifestyle for the Environment

Along with supply side of agriculture, demand side factors which emanate from consumers are viable long term and support green agriculture. Changing lifestyles are leading to demands for customized diets that adversely impact our agri-system. Approach such as ‘Lifestyle for the Environment (LiFE)’ leads to more demand for organic based and naturally grown foods products enabling transition of agriculture system towards resource efficient and environmental friendly farming.

Achieving sustainability with climate smart approach needs science and evidence-based innovations focusing on climate action, technological, social and institutional base across agriculture and food systems.

Digitalization of Agricultural Transformation in India

> Agriculture will continue to undergo digital transformation. Indian and foreign agritech businesses can play a crucial role in supplying farmers with these cutting-edge technologies

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For almost a decade, the phrase "digital transformation" has been making waves in the agri-food industry. It has made it possible for both corporate and public organizations to use advances in digital technology to rework procedures and find new business models. The word "digital" does not, however, have the same meaning for everyone at every level of the organization. For one person, adopting modern technology may just refer to streamlining corporate procedures and gaining a competitive edge, but for another, it may also imply using it to improve interactions with buyers and consumers. For another person, it can signify the digitization of all data to increase cost and time efficiency.

The term "digital agriculture" can refer to instruments that gather, store, analyse, and/or distribute electronic data and/or information in agriculture. It is sometimes referred to as "smart farming" or "e-agriculture." A general definition of agricultural transformation is the process over time by which the agrifood system shifts from being farm-centered and geared towards subsistence to being more commercialized, productive, and off-farm focused. One of India's key economic sectors is its agriculture industry, which is currently valued at US$ 370 billion. According to the Economic Survey 2020-21, The Agriculture sector contributed 19.9% of GDP in 2020–21, up from the 17.8% recorded in 2019–20.

The use of digital farming allows farmers to get knowledge and make decisions that will increase productivity. Popular reasons for the adoption of digital farming include crop and livestock management, pest control, and communication ease in the industry.

Importance of Digitalization of Agriculture

In this digital era, it is hardly surprising that technology is breaking its way into the agricultural industry. Digital farming is now a tool that farmers may utilise to gain knowledge and make successful decisions. The implementation of digital agriculture has given farmers a way to increase agricultural productivity, sustainability, and profitability. Starting with a single farm, the impact may be seen at the micro level. As it increases, it influences global policies at the macro level.

Top benefits include:

- Improved decision-making and management procedures
- Improvement in output and revenue
- More target applications lead to increased efficiency
- Improved marketing
- Better Documentation
- Current information
- Modernization of record keeping
- Reduces environmental and ecological impacts
- Risk and uncertainty management
- A reduction in the regulatory burden
- Save Time and Money
- Uplifts socio-economic statuses of farmers

Recent Digital Agriculture Initiatives in India

Over the years, the government has made significant efforts to assist and advance the agricultural industry with tried-and-true farming technologies and encouraging legislation. In September 2021, Mr. Narendra Singh Tomar, Hon'ble Union Minister of Agriculture & Farmers Welfare, Govt. of India announced the launch of the Digital Agriculture Mission 2021–2025 and signed five Memorandum of Understandings (MoUs) to advance digital agriculture through pilot projects with:

- CISCO
- Ninjacart
- Jio Platforms Limited
- ITC Limited
- NCDEX e-markets Limited (NeML)

The goal of the Digital Agriculture Mission 2021–2025 is to encourage and speed up projects based on cutting-edge technologies including artificial intelligence (AI), blockchain, remote sensing and GIS, and the usage of robots and drones. Major digital tools have been created by the Ministry of Agriculture & Farmers Welfare to encourage farmers to adopt technology, including:

» National Agriculture Market (e-NAM, 2016)

» Direct Benefit Transfer (DBT) Central Agri Portal, 2013

The Ministry of Agriculture and Farmers Welfare and Microsoft signed a Memorandum of Understanding in June 2021 to operate a pilot programme in 100 communities across six states. According to the MoU, Microsoft will use its cloud computing services to develop a "Unified Farmer Services Interface." This is a key component of the ministry's future ambition to build "AgriStack," a single platform to offer farmers end-to-end services throughout the agriculture and food value chain.

Digital Agriculture Implementation in India

The predominance of segregated small-holder farms in the nation, which makes data collection challenging, is the fundamental reason for the gradual acceptance of digital farming in India. Additionally, limited penetration of mechanization tools and frequent natural calamities like droughts, floods and excessive monsoon rains, have negatively impacted the deployment of digital solutions in the sector.

To make digital agriculture successful in India, the following actions could be taken:

- Cost-effective technology
- Platforms for renting and sharing agricultural gear and equipment
- Portable equipment
- Academic assistance

Emerging Digital Society

Indian and foreign agritech businesses can play a crucial role in supplying farmers with these cutting-edge technologies. Indian Agriculture and the allied sectors are on the verge of adopting contemporary technology, such as IoT, AI/ML, and Agri-drones for unmanned aerial surveys. There are currently few competitors in the sector, but serving the nation's 267 million farmers presents a significant opportunity for private and foreign businesses to increase their presence in the nation.

It is in national interest to solve the issues the Indian agricultural industry is facing holistically from an ecosystem perspective in order to achieve goals like sustainable development and double farmer incomes. Despite these issues, there is no denying that agriculture will continue to undergo digital transformation. FAO is committed to assisting governments and partners in bridging such multidisciplinary digital divides to ensure that everyone benefits from the emerging digital society.

Reversing Pollinator's Decline

Improvement Of Pollinator's Health And Habitat Restoration Using Ornamental Crops

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> Restoring floral resources with nutritious floral rewards can improve pollinators' health, compensate for habitat loss and reverse pollinator decline. Development of a region-specific floral calendar has been recommended as a key strategy to prevent habitat loss and increase floral resources

Agricultural production has become increasingly pollinator-dependent to meet growing food demand, and pollinator decline has caused concerns about future pollination services. Depletion of floral resources, habitat loss, fragmentation due to land-use change and pesticides are the most significant drivers of pollinator decline. Globally, pollination in crop production is estimated to be worth $235 billion to $577 billion annually.

Wild bees are very efficient pollinators of crops. Unlike in American and European countries, very limited data are available on pollinators conservation in India. Pollinator decline can adversely affect the food supply, especially the decline of those pollinator species which play a very significant role in pollination even under harsh climatic conditions. Therefore, sincere efforts and efficient conservation strategies are required to restore habitat and improve health.

Region-Specific Floral Calendars

Restoring floral resources with nutritious floral rewards can improve pollinators' health, compensate for habitat loss and reverse pollinator decline. Development of a region-specific floral calendar has been recommended as a key strategy to prevent habitat loss and increase floral resources. Pollen and nectar provide essential nutrients to honeybees; the type and quality of these rewards significantly impact the bee's physiology and performance. Rich pollen nutrition also fosters tolerance to pesticides and parasites. Therefore, pollen and nectar nutrition optimization are vital to pollinators conservation programs.

India's floriculture industry is rapidly evolving as a promising sector for doubling farmers' incomes. Floricultural/ ornamental plants are obviously the most accessible and continuous option for restoring floral resources patches. Due to aesthetic demands and beauty, both the government and private sector consistently develop varieties of ornamental crops having different flower characteristics and colour schemes. ICAR-DFR is a national repository for ornamental and flower crop germplasm. The most effective strategy for conserving pollinators would be to design a floral calendar that is nutrition-centric and habitat-recreative. Floricultural crops have numerous species and very high levels of intra-specific diversity in terms of floral attributes, flower schemes, flowering time, floral rewards etc.

Hence floricultural crops would be the most suitable, readily accessible and cost-effective component of the floral calendar. It is observed that many pollinators can survive and flourish even in human-disturbed areas and a variety of agricultural landscapes.

This offers immense scope for integrating highly nutritious bee-friendly flora for promoting such pollinators in gardens of residential premises in urban and peri-urban areas; roadside national highways; non-cropped areas in agricultural landscapes; in pollination-dependent fruit and vegetable farms etc.

Pollinator-Friendly Genotypes

In this context, ICAR-DFR, Pune has identified pollinator-friendly genotypes of Chrysanthemum and China aster. Three chrysanthemum genotypes viz., OPCH-12-7 (Fig 1); OPCH Double White (Fig 2) and DFR C-2 (Fig 3) have been identified as highly attractive and rewarding genotypes for honeybees. Similarly, few open pollinated aster genotypes viz., DFR-Ento-9 (Fig 4); DFR-Ento-11 (Fig 5); DFR-Ento-12 (Fig 6) and DFR-Ento-13 (Fig 7) have been identified as excellent bee-friendly genotypes. ICAR-DFR also studied the role of the dominant pollinator 'Apis florea' in aster seed production. It was found that bee pollination increases seed yield by 3.11 times; seed test weight by 25.35% with significant increase in seed germination (%). The pollinator-attractive & rewarding genotypes can be used for preparation of floral calenders to improve pollinator's health & habitat restoration. Pollens from bee-friendly flora can be used as a dearth-season diet for honey bees. Multiplication and marketing of such bee-friendly flower crops would also offer an entrepreneurship opportunity and a new source of income for rural youths and farm women.

Fig 1. Chrysanthemum (OPCH 12-7)

Fig 2. Chrysanthemum (OPCH Double White)

Fig 3. Chrysanthemum (DFR C-2)

Fig 4. China Aster (DFR-Ento-09)

Fig 5. China Aster (DFR-Ento-11)

Fig 6. China Aster (DFR-Ento-12)

Fig 7. China Aster (DFR-Ento-13)

Post-Harvest Infrastructural Interventions

Development of Quality Infrastructure A Key Priority Area

> The principle objective of AIF is to streamline the engagement with stakeholders like farmers, government, agri-entrepreneurs and startups, the banking ecosystem and consumers. Through these interventions, India is poised to resolve its food loss problem, through proactive grassroots support from its farmers

India is rightly considered a thriving agrarian economy. Known for its rich farming traditions, the country produces sumptuous grains and pulses, as well as cash crops like tea, cotton, and latex that are highly in demand both domestically and in the global marketplace. India's agriculture sector makes a remarkable use of its diverse geography, cultivating high-quality crops not only on her famously fertile northern plains, but also on difficult terrains such as the vast mountain ranges and sandy deserts.

This high agricultural output enables her to feed a massive and growing population, and the country is moving towards addressing malnutrition with its robust farming systems and surplus produce to acheive food security and nutrition to all.

Addressing The Problem Of Food Loss

The Indian socio-economic disparities are complex and multi-layered, and call for a larger discussion. Speaking from an administrative perspective, one of the historical reasons behind the aforementioned issues is the thousands of tonnes of food grains that were found to be routinely going to waste in warehouses every year. Exposure to natural elements and pest attacks, apart from inadequate supply chain facilities, were observed to be some of the main causes. India's food loss problem had assumed monstrous proportions in the last few decades and needed a structural intervention from the administration.

The Need For Agriculture Infrastructure Fund

The government realized that the problem of food loss is tied to poor handling of the produce post harvest. Consequently, the crux of the ensuing intervention was to proactively support the development of quality infrastructure that is better equipped to manage the harvested output.

In order to achieve this at scale, the government established the Agriculture Infrastructure Fund (AIF) in 2020, under the National Agriculture Infra Financing Facility. The AIF is worth INR 1 lakh Crore and is meant to facilitate maximum convergence across state and central-level schemes that support farmers with their infrastructural needs.

Its principle objective is to streamline the engagement with stakeholders like farmers, government, agri-entrepreneurs and startups, the banking ecosystem and consumers.

Highly Encouraging Response

The facility encourages farmers to seek loans, subsidies and other benefits from the government. Its online portal acts as a repository of all relevant information, and helps them submit loan applications and track their progress. The portal also has a dashboard that puts crucial data on the fund's performance in the public domain. So far, the facility has attracted 78,194 registered beneficiaries and 64,222 loan applications. Of these, 29,762 applications have been aproved by SCB and Coop. under the Agriculture Infrastructure Fund. In addition to this, the total cost of sanctioned projects under this scheme is INR 40,130 Cr. of which INR 14,383 have been disbursed to 24,579 applicants so far.

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Diverse Sectors

The projects that are eligible to apply for the scheme include diverse farming activities, including bio stimulant production units, nurseries, tissue culture, seed processing, harvest automation, purchase of drones and specialized field sensors, e-marketing platforms, warehouses, and cold chain packaging units. The fund is also meant to support projects that build new-age community farming assets that sustain hydroponic farming, mushroom farming, vertical farming, aeroponic farming, and poly-house/ greenhouse logistics. Through these interventions, India is poised to resolve its food loss problem, through proactive grassroots support from its farmers.

In practice, there are huge gaps in the agriculture development policy level which prevent women from performing their full potential. To address gender disparity, G20 has previously launched two major initiatives namely, W20 and We-Fi

Gender Mainstreaming in Agriculture

G20 members together represent two-thirds of the world's population and 85 per cent of its economy. G20's goal of inclusive and sustainable economic growth will remain an elusive dream without its commitment to women's social and economic empowerment.

In developing countries such as India, agriculture is the main source of livelihood of 55% of total population, which is increasingly becoming a female activity. Women's engagement in agriculture varies from 30% in Europe to nearly 80% in developing countries. Women contribute extensively to the agri-food systems but their work largely goes invisible, unaddressed, and unpaid.

The situation is no different in India. Estimates indicate that the share of female operational holders has increased from 12.8 % in 2010-11 to 13.96% in 2015-16 in total operational holders. During 2020-21 around 62.2% of women labour force in the country was engaged in agricultural activities against 40% of male workers .

Empowering Women In Agriculture

Empowering women in agriculture is a crucial to achieve an equitable and inclusive food system. The challenges women farmers face in crop cultivation, animal husbandry, dairying and fisheries activities can no longer be ignored.

Large scale outmigration of male members, owing to both "push"and "pull" factors has altered the gender roles in the rural landscape. This may accentuate due to an ongoing process of structural transformation, including growing urbanization and demographic changes across the developing countries.

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G20 agriculture ministers meet every year to make commitments relevant to agriculture sector. Some of the key priorities of Agriculture Working Group in past have been agricultural trade, market transparency, responsible investments, food loss and waste, ICT in agriculture, soil health, sustainable water management etc.

Factors For Women's Marginalisation

Specific needs of women farmers, female labourers/cultivators have received lesser attention. In the wake of COVID-19 pandemic, rising climate risk and conflicts, agricultural policy thrust has shifted towards transitioning to sustainable, inclusive and resilient agriculture and food systems.

In many countries women are denied the right to land and livestock ownership which deprives them of access to institutional credit to purchase inputs, and make capital investment as banks usually consider land as collateral. Lack of crop insurance, training, and gender friendly tools and machinery become the limiting factors, adding to their drudgery and hardships in the fields.

In some cases, women own farm resources and undertake farm operations yet their contribution remain invisible due to inadequate resources in hand. Even if they are able to generate marketable surplus after toiling hard in the fields, it becomes hard for them to sell produce at reasonable price.

Despite more work for longer hours (both paid and unpaid) when compared to male farmers, women farmers can neither make any claim on output nor ask for a higher wage rate. An increased work burden with lower compensation is a key factor responsible for their marginalisation.

W20 And We-Fi To Address Gender Disparity

In practice, there are huge gaps in the agriculture development policy level which prevent women from performing their full potential. To address the gender disparity, G20 has previously launched two major initiatives namely, W20 and We-Fi. The first, W20 launched during the Turkish presidency serve as an important mechanism to foster global coordination for gender equality. And the second, We-Fi launched during the German presidency enable financial access to small and medium enterprises (SMEs) owned by women entrepreneurs.

The current Indian presidency of G20 has put forward women-led development as one of the main agenda. Indian government has prioritized agenda of 'Gender Mainstreaming in Agriculture' to provide access to resources/schemes to rural women engaged in agriculture and allied sector.

National Policy on Farmers, 2007 highlighted "mainstreaming the human and gender dimensions in all farm policies and programmes" as one of the major policy goals. Special beneficiary-oriented schemes are laid by Department of Agriculture and Farmers' Welfare to mainstream the participation of rural women by allocating at least 30 % expenditure on women farmer.

Skill-Development Capacity Building Schemes

Various skill-development and capacity building schemes such as Mahila Kisan Sashaktikaran Pariyojana (MKSP) are launched by Ministry of Rural Development. However, G20 still has a long way to go to give greater voice and visibility to women's contribution in agriculture.

With the 'feminisation of agriculture' picking up pace, G20 must embrace gender-sensitive actions and solutions that cater to women farmers requirements such as opening up of service centres or farm machinery banks that cater to women's input, capital and operational requirements, and providing extension services, technological know-how, skill development and entrepreneurial opportunities can go a long way in ensuring economic empowerment to women farmers.

Kisan Business School

Connecting Bridge For Farmers To Value Chain

India's agriculture consists of two key elements. Produce is produced in one place, and is then sold in another. Farmers' roles are limited to the producing area, where they put forth the most effort, but the reward depends primarily on how well the produce is marketed. The effective marketing strategies will help the farmer to earn more profits with less resources.

The FAO's Farm Business Schools (FBS) or Kisan Business Schools encourage the development of small farmers through entrepreneurship for inclusive value chain development. It operates mainly at field level with the involvement of different organizations, extension functionaries and expert institutes. The main goal of FBS was to encourage farmers to think of farming as a business in order to increase farm earnings. It sought to alter farmers' incomes by enhancing their current endeavors and meeting market demands.

> Kisan Business School is formed by a group of farmers for experiential learning to inculcate the skills for innovative marketing, entrepreneurship development and management. These schools, initiated for different commodities, can function as a suitable approach to help small and marginal farmers to compete in different value chains

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The FBS is formed by a group of farmers for experiential learning to inculcate the skills for innovative marketing, entrepreneurship development and management. The school aims to train the farmers under the tutorship of trained facilitators with financial assistance from the different organizations. The school empowers groups of farmers to trust and cooperate with each other and value chain actors for linking their produce to earn best prices.

In India, these schools are organized in the form of Kisan Business School (KBS) for development of small and marginal farmers under expert institutes. These have the ability to significantly improve farmers' livelihood security and access to employment.

Capacity Building Programmes For Farmers

The State Agricultural Universities, Research Institutes, KVKs, NGOs, Agri Incubation Centre, Corporates, and other organizations are noted for acting as expert institutions. The school organizes a capacity building programme for select farmers in the different commodities to link them to different value chains through on farm classes, demonstrations, exposure visits, field visits, training, and grading up of extension delivery system. The capacity building programmes are mainly focused on motivating farmers to consider the value addition of produce and to start an entrepreneurial venture.

The generic process of developing Kisan Business School will be difficult in Indian conditions due different agro climatic conditions and farming activities. Hence commodity based KBS was initiated.

KBS For Dairy Farmers

India is the largest milk producer and possesses the largest animal herd. The dairy in the country is dominated by small animal holders with 2-3 cattle. To help the dairy farmers, Dairy Business School under ICAR-NDRI, Karnal was taken up to connect them to different stakeholders. It involved the rigorous training of the farmers in the dairy production, processing and marketing aspects to meet the global value chain standards.

The curriculum was developed for farmers to organize the school based on their interest. The farmer's capabilities were developed in clean milk production, Artificial Insemination, Integrated Farming System, Processing of milk into milk products like Khoa, Paneer, Buttermilk, Ice cream, Ghee and Whey drink to match standards of other big competitors. The farmers were encouraged to start their entrepreneurial venture through mentoring under experts. The successful farmers to reach the marketing stage under school were linked to different value chains for marketing of their produce. So, Kisan Business School in different commodities can be a better approach to help small and marginal farmers to compete in different value chains.

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Cultivating India's Agriculture for Export Growth

> A dedicated "Green Channel Logistics Infrastructure" with 24x7 customs clearance especially for perishable goods should be implemented urgently in collaboration with state governments. Adequate attention should be given to air cargo companies

As per the projections of the United Nations, the world's population may increase to around 8.6 billion in 2030 and 9.8 billion in 2050. According to an estimate, 30% of the world's population experienced moderate or severe food insecurity in 2020. These figures indicate that international trade in agriculture and allied commodities is the cornerstone of the global food security system. Therefore, India has a huge potential to bridge the global demand for food security and emerge as a top agricultural export country by bridging this yawning gap.

Overview of Agriculture and Allied Sectors

Agriculture in India is practiced across different climatic zones and contributes to around 18% of India's GDP. Presently, India is the largest producer of spices, pulses, milk, tea, cashew, mango, banana, jackfruits and jute and second-largest producer of wheat, rice, fruits and vegetables, sugarcane, cotton and oilseeds.

India is also the highest exporter of cereals across the globe and has captured nearly 50% of the world market for rice. However, India's share of agricultural exports accounts only for 1.6% - 2.4% of the world's agricultural exports. Therefore, there are plethora of opportunities that can be taken advantage of for boosting India' export in the near future.

Challenges and Way Forward

Agriculture constitutes an integral part of the Indian economy. There are some challenges that act as a roadblock to its unexplored trade potential. Overuse of pesticides/insecticides, lack of infra structure including cold-chain and little/no use of technology are some of them. Others include SPS & NTB (Sanitary & Phytosanitary issues and Non-Tariff Barriers), Accreditation /Certification issues and lack of uniform quality standards across different verticals, as mandated by importers across the globe. Further, it has been observed that export in Agriculture commodities is a function of surplus.

Though India may rank high amongst countries in production its yield rate is very low. This is attributed to low level of mechanization coupled with large sections resorting to subsistence farming. Therefore, it is essential to bridge gap in production rank and yield rate.

Multi-Pronged Strategy To Ensure Competitiveness

A multi-pronged strategy to ensure competitiveness of India's agricultural exports is required. These strategies can be designed, planned and implemented through One District One Focus Product (ODOFP) initiative. It can further, help create templates for states to adopt, that can help speedier implementation, cost efficiency and optimum resource alignment

The below mentioned "ten commandments", should be our guiding light going forward.

Agriculture Infrastructure & Quality Upgradation

India is one of the largest producers of agricultural commodities in the world, yet its role is very minimal in international trade. Connectivity of land locked states to the ports/ terminals is a stiff challenge along with congestion at ports. Therefore, removing logistics & infrastructure bottlenecks at fast gear is an important need.

Key Highlights – Agri and Allied Commodities

11.8% Share of Total Exports (2022-2023)	**3235.54 lakh tonnes** Total foodgrain Production (2022-2023 – 2 AE)	**263.1 million** Employment in the Agriculture Sector	**56.5%** Women Participation in the sector

> It is imperative that we move up the value chain by enhancing a product's characteristics, discovering new innovative products, creating unique brand names and developing unique customer experiences

A dedicated "Green Channel Logistics Infrastructure" with 24x7 customs clearance especially for perishable goods should be implemented urgently in collaboration with state governments. Adequate attention should be given to air cargo companies as they are yet to achieve their full potential.

Efforts should be undertaken to attract investments & FDI in logistics including cold chains, warehouses, and reefer vans. Equal importance should be given to maintaining backward linkages, as they help in reducing wastages at farm level.

Facilitating setting up of state of the art food processing units & food processing parks within specially designed SEZs would further strengthen the value chains, and augment exports. Promotion of sunrise sectors, such as horticulture and floriculture would go a long way in realizing India's trade aspirations.

Product Segmentation

To make Indian agriculture products lucrative in the international market, we need to ensure that exports are no more a function of the surplus. We should have a clear export policy for agriculture commodities which may be centred around trading in high value items and help us in earning more revenue.

Quality Enhancement

Quality is the single most important factor other than pricing that impacts exports and has the strength to shield negative impact against price. To comply with norms of importing nations, it is requisite to procure the produce from certified registered farmers who follow the required quality norms and should be done on priority by the state governments. We may also facilitate the farmers registration process and bring more and more in the ambit.

Marketing & Promotion

It is recommended that India expands its market base for better risk management & increase market penetration in existing markets to increase exports value by further diversifying into value-added products

Organizing virtual buyer seller meets (V-BSM) with major importing countries and setting up of Agri-Cells across all Indian Embassies for G2G engagement would further give a fillip to India's trade ambitions. Similarly, States can establish "Agricultural Trade Cells" in their respective states to boost exports.

Often exporters are unable to capture their targeted market due to high cost of quarantine inspectors. It is suggested that to reduce costs, local inspectors appointed by the importing country/ third-party inspectors from nearby countries could be used. Again, reciprocal approval of inspecting agencies may be pushed through Indian embassies.

Value Addition

India currently processes less than 10% of its agricultural output. It is imperative that we move up the value chain by enhancing a product's characteristics, discovering new innovative products, creating unique brand names and developing unique customer experiences. We should focus on creating awareness about millet/other superfoods and build exportable surplus in the same. For example, Shree Anna is the flavor of the year. Priority should be given to organic products, specifically from the NE states, especially by setting up of processing centers at the production centers to avoid pilferage and enhance shelf life.

Skill development

To increase our credibility in the international market it is of utmost priority that our farmers have the required skills and capabilities to match international standards. Farmer awareness is critical as unregulated chemicals usage at the farm level could lead to rejection of exports due to breach in MRL (Maximum Residue Levels). It is imperative that we collaborate with agriculture research universities/other stakeholders to prepare commodity & region-specific cultivation practices manuals.

Organizing rural women into self-help groups and finding ways to scale-up their operations would help them sustain professionally and leverage SDG's.

Branding

To make our exports remunerative, we should capitalize on principles of marketing i.e. branding, packaging and labelling. A detailed guideline can be made available online, with clear listing of dos and don'ts which would further help us in addressing our market access issues in China, EU and USA. A detailed strategy for specific brands, to begin with GI items may be adopted.

Disruptive Technologies

Farmers can use Artificial Intelligence to determine optimal dates to sow crops, precisely allocate resources (water and fertilizer), identify crop diseases, long-term weather forecasts and commodity pricing predictions, among other inputs. Immersive technologies can be leveraged to the advantage of exporters/ sellers, buyers and other trade facilitators by organization of real time virtual expo centers that transcend geographical, language and time barriers. This can be taken up by the central and state governments together.

Climate Smart Approach and Way Ahead

Although India is the largest exporter of rice in the world, it is undeniable that it is a water guzzling crop. Going ahead, we need to diversify our markets and look for other environmentally sustainable products/methods that can be leveraged for exports. For example, aeroponics uses 95% less water than field farmed-food. Aeroponics is currently expensive but India can lead the way through "Jugaad" technology, in making it affordable & commercially viable.

Therefore, our aim should be to make these methods cost effective and convert agriculture into a booming & an environment friendly industry, as envisaged by the Hon. PM.

Agriculture Value Chain Finance Vital for Developing India

Agriculture continues to be the backbone of developing economies and the major means of subsistence for people especially in countries like India. Despite being a smallholder economy, India is a prominent producer of several agricultural commodities and has become self-sufficient in food production. However, the farming community in India has not benefited in a proportionate way from the unprecedented levels of productivity it has achieved.

While the absence of economies of scale highlights many difficulties affecting the general productivity of small and marginal farmers, the most significant one has been the lack of funding. This has put tremendous pressure to shift the focus on the development of organised agriculture value chains (AVCs) and their finance. In fact, Agri Value Chain Finance finance is crucial for ensuring food security, generating jobs, and promoting overall economic growth. It offers a strategy and innovative technologies for successful agricultural lending and market inclusion.

However, due to obstacles like lack of visionary anchors, high procurement costs resulting from the large number of small producers, low-quality produce, a high number of intermediaries, a dearth of post-harvest infrastructure, and limited access to low-cost financing, the organisation of AVCs has been challenging in India.

Need For Agri Value Chain Finance (AVCF)

Value chain actors require funding for production, acquisition, processing, storage, and delivery from genetics to end usage. For the production, bulk purchasing, storage, and distribution of seeds, agrochemicals, machinery, and equipment, input providers need credit. Credit is required by farmers to buy inputs and to invest in machinery, equipment, land upgrades, irrigation, storage, transportation, infrastructure, bulk purchases, stocking and for grading or weighing equipment.

GOI Supporting AVCF

Both banks and NBFCs have successfully financed value chains in some cases. In comparison to banks, NBFCs can delve deeper into the ecosystem due to their agile organisational structures, focus on technology, and speed of delivery. The National Bank for Agriculture and Rural Development (NABARD) offers financial assistance to farmer producers' organisations (FPOs) for the production, processing, and sale of agricultural products to improve AVCs.

In line with the priority of the Government of India for promoting FPOs, NABARD has so far promoted 5136 FPOs including 1064 FPOs under a centrally sponsored scheme for formation and promotion of 10,000 FPOs. Additionally, a Credit Guarantee Fund with a corpus of Rs 1,000 crore has been established with equal contributions from NABARD and the Ministry of Agriculture & Farmers' Welfare.

This fund is administered by NABSanrakshan Trustee Pvt. Ltd., a fully owned subsidiary of NABARD, to persuade institutional lenders to extend credit to FPOs. A total of Rs 444.02 crore in FPO finance was granted by NABKISAN, a bank subsidiary and NBFC, to more than 1,400 FPOs. There are also several government schemes which extend financial support towards development of commodity value chains including SAMPADA yojana, MIDH scheme, subsidies from NHB and APEDA.

GOI has also collaborated with various international organizations to strengthen the capacity of national stakeholders and increase income. Food and Agriculture Organization, India has formulated a Country Programming Framework (CPF) for India for the period 2019-2022 in line with UN SDG(s) to strengthen the species value chain and improve the safety and quality of Indian spices in states such as Rajasthan, Andhra Pradesh, Madhya Pradesh, and Gujarat.

World Food Programme is working with the Development Monitoring and Evaluation Office (DMEO) of NITI Aayog to support national evaluation capacity development. The Government of India is constantly working to make value chains more inclusive by providing smallholders with the resources they need to participate in higher value market possibilities.

Shri Rabindra Prasad
Director, G20, DA&FW
Ms. Vanshika Singh
Consultant, AWG - G20 India

"Agri Value Chain Finance finance is crucial for ensuring food security, generating jobs, and promoting overall economic growth. It offers a strategy and innovative technologies for successful agricultural lending and market inclusion

Rewal Chaal

Equestrian Sports for Sustenance of Indigenous Horses

Dr SC Mehta

Principal Scientist

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Dr TK Bhattacharya

Director

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> The need of the hour is to develop and organize sporting events for the indigenous horses of the country. The country doesn't have dedicated race courses or race clubs for the 0.34 m indigenous horses of the country. Ironically, we have dedicated race courses and race clubs for exotic horses which may populate somewhere between 5000-10,000 in the country

Horse. The glorious history of this animal has prideful acknowledgements of the great warriors and travelers of the world, and the story remains incomplete without the reference of the incomparable braveness and loyalty of Chetak, the horse of Maharana Pratap of Mewar.

However, the 20th Livestock Census (2019) shows 45.58% decline in the population of horses during the quinquennial census period of 2012 to 2019 with a negative trend in most of the states except Gujarat where the population has increased by 19.42%. The typical reason behind this increase in population is the craze for Rewal Chaal of Sindhi (Kachchi-Sindhi) horses. The conservation biologists look at this typical gait of Sindhi horses with great hope to sustain the species in situ.

The Horse's Ambling Gaits

There are two kinds of the Chaal or ambling gait. The Rewal Chaal and the Madri Chaal. The Rewal Chaal is a typical four-beat gait where each leg of the horse touches the ground separately. At any given time during this Chaal, the horse balances its weight on a single leg but gives a smooth and comfortable ride to the rider as the back of the horse remains straight.

It is said that even if the rider carries a pot of Ghee, it will not slip-out. It is a walk that can be carried out at much faster speed of 40 km per hour or more. However, this Chaal needs to be taught to a horse and generally it takes around one year to train a horse.

On the other hand, the Madri Chaal is the Chaal which is inherited by a horse from its mother and does not require to be taught. It is also a four-beat gait and the horse lifts its one side legs followed by the other side. At any given time, the horse carries its weight on all four legs and creates a bouncy gait due to which the rider is not comfortable. In this Chaal, the horse does not get tired easily and can travel for higher distances than that in the Rewal Chaal.

Sporting Events For Indigenous Horses

The Rewal and the Madri Chaal events are popular in Jaisalmer, Barmer and Jalore districts of Rajasthan; and Kachchh, Morvi, Surat and Navsari districts of Gujarat. This indigenous equestrian sport is also popular at some places in Uttar Pradesh and Bihar. The Marwari, Kathiawari and Sindhi horses can be trained for this ambling gait but the Sindhi horses have been found better adapted for the purpose and the Sindhi horses of Rajasthan are considered as the best. The Rewal Chaal competitions attract a large number of horse lovers of the country in the events and the price money is also very encouraging.

Thus, the need of the hour is to develop and organize the sporting events for the indigenous horses of the country. The country doesn't have dedicated race courses or race clubs for the 0.34 m indigenous horses of the country but it has the same for the exotic horses which may populate somewhere between five to ten thousand in the country. Promotion of endurance racings of the kind of Rewal Chaal, training the horses for Area Polo and opening of the riding schools for the youth may go a long way in sustaining the species in situ.

> Promotion of endurance racings of the kind of Rewal Chaal, training the horses for Area Polo and opening of the riding schools for the youth may go a long way in sustaining the indigenous species in situ

Rural Poultry Revolution Rejuvenating Indian Backyards

Indian poultry landscape is one of the major bright spots in the run up to realizing the global vision of achieving food and protein security and doubling the incomes of small farmers and other vulnerable groups. Sustained efforts have revolutionized poultry farming, particularly in the remote, hilly, tribal and deprived areas of the country, effectively resulting into a Backyard Poultry Farming (BYPF). It has been made possible by widespread distribution of improved chicken varieties with a potential for higher egg production even under resource poor conditions.

The success of Indian BYPF revolution can be gauged by the fact that despite being just 17.44% of the total backyard poultry population of layers, these improved varieties constitute around 30% of the total egg production in the backyards. The annual productivity of these improved populations is on a rising trend, thus, contributing to the socio-economic upliftment of the rural populace.

Improved Backyard Poultry Varieties

This renewed push for BYPF system derives its major strength from the development of low-input, hardy varieties with genetic potential for high production. In this regard, ICAR-Directorate of Poultry Research (DPR), Hyderabad is constantly endeavouring to develop genetically improved backyard poultry varieties suitable for propagation on a pan-India basis.

Vanaraja is one such dual-purpose chicken variety developed in 1990s which is being reared for both meat and egg purposes. It has been thoroughly tested and validated for its performance in different agroclimatic regions and across the length and breadth of the country through different state animal husbandry departments, Central Poultry Development Organizations, Krishi Vigyan Kendras and other Central government agencies.

This variety has a huge noticeable impact in terms of higher benefit–cost ratio and household food security in the predominantly tribal north-eastern regions of the country.

Another variety which has left an impeccable mark in the backyard poultry landscape in the country is Gramapriya. It is a brown-egg layer variety developed for free-range farming in rural and tribal areas with annual egg production potential of 160-180 eggs. It has wider acceptance among the masses and its germplasm has been widely propagated through poultry seed project centres located throughout the country.

Superior characteristics of Vanaraja and Gramapriya were combined to develop Srinidhi with optimum body weight and egg production which is gaining popularity. Swetasri and Krishibro are layer and broiler varieties respectively, developed for small-scale intensive farming operations in rural and tribal areas of the country.

Location-Specific Rural Chicken Varieties

Further, AICRP (All India Coordinated Research Project) on poultry breeding centres on poultry breeding have been steering the development and propagation of location-specific rural chicken varieties by introgression of native germplasm with improved lines and crosses. Pratapdhan (Rajasthan), Narmadanidhi (Madhya Pradesh), Kamrupa (Assam), Jharsim (Jharkhand) and Himsamridhi (Himachal Pradesh) are five such varieties tailored for performance and adaptability in specific regions while conserving the native chicken germplasm at the same time.

ICAR-DPR is distributing about 38-40 lakhs of improved chicken germplasm every year to farmers and different stakeholders across the country with an estimated annual GDP contribution of Rs. 1 billion. The success of BYPF model in India is a reiteration of the need for participatory technology development i.e. developing technologies to address local issues by integrating indigenous knowledge with scientific interventions and ensuring sustainability of the technology by widespread testing and community participation. While the chicken vs egg debate continues, backyard poultry and farmers are the ultimate winners.

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ICAR-Directorate of Poultry Research, Hyderabad

> This renewed push for back-yard poultry farming derives its major strength from the development of low-input, hardy varieties with genetic potential for high production. ICAR-Directorate of Poultry Research, Hyderabad is constantly endeavouring to develop genetically improved backyard poultry varieties suitable for propagation on a pan-India basis

Foot and Mouth Disease

A Major Obstacle in Livestock Health and Productivity

> Highly contagious animal diseases cause enormous economic losses to livestock. Although FMD is not considered a public health problem, it causes huge economic losses. These potential losses have three components: eradication costs, production losses and trade restrictions

Dr Manoranjan Rout, Senior Scientist; Dr JK Mohapatra, Principal Scientist and Dr RP Singh, Director, ICAR-National Institute on Foot and Mouth Disease, Argul, Bhubaneswar, Odisha

Agriculture contributes 75% of the world's poor to earn their livelihood. Probably two-thirds or even three-fourths of the global population involved in agriculture chiefly depend upon livestock farming. In India, livestock production and agriculture run in parallel to each other. Livestock sector provides nutritive food and family income, generates employment among the landless, small, marginal farmers thereby playing an immense role in the socio-economic development of India's rural population. India stands first with respect to buffalo, second in cattle and goats, third in sheep population in comparison to the world livestock population.

Animal diseases severely constrain the livestock health causing dramatic economic loss. Foot-and-mouth disease (FMD) is the most economically devastating animal disease affecting cattle, buffaloes, sheep, goat, pigs leading to an annual loss of 20,000 Crore.

The disease is caused by FMD virus in the genus Aphthovirus, in the family Picornaviridae. Three serotypes O, A, Asia 1 are prevalent in India, where serotype O is responsible for majority of the outbreaks. Sheep and goats being the maintenance hosts produce mild clinical signs. Pigs being the amplifying hosts produce huge quantum of infectious aerosol virus, while cattle are indicator hosts and most often show clinical signs with more severe lesions.

Severe Economic Impact Of FMD

Historical examples have illustrated the severe economic impact of FMD. The cumulative loss of an incursion of FMD on New Zealand's economy was estimated to be $6 billion in the first year, rising to $10 billion by the second year. Costs of the outbreak of FMD in the UK in 2001 were £3.1 billion in losses to agriculture and the food chain and 20% of the estimated total farming income for 2001 (£355 million). In the 2001 UK outbreak, 2.5 million animals were slaughtered that was the largest slaughter category in the outbreak. Italy's 1993 outbreak cost over $130 million, and the 1997 Taiwan outbreak cost roughly $15 billion.

FMD in cattle causes fever, anorexia, hypersalivation, lameness and formation of vesicles/erosive lesions on tongue, dental pad and gums, muzzle, interdigital spaces, vesicles in the udders and teats of lactating cows leading to mastitis. FMDV also affects some vital endocrine glands leading to panting. The direct costs of disease account for the cost of vaccination, cleaning, disinfecting and administrative costs.

The indirect effects are loss of production, loss of milk yield and breeding capacity including abortions, infertility, loss due to reduced draught capacity in working bullocks, mortality in young calves etc. Animals with FMD usually recover uneventfully and may experience poor growth and permanent hoof damage.

Preventive Vaccination

Highly contagious animal diseases cause enormous economic losses to livestock. Although FMD is not considered a public health problem, it causes huge economic losses. These potential losses have three components: eradication costs, production losses and trade restrictions.

Preventive vaccination twice a year is the main tool for control of the disease that is taken care by LHDCP under Govt of India. Along with this, movement control of susceptible animals and strict enforcement of zoosanitary measures are important for control of FMD.

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Towards Inclusive Rice Value Chain Development

Agricultural growth is critical to fostering overall economic growth. The sustainability of agriculture depends on the efficient, transparent, and inclusive agricultural value chain development that not only contributes to abolishing poverty but also ensures food security.

The ongoing rapid transformation and technology disruptions across value chain nodes along with the new and expanding markets are opening up new opportunities as well as challenges. However, the marginalized groups in the value chain often face challenges in exploiting such opportunities and increasing their participation.

The key issues are limited asset endowment in the form of landholding and other forms of capital to produce market surplus; asymmetric information lack of trust, and power imbalance between farmers and other value chain actors; high transaction costs; and market access in the form of physical proximity, connectivity, opportunities, etc.

Therefore, in addition to research and technology innovation, complementary measures are needed to address these issues and capacitate farmers to cope with the challenges and exploit the opportunities. Value chain approaches are among such measures that create an enabling ecosystem and facilitate farmers' participation to increase their share in the value chains.

Innovative Technologies, Effective Management Practices

IRRI South Asian Regional Centre (ISARC) is focusing on research for the development of innovative technologies, effective management practices, and novel value-added products in rice-based systems. These include 1) new climate resilient, premium quality, nutraceutical, and healthier rice varieties; 2) Novel value-added products like gluten-free cookies, muesli, pasta, etc.; 3) Digital innovations like tools and applications on advisories and knowledge sharing, digital marketing solutions, agri-services, and management recommendations; and 4) Precision farming technologies like drones, mechanization, irrigation, etc.

The value chain and entrepreneurship development unit at ISARC is working towards inclusive rice value chain development by integrating these R4D innovations and value-chain approaches through the following objectives:

- Value chain analysis to map the requirements and opportunities.
- Research and innovation in inclusive value chain approaches.
- Develop and test innovative business models (including collective enterprises), business linkages, and entrepreneurship development.
- Development of inclusive value chains for specialty rices including traditional aromatic, nutraceutical, and healthier rice varieties, novel rice value-added products, digital innovations, precision farming technologies, and management solutions.
- Create an enabling ecosystem and platform for training, mentoring, coaching, and technical support to agri-startups, aspiring agripreneurs, FPCs, SHGs, farmers, extension systems, ToTs for product and entrepreneurship development agencies/ institutes and students to promote innovation, entrepreneurship and business development in rice value chains.
- Promote a culture of entrepreneurship to attract and engage youth and women.
- Create a platform for learning, innovation, co-development, and collaboration between agripreneurs, startups, and FPCs/SHGs and establish a network with other upstream, midstream and downstream agricultural value chain actors.

Inclusive agricultural value chain and food systems development is crucial for sustainable agriculture, abolishing poverty, and ensuring food security. The value chain and entrepreneurship development unit at ISARC is working on inclusive value chain development. This helps capacitate the value chain actors including smallholder, women and youth farmers, aspiring entrepreneurs, agri-startups, and collective enterprises to respond to changing technological and economic challenges and opportunities that are emerging as a result of new and expanding markets.

> WeRise integrates a localized seasonal climate prediction and real-time weather data with a crop growth model. It is web-based and enables data-driven decision support through science-based advisories including the optimum sowing timing, suitable variety for planting, and fertilizer application schedule based on the weather characteristics of the upcoming cropping season

Dr Sheetal Sharma, Dr Preeti Bharti, Dr Ajay Kumar Mishra, Dr Benedict Jardinero, Iris Bugayong, Dr Niyati Singaraju and Dr Renaud Mathieu
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Making Way For Digitally Transformed Agri-Food Systems

Digital transformation in agriculture refers to the integration of digital technologies and solutions to enhance the efficiency, productivity, and sustainability of agricultural practices. Digital technologies have the potential to revolutionize the agriculture industry by addressing the challenges faced by farmers, offer solutions to tackle climate change effects on crop production, reduce GHG emissions and improve the overall productivity and profitability of the sector.

While the potential of digital technologies is clear, their reach is not universal, and digital divide poses a significant challenge in realizing the transformative potential of digital technologies. Enabling policies and infrastructure and capacity strengthening of different stakeholders with a human-centered design approach is essential for inclusive, equitable, and sustainable digital transformation in agri-food systems.

IRRI's Contribution Towards Digital Transformation

Rice Crop Manager for precision farming and climate resilience: Precision agriculture, also known as precision farming, is an approach to crop management that uses technology and data to optimize production efficiency and reduce waste. Rice Crop Manager (RCM) based on Site-Specific Nutrient Management (SSNM) principles, a web-based, decision support digital tool, developed by IRRI in the year 2013 for Bangladesh, India, Indonesia and Philippines, enables the users to use a computer/smartphone to provide farmers with field-specific recommendations on the source, timing and amount of fertilizers.

Weather-rice-nutrient integrated decision support system (WeRise)

WeRise integrates a localized seasonal climate prediction and real-time weather data with a crop growth model. It is web-based and enables data-driven decision support through science-based advisories including the optimum sowing timing, suitable variety for planting, and fertilizer application schedule based on the weather characteristics of the upcoming cropping season (i.e., onset, amount, and distribution of rainfall throughout the upcoming cropping season, possible drought and flooding occurrences), crop growth development, soil characteristics, and farm management practices.

Remote Sensing Based Information and Insurance for Crops in Emerging Economies (RIICE)

Where is rice, when is rice, how much will be/is rice yield is the underlying information produced by RIICE, a digital platform developed and implemented by SARMAP and IRRI, institutionally supported and co-founded by the Swiss Development Cooperation. RIICE relies on the integration of Synthetic Aperture Radar (SAR) derived products – such as the rice area (where), the beginning of the rice crop season (when), the Leaf Area Index (LAI) – and a crop growth simulation model – ORYZA – to provide spatially explicit forecast at mid-season and estimate yield at harvest time (how much will be/is rice yield).

Scope of digital technologies

All the aforementioned technologies are contributing towards the climate-resilient, sustainable agriculture practices which are the need of the hour. Rice Crop Manager offers the farmers an innovative way to get the field-specific crop management advisories. WeRise helps the farmers to know the optimum sowing window and further provides in-season advisories based on weather forecasts. The map-based representations from RIICE can help governments in estimating actual rice yields, forecast future rice yields, assess disaster damage, understand climate impacts on rice crop growth and access insurance schemes.

Overall, digital transformation in agriculture farmers can better manage their operations and adapt to the climatic challenges thus revolutionizing the agriculture industry by improving efficiency, increasing productivity and enhancing sustainability.

Getting the Nutrition Back to Rice and Value Addition

The world is currently facing triple burden challenges of increasing hidden hunger, obesity, and undernutrition, especially in the developing world, with India being no exception.

Rice, a staple crop for more than half of the global population caters to 40% of daily calories in Asia— given that milled rice covers more than 90% of the consumption. Notably, milled rice varieties often possess high glycaemic index (GI) escalating blood glucose levels—High GI food on persistent consumption poses increased risk of type-2 diabetes, obesity, and other health risks.

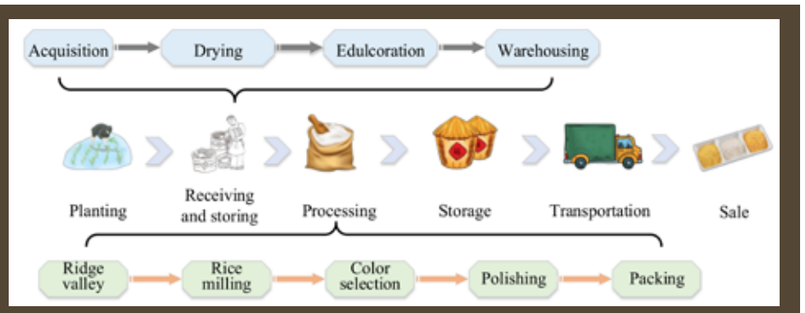
Milled rice composed of more than 90% starch (dry weight) and exhibits limited nutrition while comparing whole grain rice (brown rice). Conversely, whole grain rice is a good source of key minerals such as zinc and iron, and vitamins like thiamin, niacin, riboflavin, together with starch and protein. It also contains important fatty acids, gamma(γ)-oryzanol, and dietary fiber. However, the milling/debraning process removes bran layer enriched with most of the healthier components.

Likewise, whole grain pigmented rice varieties identified offer antioxidant and anti-cancerous attributes. That said, ironically, all rice varieties don't offer similar nutrition and nutraceutical, even in whole grain form. Thus, defining the rice varieties with higher nutritional potential and their timely introduction to the value chain, is the need of the hour.

The Focus Of CERVA

India being a treasure trove of highly diverse rice varieties, tapping it effectively is vital to explore its immense nutritional potential. Centre of Excellence in Rice Value Addition (CERVA) of International Rice Research Institute-South Asia Regional Centre (ISARC) based at Varanasi, India, has been prioritizing its efforts to profile the heritage specialty and traditional rice varieties for a suite of grain quality and nutritional traits using its state-of-the-art facilities catering to India and rest South Asia regions.

India being a treasure trove of highly diverse rice varieties, tapping it effectively is vital to explore its immense nutritional potential. Centre of Excellence in Rice Value Addition (CERVA) of IRRI South Asia Regional Centre has been prioritizing efforts to profile the heritage specialty and traditional rice varieties for a suite of grain quality and nutritional traits using its state-of-the-art facilities catering to India and rest South Asia regions



Dr Saurabh Badoni, Dr Deepak Verma, Dr Amitava Srimany, Dr Vivek Kumar Singh, Dr Hameeda Itagi of International Rice Research Institute, South Asia Regional Centre, Varanasi, Uttar Pradesh

CERVA has been focusing on pinpointing high value germplasm with nutritional propositions by identifying the following:

A) low and intermediate glycaemic index (GI) rice varieties showing a good yield potential, have been handed over to ICAR-Indian Institute of Rice Research (IIRR) for evaluation

B) The Centre identified high quality traditional accessions of Kalanamak after profiling and verifying for the premium quality. Kalanamak rice, a GI-tagged for the districts of Eastern UP, popular for its higher unique aroma and eating quality. Currently, efforts with linking KVKs, FPOs, millers, and microentrepreneurs are being positioned effectively for seed production and leveraging value-chain stakeholders in promoting the high value lines and value-added products, like nutrient-rich cookies—as 'Buddha prasadam'

C) Identified improved and traditional rice varieties with higher micronutrients, protein content, antioxidants, and anticancer compounds.

On top of this, for effective value-addition, a wide variety of novel rice-based products such as nutraceutical-rich cookies, muesli as tertiary products from nutrient-rich puffed and flacked rice, fortified pasta, and ice cream, etc are being prepared using either whole rice grains or utilizing the bran and broken rice as a component of the products. These high value products being delicious and nutritious, suit people of different age groups.

Promoting nutraceutical rich premium and safe specialty rice varieties and novel value-added product has potential to not only help consumers to find healthier staple alternatives, but also support farmers and other stakeholders to fetch better value and premium in domestic and international markets through strengthened value chains—enabling farmers and key stakeholder of rice value chain to uplift their livelihood.

Understanding Millets

Epicentre of India's Amber Revolution

> **Today, India stands at a potential inflexion point where a millet led "superfood revolution" can be brought about by tapping its health, environmental and trade potential**

19 April 2023 marked the successful conclusion of the Meeting of Agricultural Chief Scientists (MACS) held under the G-20 Indian Presidency in Varanasi. Sitting on the holy ghats of Varanasi, and sipping the city's famous "masala chai", dawned upon me the significance of the key outcome of this meeting i.e., MAHARISHI - Millets And OtHer Ancient GRains International ReSearcH Initiative.

The MAHARISHI initiative has the potential to challenge millets' classification as a 'food of the poor' or "Inferior" good (goods whose demand increases as income decreases). It is certainly a special providence that this ancient, spiritual capital of India witnessed the strengthening of the foundation for the revival of this ancient grain, which dates back to Harappan Civilisation.

In pre-1960 India, when two-thirds of the country was below the poverty line, millet dominated food-grain cultivation. Post-Green Revolution and with declining poverty levels, other cereal (like wheat and rice) consumption and plantation increased.

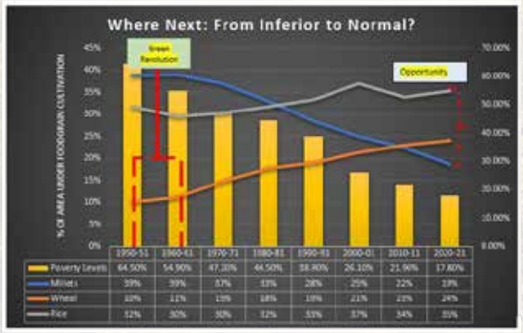


Figure 1

Source: Poverty Levels- World Bank; Area under foodgrain

Today, India stands at a potential inflexion point where a millet led "superfood revolution" can be brought about by tapping its health, environmental and trade potential.

Nutri-Cereals Have Multiple Benefits

These nutri-cereals have multiple benefits. Non-communicable diseases account for 17.9 million (74%) of all deaths globally of which diabetes accounts for >10% (WHO). Millets, due to low glycaemic index, complex carbohydrates and high fibre can mitigate the impact and occurrence of NCDs, anaemia, obesity and malnutrition.

Three crops, i.e., wheat, rice and maize fulfil more than two-thirds of global calorie demand and consume more inputs (FAO). For instance, bajra and ragi require 250-400 mm and 400-600 mm of water respectively while rice requires 1500-2000 mm of water. Further, millet unlike other cereals can be grown in arid areas and are resilient to rainfall and temperature variations.

Millets are nutritionally superior to other cereals. As per a comparative study by APEDA, millets have 7-12% protein, 2-5% fat and 15-20% dietary fibre. The carbohydrate content in millet ranges from 60-70 grams compared to 64-68 in other cereals. Therefore, millet can facilitate the transition from food to nutritional security especially when adult Indians are not meeting their recommended dietary targets (Global Nutrition Report 2021).

Export Potential

India is the leading producer of millet, accounting for 80% of Asian and 20% of global production, and this presents big opportunities. Even if 5% of the world's diabetic and anaemic population is targeted for millet consumption, the potential increase in millet demand would be 4 LMT (APEDA). With the value addition of millet, the export opportunity is close to $2 billion. This trade opportunity is also environmentally friendly. At present, India's major exports are rice and wheat which makes us a net exporter of natural resources like water. Moving towards millet will change that trend.

While India has successfully designated 2023 as the International Year of Millets, challenges to tap their full potential remain. The production and area under millets and consequently the marketable surplus have remained stagnant. In developed countries, millet is largely used in animal feed and rebranding them as a food item remains to be done to address perception issues. Finally, the low productivity of millets also needs redressal (growth at a decadal CAGR of 2% only). Thus, an approach that addresses the demand-side and supply-side bottlenecks needs to be adopted.

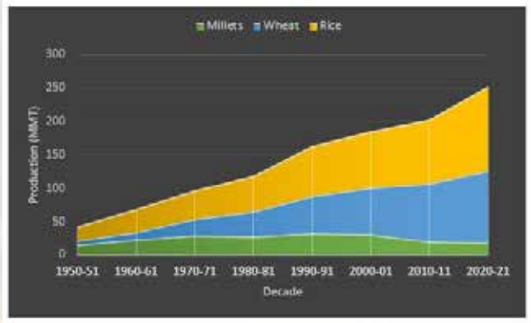
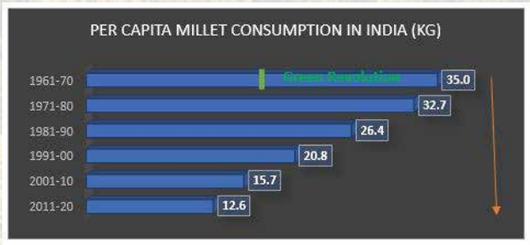


Figure 3

Source: Directorate of Economics and Statistics, MoAFW

Demand For Nutritional Food

On the demand side, tapping the demand for nutritionally dense food by the rising urban population (which places a lot of importance on a healthy lifestyle) holds promise. Using behavioural interventions is equally important and could include advertisements through health-conscious celebrity chefs and influencers, awareness-raising campaigns, prominently placing millet and millet-based products at department stores, and adding them to restaurant menus.



Source: USDA and author's calculations

On the supply side, millets can be encouraged to be grown alongside other crops. Announcing remunerative MSP and strengthening the public procurement and WCD programs are some solutions. For integrating millets into the global supply chains, agri-business promotion holds potential. Many Indian start-ups have been giving millets a makeover and changing perception issues by coming up with new millet-based recipes and focusing on better branding. Further, the millet corridors may be established near production centres. Such corridors would have several processing hubs that will provide backward linkages to producers for procurement and also value addition to consumers. Millet FPOs can address the lack of processing facilities. Finally, HYV millet production through seed hubs and Agriculture Universities may be encouraged. MAHARISHI whose Secretariat shall be housed at the Indian Institute of Millets Research in Hyderabad aims to do just that by strengthening institutions and building capacities for research and knowledge.

Time Ripe For Amber Revolution

At an institutional level, the convergence of departments like NITI Aayog and APEDA, with DA&FW can enlarge the mandate of millet promotion in the country. Further, determining HS Codes, grades and standards for certain millets can deepen their export potential. To boost millet production and exports, a "One State, One Millet and One Country" approach may also be adopted, i.e., States in India wherein a particular type of millet is produced may be mapped to countries which have its demand.

Indian agriculture has witnessed various revolutions- Green Revolution that ensured food security, White Revolution that made India the world's largest milk producer, Blue Revolution that nurtured fisheries and aquaculture. The time is now ripe for an "Amber Revolution" that will ensure nutritional security while addressing environmental challenges.

Ms. Parul Jain
Assistant Director, DA&FW
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Soybean for Food Security in India

> To support the growth of the soybean industry, strong collaboration among industry stakeholders, state agricultural departments, seed production agencies, and policy planning is essential

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Soybean, often referred to as the "miracle bean," has gained significant importance worldwide due to its unique combination of approximately 20% oil and 40% protein content. It plays a crucial role in global agriculture, contributing to 25% of edible oil and 65% of animal feed production.

India, one of the major soybean producers, has recognized the potential of this crop and has made significant strides in utilizing soybeans for food security and economic growth. In the fiscal year 2021-22, India earned Rs 2207 crores through the export of soybean oil meal alone, indicating the economic value of this versatile crop (source: SEA of India).

Despite belonging to the leguminous family, soybean's use as a human protein source remains limited. Approximately 94% of the world's soybean production is crushed for oil and animal feed. India's soybean growing regions are primarily concentrated in three states: Madhya Pradesh, Maharashtra, and Rajasthan, which contribute significantly to both the area and production of soybeans.

Globally, major soybean producers include Brazil, the United States, Argentina, China, and India. These countries have witnessed continuous growth in soybean production, thanks in part to the development of new cultivars.

Introduction Of New Soybean Varieties

The introduction of new soybean varieties has played a vital role in improving yield and productivity. Various factors have contributed to the yield increase in soybean varieties, including the number of seeds per area, number of seeds per pod, number of pods per area, and reduced lodging.

In India, the introduction of selection cycle 1 cultivars, developed through the selection of exotic introduced material, resulted in four times higher yield and harvest index compared to local varieties like Kalitur. Furthermore, selection cycle 2 cultivars, developed through hybridization between exotic and local material, exhibited an additional 19% and 16% increase in yield and harvest index, respectively, over selection cycle 1 cultivars.

A comprehensive assessment of yield gain in Indian soybean varieties between 1969 and 2008 revealed a remarkable 103% improvement, averaging at 23 Kg/year or a growth rate of 2.6% per year. Soybean's protein content, ranging from 40% to 45%, surpasses its oil content. Even after oil extraction, the protein content remains substantial, making it an excellent source of nutrition.

However, the use of soybean as a food source is limited due to the presence of anti-nutritional factors, such as the Kunitz trypsin inhibitor (KTI), and undesirable compounds like lipoxygenase (LOX2) that contribute to a beany flavour.

To overcome these limitations, researchers have developed soybean varieties free from KTI (e.g., NRC 127, MACSNRC 1667), LOX2-free (e.g., NRC 132), and varieties that are both KTI and LOX2 free (e.g., NRC 142 & NRC 152). Additionally, efforts have been made to develop medium oleic varieties (e.g., NRC 147) with approximately 42% oleic acid content, which enhances the shelf life of soybean oil.

Challenges

While soybeans have numerous advantages, their thin seed coat and loose attachment to the seed make them susceptible to mechanical damage during harvesting and post-harvest operations. Losses in seed germination can occur as a result of these mechanical forces. Varieties with high lignin content have been found to have stronger seed coats, but they also pose challenges during processing and utilization.

Currently, soybean cultivation in India is concentrated in Madhya Pradesh, Maharashtra, and Rajasthan. However, promising results from multilocation yield evaluation trials conducted under the All India Coordinated Research Project on Soybean (AICRP-Soybean) indicate the potential for expanding soybean cultivation to other states. The states of Punjab, Haryana, Uttar Pradesh, Bihar, and Orissa have shown high seed yields in these trials, encouraging the adoption of soybean cultivation as an alternative to paddy cultivation. Short maturity duration varieties may be particularly suitable for Bihar and Orissa.

Intercropping Of Soybean With Sugarcane

Additionally, intercropping of soybean with sugarcane has been successfully established in Karnataka (Belagavi) and Maharashtra (Kolhapur) during the spring season, thanks to the efforts of the Indian Institute of Soybean Research (IISR) in Indore. These initiatives highlight the need for intensive extension efforts by state governments to introduce soybean and demonstrate its benefits to farmers.

Need For Comprehensive Extension Programs

There is still a significant yield gap of 428 kg/ha between farmers' practices and improved practices, highlighting the need for comprehensive extension programs. Developing photo-insensitive varieties with varying maturity durations, resistance to post-harvest sprouting (PHS), high oleic acid content in oil, and food-grade quality is a priority. Such varieties can be tailored to fit specific regional cropping systems and consumer preferences.

To support the growth of the soybean industry, strong collaboration among industry stakeholders, state agricultural departments, seed production agencies, and policy planning is essential. Ensuring fair pricing and efficient procurement systems will incentivize farmers to increase soybean cultivation and contribute to India's food security and economic prosperity.

In conclusion, the use of soybean for food security in India has the potential to significantly impact the agricultural landscape and economy. With continuous efforts in developing high-yielding varieties, addressing nutritional limitations, and expanding cultivation to new regions, India can harness the full potential of soybean to meet the nutritional needs of its population and contribute to global food security.

Dr. Ranjit Singh, Director (IC & PP), DA&FW
Ms. Richa Pathania, Consultant, AWG-G20
India

Making Agriculture Sustainable and Climate- Smart

Better Yield, Better Nutrition, Better Life

> In order to make agriculture productive, sustainable and remunerative, GOI through National Mission for Sustainable Agriculture aims to promote sustainable agriculture with major thrust on enhancing agricultural productivity, soil health management and synergizing resource conservation by promoting location-specific integrated/composite farming, soil & moisture conservation measures, efficient water management practices and main streaming of rainfed technologies

India is determined to achieve transformation in the agriculture sector that is not just productive but also regenerative and focuses on providing food security to its citizens.

Agriculture is sustainable when it meets the food needs of the existing and future generations, while ensuring profitability, environmental health, and economic growth. As per the FAO, "Sustainable agriculture practice nurtures healthy ecosystems and supports the sustainable management of land, water, and natural resources while ensuring world food security". Modern farming practises, to meet the food requirements of the expanding population relied on fertilizers, chemical pesticides, and unsustainable farming practices. This led to the depletion of water reservoirs due to the excessive use of water for irrigation, increased usage of fertilizer and pesticides for bulk production which further led to the loss of soil nutrients and biodiversity loss.

Demand For Sustainable, Resilient, Climate Smart Agriculture Practices

We have been witnessing climate change extremes like heatwaves, floods, forest fires that are severely impacting the agricultural sector, threatening food security, nutrition, and livelihood of the people. Global Warming and emission of Green House Gases and CO_2 emissions at very high levels are also negatively impacting the crop grassland quality and harvest stability.

These challenges faced by the farming community have given a rise to the demand for sustainable, resilient, and climate smart agriculture practices. To ensure food availability sustainable measures like a shift in the pattern of sowing of crops are being considered and focused efforts are being made towards cultivation of climate resilient crops like millets apart from wheat, maize & rice.

In order to make agriculture productive, sustainable and remunerative, the Government of India through National Mission for Sustainable Agriculture (NMSA) aims to promote sustainable agriculture with a major thrust on enhancing agricultural productivity, soil health management and synergizing resource conservation by promoting location-specific integrated/ composite farming, soil & moisture conservation measures, efficient water management practices and main streaming of rainfed technologies.

Holistic, Sustainable Development Of Rainfed Areas

The government is prioritising the holistic and sustainable development of rainfed areas by efficient use of water management at the farm level through Per Drop More Crop (PDMC) and Rainfed Area Development (RAD). The adoption of micro-irrigation system at the farm reduces water consumption, power consumption, and fertilizer consumption and increases crop productivity. The implementation of agroforestry will help in Carbon Sequestration and creation of additional source of income for farmers by planting trees including fruits and timber species. Organic farming is being promoted to maintain and improve the soil fertility, conserve natural resources, and produce chemical free and nutrient rich food.

To mitigate the adverse effect of climate change, the government is in the phase of implementation of climate-smart agricultural practices to enhance production and provide better yield, better nutrition, and better life. There is a rapid application and adoption of Emerging technologies and advanced digital solutions in Indian agriculture to become climate smart.

Promotion of Precision Agriculture

The use of drones is being promoted as part of precision agriculture. GPS technology is used for spraying pesticides, to achieve higher bio-efficiency and reduce manual labour. For Crop protection, the use of Geographic Information Systems (GIS) and remote sensing helps in providing accurate information about weather forecasts and extreme temperature fluctuations. This further helps in collection of crop production related data, its mapping and analysis.

The advanced technologies in crop physiology, molecular biology and genetics will help to deal with better understanding of the abiotic stress like heatwaves, drought, soil salinity, metal toxicity and nutrient deficiency which affects the crop productivity.

The above initiatives and programmes like promotion of millets farming by the Government of India and declaring of 2023 as the International Year of Millets by the UN is another major step towards promoting sustainable farming, crop cultivation in adverse & changing climatic conditions, achieving food security and providing a source of remuneration to the farmers.

STRATEGY FOR AGRI PROSPERITY

Reaping the benefits of agri-value chains for poverty reduction

The importance of agriculture and allied sector in India's growth can be understood by the fact that in 2022-23, the share of Gross Value Added (GVA) of the sector in the total economy stood at 18.3%. The sector also provides livelihood opportunity to approximately 55% of people. Compared to the other sectors the growth in the agricultural sector has been found to be two to four times more effective in raising the income among the poorest.

Compared to other sectors, agriculture uses a higher proportion of labour who does not have skills. As a result, when this sector experiences growth, it leads to increase in rural wages and creation of more jobs. Supporting agricultural activities can enhance economic prosperity and help in reducing poverty.

Improved Linkages

The agri-value chains are key to unlocking these opportunities. The development of value chains has been conceived as one of the important strategies that bring efficiency to the agricultural sector. Research like that of ADB (2012), Najera (2017), Oingali Prabhu et al (2019)- have shown that value chains have improved the linkages between poor farmers and the buyers which have been beneficial for the smallholder farmers.

The focus on agricultural value chains has increased in the last few decades as an understanding has emerged that these chains can not only fight against the challenge of food security but also can help in poverty reduction. The improvement in transport and logistics, innovation in processing, and sourcing of agricultural products from different parts of the world have paved the way for the growth of agri value chains.

The growing preference of consumers for healthy and safe food has significantly bolstered this concept, amplifying its economic viability and attractiveness. The urban population is a major consumer of the world's food supply. The income growth is leading towards dietary transition. The urban consumers are shifting from cereals to high-value fish, meat, dairy products, and processed foods to name a few. This is opening some new avenues for value addition of agricultural products.

Boost For The Economy

The food systems are transforming and with the emergence of small and medium enterprises in processing, transportation, and distribution the rural poor can be included in different operations. Many of these are labour-intensive. They lead to employment multipliers in rural areas and small towns.

The sector has the potential to create non-farm employment. The non-farm employment opportunities are considered important for low-income contexts.

In India the climatic conditions favour the farmers to produce fruits and vegetables. These have high potential for value addition and once processed and marketed the value of the final products can be increased.

However, a major challenge has been that the smallholders who have little land, human capital, and limited access to finance, market, and services are often poorly integrated into the agri-food value chains.

Importance Of FPOs, SHGs

To reap the benefits of agri-value chains for poverty reduction, it is equally important that higher prices being paid by the consumer trickle down to the farmers. Here the farmers' Producer Organizations (FPO) and Self-Help Groups (SHG) can play an important role in not only helping them achieve economies of scale but also increase their bargaining power.

Productivity growth among the smallholders is an important step for poverty reduction. This can be achieved through use of modern technologies.

The digital technologies like artificial intelligence can help in efficient use of resources like water in the production. Blockchain, internet of things and other information and communication technologies can help in improving traceability, quality and information security in addition to increasing overall efficiency.

Also, the development of downstream activities helps provide opportunities for inclusive development.

> "The improvement in transport and logistics, innovation in processing, and sourcing of agricultural products from different parts of the world have paved the way for the growth of agri value chains

Sustainable Agri Value Chains

The inclusion of women and the growing number of youths into food system jobs can raise productivity and improve social harmony. The fruits, dairy and millets value chains can offer a large number of jobs and through their skill enhancement. Keeping in view the requirement of these value chains, a large number of jobs can be created.

The agri value chains also need to be sustainable to uplift the livelihoods of the poor and address different global challenges like food security, revitalization of rural and urban economies, and domestic growth. In India, in the last few years, there has been increasing emphasis on the development of efficient value chains and as a result, many innovative and successful value chains have come up.

Dr. Prem Chand

Senior Scientist (Agricultural Economics), ICAR-National Institute of Agricultural Economics & Policy Research, Pusa, New Delhi and Abhijeet, Consultant, AWG-G20 India

Biologicals for Soil Health Revival and Sustainable Agriculture

Introduction:

Soil health is vital for life on Earth, depending on microorganisms and their environment. The soil microbiome transforms organic matter, aiding plant growth. Healthy soil means better nutrition and well-being. Unsustainable practices like excessive and imbalanced fertilization, intensive ploughing, mono-cropping, burning of residues, and high cropping Intensity disrupt this balance, causing biodiversity loss and degradation. To ensure food security, prioritize sustainable soil management, and restore agro-ecosystem health.

Soil Health Status in India:

Globally, 30-75% of organic matter is lost in soils, while in India, soil organic carbon has declined from 1% to 0.3% in the last 70 years. The FAO warns that without organic matter, the soil becomes lifeless, posing a threat to cultivation and our future harvests.

	Soil Nutrient Status - % area under Low/Medium/High Category		
Nutrients	Low	Medium	High
N	59	36	
P	49	45	
K	9	39	52

Widespread deficiencies of S and micro-nutrients (Fe, Zn, Mn, and B) are reported. Depleted soils cannot be expected to produce bumper crops. Additionally, the nutrient application pattern is skewed, focusing more on nitrogen instead of balanced fertilization.

Soil Restoration through Microbial Solutions:

Similar to soil analysis done for nutrient management, understanding the role of microbial life in improving nutrient use efficiency through solubilisation (Phosphorus Solubilizing Bacteria), mobilization (Potash Mobilizing Bacteria), and increasing root absorption area (VAM) for better nutrient plant uptake is becoming more important. Mycorrhizal fungi produce organic “glues” that bind soils into aggregates, improving soil structure and porosity overall. Nitrogen-fixing bacteria (Azotobacter and Rhizobium) can partly supplement the nitrogen requirement and lessen the subsidy burden on the government.

Sustainable Soil Management Pillars:

1) Boost microbial biodiversity in the soil.

2) Replace what is removed from the soil.

3) Achieve more crop per drop.

4) Achieve more crops per unit of nutrient application.

5) Implement site-specific crop management.

6) Adapt cropping patterns to agro-climatic conditions.

Soil Health Protection:

The All India Network Project on Soil Biodiversity and the National Mission on Sustainable Agriculture (NMSA) promote the usage of bio-fertilizers, but the government may need to enact laws to protect soil health. Farmers should be rewarded for improving organic matter in their land, carbon sequestration, strengthening soil biodiversity, improving crop quality, and reducing GHG emissions. Soil health education should be included in school curricula to educate children about the importance of soil and how it shapes human life.

IPL Biologicals Limited stands as a trusted leader in the field of biological solutions. With a remarkable legacy of 28+ years, we proudly showcase a diverse range of 50+ innovations, accompanied by 6 granted patents and products registered under CIB, certified by IMO, IndoCert & OMRI. Our world-class TIC Centre in Gurgaon, India, houses a modern and state-of-the-art R&D facility that has earned recognition from the DSIR, Ministry of Science & Technology, and the Government of India.

Our unwavering commitment lies in amplifying revolutionary microbial solutions. Leveraging our extensive network of 5000+ dealers, we consistently drive progress in agriculture, benefitting over 25 lakh farmers across India and the international market.

Authored by:

Dr. Narendra Pal Gangwar

IPL Biologicals Limited

M2K Corporate Park, Sector 51,

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ICLeaf: A New Approach to Season-Long Data

What is ICLeaf?

Opening new opportunities for precision farming and higher yields in India! Modern agriculture and growing demand in global food needs necessitate improved crop production methods. That's where ingenious agriculture, powered by big data analytics and information, comes into play.

We're excited to bring ICL's newest digital suite to India: ICLeaf. ICLeaf is a cutting-edge diagnostics technology that will provide farmers with a personalized prescription for increasing productivity. In addition, to allowing farmers to make quick and data-driven decisions, the tool examines 10 different elements in a leaf sample and them provides accurate, real-time feedback and recommendations regarding nutrient use.

Results are also available quickly, as opposed to several weeks with traditional methos.

Agronomists and farmers have long been collecting site-specific data to understand nutrient availability and needs. Soil analysis has been a common method of understanding site-specific needs. But it represents a very small area of soil, which may not be representative of the soil near the plant's roots, where the nutrients are needed.

Leaf tissue analysis has been an option for supplemental data, but has been a lengthy process – sometimes taking up to three weeks for results. In the waiting time for the plant leaf analysis, plant growth occurs and nutritional needs can change drastically. Leaf nutrient analysis used to be an expensive and slow endeavor.

With ICLeaf, a new approach to testing makes leaf tissue analysis fast and cost-effective, adding a new tool to the agronomist's toolset for data-driven decisions. Leaves, petioles, fruits, and more can now be tested to learn more about the growing plant's nutrition needs and adjust plans accordingly.

Cotton, tomatoes, grapes, pomegranate, and bananas are all compatible with ICLeaf today, with sugar cane coming soon. Ultimately, the sky's the limit for the crops that will someday benefit from precise nutrition through this fast, effective leaf nutrient analysis.

A single agronomist, armed with ICLeaf, can now be a single point of contact with a full support package for growers. Managing samples, providing recommendations, and supporting the implementation of those recommendations can all be done by one agronomist, whose relationship with their growers will be strengthened.

How does ICLeaf work?

ICLeaf was created by taking existing, approachable tools – infrared x-ray technology – that can measure a spectrum and then calibrate the spectrum to address the analysis. This calibration allows plant leaf analysis to have consistent, accurate results regardless of lab. Machine learning was used to learn the nutrient elements and the crops at a very high level of accuracy.

The deviation between labs was overcome through innovative algorithms that transform chemical analysis into a spectrum of infrared and visual light that can be calibrated. This covers the 12 essential elements and heavy metals, which can influence food safety and sustainability. This unique approach reduces variability between labs, including those that are in different countries.

ICLeaf can be integrated into other systems, too. The hope is to integrate with other systems to improve support at the farm level. For example, through remote sensing, ICLeaf and data-driven decision support systems would grow beyond nutrition and into plant protection, irrigation, and other critical management aspects. Additional innovation is expected through the data collected from the field.

ICLeaf and Digital Crop Advisor

Agmatix's Digital Crop Advisor is a decision support tool to support the day-to-day work of growers' trusted advisors. The platform allows a few data points specific to the nature of the field and crop to determine the crop requirements and provides an optimized crop nutrition plan for agronomists to manage with their growers.

ICLeaf serves as the first stage of data collection to feed the Digital Crop Advisor with key information by identifying plant nutrient deficiencies. Stage two is fulfilling the nutrient requirements of the plant with the right products at the right rates and the right complexity.

This can mean fertigation or a foliar spread or broadcast application, or even a controlled-release fertilizer. Digital Crop Advisor helps translate the ICLeaf results into the right actions to address crop nutrition needs in a sustainable way.

With lab technology ICLeaf and Digital Crop Advisor together, it's possible to have precise inputs at the beginning of the season AND additional data, like soil, water, and leaf analysis, added throughout the season to adapt crop nutrition plans. This is key for improving soil health and farming in an environmentally sustainable way.

What are the key features of ICLeaf?

ICLeaf leverages protocols or templates that work as pre-made professional processes to determine the elements and products needed. These are dynamically changed based on site-specific attributes like altitude and soil pH.

Using plant leaf analysis at 4-7 points during the growing season, a prescription can be created based on the analysis results and other key data points. These analyses can be completed at critical points in the growing season when the farmer can adapt management practices.

This allows seasonal support for spoon-feeding precise nutrients to the crop instead of a single application of nutrients intended for yearly support. This approach is environmentally friendly and delivers the right nutrients to the crop at the right time to support it in reaching its full yield potential.

1700 farmers are currently experiencing the benefits of ICLeaf. Thousands of prescriptions have been created based on the data from this plant leaf analysis, and it's becoming possible to identify patterns of deficiency to proactively address plant nutrition. ICLeaf even supports fully remote crop nutrition. Right now, this is working well in India, where farmers are working with agronomy teams across different regions and different languages.

ICLeaf also supports the sustainable useability of products with different environmental sensitivity. For each prescription, it is possible to see a calculated carbon footprint. Based on this view, it is possible to change the product used in the prescription and see the corresponding change in carbon footprint for the field. To date, 140 kilograms of carbon have been saved per field through changes to product type leading to less runoff and other environmental impacts.

ICL and Sustainability

Maintaining soil health, environmental health, crop yield, and profitability is a balance. ICL is committed to supporting growers and agronomists in achieving success in all of these areas. Sustainability in agriculture is a core commitment for ICL and we are driven to develop technologies for a better future. High environmental standards and the best technologies are the foundation of ICL's sustainable approaches.

From controlled-release fertilizers to plant biostimulants, ICL's innovations are shaping a better and more sustainable future. These technologies address long-term goals such as addressing food scarcity and maintaining natural resources to support a growing population.

Through technologies like ICLeaf that work to identify plant nutrient deficiencies to allow data-driven decision-making on an ongoing basis throughout the growing season, growers and agronomists can take impactful steps to protect the environment while producing for a growing world.

Elad Aharonson, president of Growing Solutions for ICL says "ICLeaf will help farmers gain greater visibility into their fields and maximize yields. This unique specialty service will assist farmers in planning for optimum nutrient management, by timely identifying deficiencies and enabling them to use the right products at the right time to improve yields and increase sales."

Dr. Sagi Katz, VP of Agronomy at Agmatix.

Dr. Sagi Katz has practiced agriculture since he was young. He holds a Ph.D. in Soil and Water Science specializing in the ecosystem of biofilms in treated wastewater usage for agriculture practices. He has been working in the agri-tech ecosystem for many years and collected a vast amount of knowledge and expertise. Sagi is the VP of the agronomy team at Agmatix, an ICL-owned digital agro informatics startup, and is responsible for the company's Ontology engine and leading the professional aspect of the company's products.

Anant Kulkarni, Country Lead-ICL India

Anant Kulkarni is country lead ICL- India played Important role in establishing this facility in India

"Efficiency in Agriculture input is going to be the major factor in creating profitable Agriculture and digital tools are going to lead this revolution.

ICL

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At ICL, we are committed to building a sustainable future, one harvest at a time. Our specialty fertilizers are designed to provide your crops with the precise nutrients they need, promoting healthy growth and optimal yields. But it doesn't stop there! Our products are formulated with the environment in mind, minimizing the impact on soil, water, and ecosystems.

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