₹80/-

AUGUST 2024

AGRICULTURE TODAY

The National Agriculture Magazine

VOLUME XXVII | ISSUE 8 www.agriculturetoday.in

Navigating Agriculture through Climate Challenges

Inside

- SPECIAL FEATURE ON CROP PROTECTION
- UNION BUDGET 2024
- 15TH AGRICULTURE LEADERSHIP SUMMIT REPORT

COVER PICTURE CREDIT - SNEHA KOPPULA

Publisher & Printer – Dr. MJ Khan on behalf of M/s Concept Agrotech Consultants Limited, Published from 306 Rohit house Tolstoy Road New Delhi-110001 and printed by Everest Press E-49/8, Okhla Industrial Area-II New Delhi-110020
Phone No. 011-23731129 Fax No.011- 23731130
E-mail: editor@agriculturetoday.in
info@agriculturetoday.in

www.agriculturetoday.in

Page in the magazine: 60

NATURALLY OPTIMISTIC?

The Union Budget 2024-25 had maintained its imperative on natural farming, since mentioning a variant of it in 2019. Since then, the government has maintained its trust in this *input sans* technique, and within two years, 1 crore farmers across the country are expected to be initiated into natural farming.

Natural Farming is a chemical-free farming system with major stress on biomassmulching, use of on-farm cow dung-urine formulations; maintaining soil aeration and exclusion of all synthetic chemical inputs. A nationwide transformation into this system may not be anytime soon on cards, the agenda of gradual transitioning to this stream is evident. How it will affect the yields or productivity of the nation is yet to be seen. For now, these are patch tests, that precedes wider application.

India is today the world's most populous country, and exports food grains to many countries. This is despite the challenges of staggering productivity on account of changing climate, dwindling resources and biotic and abiotic stresses. We also have an added responsibility of securing nutrition to our population as we do not fare well in hunger and nutrition indices. This puts an added burden on our research organisations to work and produce more from what we have. Also, to protect what we have produced. Around 30 % of what is produced is lost to pest and diseases. Appropriate crop protection can therefore increase one third of our production. Once we were dependent entirely on chemicals for crop protection, but thanks to continued research and development, there are many new avenues of crop protection techniques and products.

Biologicals which encompasses a gamut of products ranging from bio stimulants, biopesticides, botanicals, microbials are going to be a very important area in crop protection. In the 15th Agriculture Leadership Summit, held on 10-11th July, 2024, biologicals emerged as a very important solution in the fight against declining productivity and climate change.

It is indeed heartening to find that the budget has also put focus on raising productivity by developing climate resilient varieties and funding research in challenge mode. However, putting a lot of energy and resources on something like natural farming, whose output is variable and unpredictable, does not augur well for India. Our focus should be on those areas that can be justified scientifically. Others should be better left as niche. To think otherwise will be unnatural.

CONTENT

VOLUME XXVII | ISSUE 8 | AUGUST 2024

THE ROLE OF BIOSTIMULANTS IN CROP PROTECTION

Modern agriculture faces a significant challenge: increasing productivity to meet the global food demand while minimising environmental impact. As the agricultural sector evolves, innovative solutions are essential. Biostimulants are emerging as critical players in this transformation. Unlike traditional fertilisers that supply nutrients directly, biostimulants enhance plant growth and productivity by improving the plants' natural processes.

Market Scenario

The biostimulants market, encompassing humic substances, seaweed extracts, amino acids, microbial amendments, minerals, and vitamins, is valued at $4.3 billion globally in 2024. It is projected to grow to $7.6 billion by 2029 at a compound annual growth rate (CAGR) of 12.0% (MarketsandMarkets, 2023).

In Europe, the biostimulants market was valued between $1.5-2 billion in 2022, accounting for about half of the global market with a 10-12% CAGR. Biostimulants improve crop yields (5-10%), nutrient use efficiency, and stress tolerance (EBIC, 2023).The industry reinvests 3-10% of its turnover into research and development (R&D), with many products needing to be patentable, thus relying on extensive partnerships with research institutes globally.

The Indian biostimulants market is experiencing robust growth, driven by increasing demand for sustainable agricultural practices and organic farming. The market is projected to grow from USD 266.58 million in 2022 to approximately USD 849.76 million by 2030, with a compound annual growth rate (CAGR) of 15.61% during this period (6Wresearch) (SkyQuest Tech Consulting).

About the **AUTHOR**
Dr Minshad Ansari,
CEO and Founder,
Bionema Group Ltd, UK

Regulatory Perspective

According to the European fertilising product regulation, biostimulants include any substance that stimulates plant nutrition independently of the product's nutrient content, aiming to improve nutrient use efficiency, tolerance to abiotic stress, and availability of confined nutrients in the soil or rhizosphere. Similarly, the U.S. Agriculture Improvement Act of 2018 aligns with this definition, highlighting a global consensus on the role of biostimulants in agriculture.

Benefits of Biostimulants in Agriculture

Biostimulants significantly contribute to sustainable farming by enhancing plant resilience and nutrient uptake efficiency. They improve plant growth by stimulating natural processes that enhance nutrient absorption, improve stress tolerance against non-living factors such as drought and extreme temperatures, and boost overall plant vigour and health. This can reduce reliance on chemical inputs, thereby decreasing the environmental footprint of farming practices.

Types of Biostimulants and their Sources

Biostimulants are diverse in nature and origin, often derived from natural sources:

- **Amino Acids**: Provide protein building blocks that help in stress resistance and growth.
- **Seaweed Extracts**: Rich in micronutrients, they promote robust plant growth and stress resistance.
- **Humic Substances**: Improve soil fertility and plant growth.
- **Beneficial Microbes**: Microbial amendments that introduce beneficial bacteria and fungi into the soil are increasingly used. These microbes help in nutrient uptake, improve soil health, and protect against pathogens (Mordor Intel).
- **Arbuscular Mycorrhizal Fungi** (AMF): AMF form symbiotic relationships with plant roots, enhancing nutrient absorption and plant growth (Fortune Business Insights).
- **Sustainable Soil Amendments**: Biochar, a type of charcoal that enhances soil health, is being combined with biostimulants to improve soil fertility, water retention, and microbial activity (SkyQuest Tech Consulting).

KEY PLAYERS

COUNTRY	MAJOR GLOBAL PLAYERS
Spain	SEIPASA SA, AgriTechno, Sustainable AgroSolutions, AXEB Biotech SL, MAFA Bioscience
India	UPL, Rallies, PI Industries, Coromandel, T. Stanes, Biostadt
UK	OMEX, Bionema Group, Nufarm
US	Corteva, Gowan, FMC
The Netherlands	Koppert, Aminocore
Germany	BASF SE
Switzerland	Syngenta Crop Protection AG
Italy	ILSA S.p.A.
Japan	Sumitomo
Australia	LawreCo
Israel	Haifa Group

While biostimulants offer immense potential, challenges such as inconsistent regulatory frameworks and limited consumer awareness still need to be addressed.

Recent Developments - A Case Study from United Kingdom Golf Courses

Bionema, a leading biocontrol developer, harnesses naturally occurring bacteria from UK soil to create targeted plant health solutions. Their team of scientists conducted 11 field trials across different UK golf courses, consistently achieving superior results compared to existing solutions. This has positioned RootVita® SP as a top choice for turf professionals, including greenkeepers, grounds managers, and sports field curators.

Composition and Mode of Action

RootVita® SP combines biofertilisers, plant growth-promoting rhizobacteria (PGPR), mycorrhizae, essential nutrients, and vital vitamins into a potent natural product. Key microbial ingredients, such as *Paenibacillus azotofixans* and *Bacillus mucilaginosus*, play critical roles in nitrogen fixation and phosphorus solubilisation.

Results: Impact on a Golf Course

A field trial on a golf course where RootVita® SP was applied at 250 g per hectare in 600 litres of water showed remarkable turf improvements 45 days after application:

- **11% Increase** in shoot and root length.
- **58% Increase** in shoot and root biomass.
- **Significant Improvement** in grass density and vigour compared to control plots.

RootVita® SP redefines turf management with its innovative formulation and proven effectiveness. It enhances turf health and resilience and promotes sustainable management practices. The documented benefits and case study results affirm RootVita® SP as an essential asset for turf professionals aiming to maintain high-quality turf standards. Ongoing research will continue to explore the long-term benefits and potential new applications of RootVita® SP, aiming to refine and enhance its efficacy for diverse turf management challenges.

Regulatory and Market Trends

The regulatory landscape for biostimulants is still developing, with significant variations between regions. In the EU, biostimulants are treated as plant protection products, whereas in the U.S., they are regulated as agricultural amendments. Despite these differences, the global biostimulant market is increasing, driven by the demand for sustainable farming practices.

Challenges and Future Prospects

While biostimulants offer immense potential, challenges such as inconsistent regulatory frameworks and limited consumer awareness still need to be addressed. Future research will likely focus on identifying specific physiological functions affected by biostimulants and optimising formulations for various crop types.

Biostimulants represent a critical advancement in sustainable agriculture. Enhancing plants' natural capacities improves productivity and resilience and contributes to a more sustainable environmental footprint. As the agricultural sector evolves, biostimulants will be increasingly important in ensuring global food security and sustainability.

CROP PROTECTION APPROACHES IN THE CONTEXT OF CLIMATE CHANGE

Higher concentration of CO2 in the atmosphere due to increasing emissions of Green House Gases (GHG) is the leading cause for significant changes in climatic conditions – temperature and rainfall - across different regions of the globe. All three variables - CO2 concentration, temperature, rainfall - have profound impact on plant growth and reproduction, and consequently, on crop productivity, and ultimately, on food production. Indian agriculture specifically is highly vulnerable to climate change as the sub-continent is expected to experience higher heat intensity and skewed distribution of rainfall. In this scenario, agricultural productivity could be affected by higher prevalence of pests, weeds, insects, and pathogens.

Higher CO2 concentration is likely to increase the foliage in plants and therefore offer more area for spore germination and pathogen infection.

Weeds

Most of the cultivated crops are C3, while majority of the weeds are C4. As higher CO2 concentrations promote photosynthesis, C3 plants will have an advantage over C4 weeds. However, with the combination of higher CO2 levels and elevated temperatures, this advantage will be negated as photosynthesis in C4 plants is favoured under hot conditions. If drought is considered as an additional consequence of climate change, the weeds will have the dominant position as they are hardier. Warmer temperatures are also likely to lead to extension of geographical boundaries of weeds. Hence, spread of weeds to new regions will be an emerging threat.

Some of the approaches to weed management under the scenario of climate change can be – 1) breeding of cultivars which offer competition to weeds 2) crop rotation and intercropping as certain crops produce allelochemicals which fight against weeds 3) optimization of seeding rate and row spacing to reduce the access of nutrients to weeds 4) use of agricultural robots for removal of weeds 5) nano formulations of herbicides for targeted application on weeds at low dosages 6) biological control of weeds 7) new herbicides based on RNA interference technology 8) Integrated Weed Management incorporating chemical and non-chemical solutions.

About the **AUTHOR**

Amit Rastogi
Executive VP and CTO,
Coromandel International Limited

Insects

Temperature is the main climatic variable which affects insects. Warmer temperatures will lead to increase in insect pests because of 1) higher population growth rates and more generations per season 2) expansion of geographical range to temperate regions 3) lower kill during winters. Changes in nutrient composition of plants due to higher CO2 concentration will also affect the host-insect interactions. At higher CO2 levels, the C/N ratio in leaves is expected to increase due to higher carbohydrate concentration. While this will increase the consumption rate of leaves by chewing insects, it may still not satisfy their N requirement, and consequently, insect population growth may decrease or remain the same. However, there will be increase in density of sucking pests who can fulfil their N needs from the phloem. Thus, the impact of higher CO2 levels will be different for chewing and sucking insects.

Some of the approaches to manage the emerging threats from insects under altered weather conditions are – 1) predictive modelling of insect populations and altering the planting dates so that there is poor synchrony between the stages of insect attack and peak insect density 2) understanding the impact of climate change on natural enemies of insects and ensuring there is synchrony between their effective period and insect life cycle 3) balanced N fertilization to ensure proper C/N ratio in plants 4) application of potassium and silicon to increase resistance in crops 5) ensuring healthy soils to provide resistance through endophytes 6) development of hybrids with higher resistance 7) shorter duration crops to reduce likelihood of insect attack 8) Integrated Pest Management (IPM) which incorporates chemical and biological control measures.

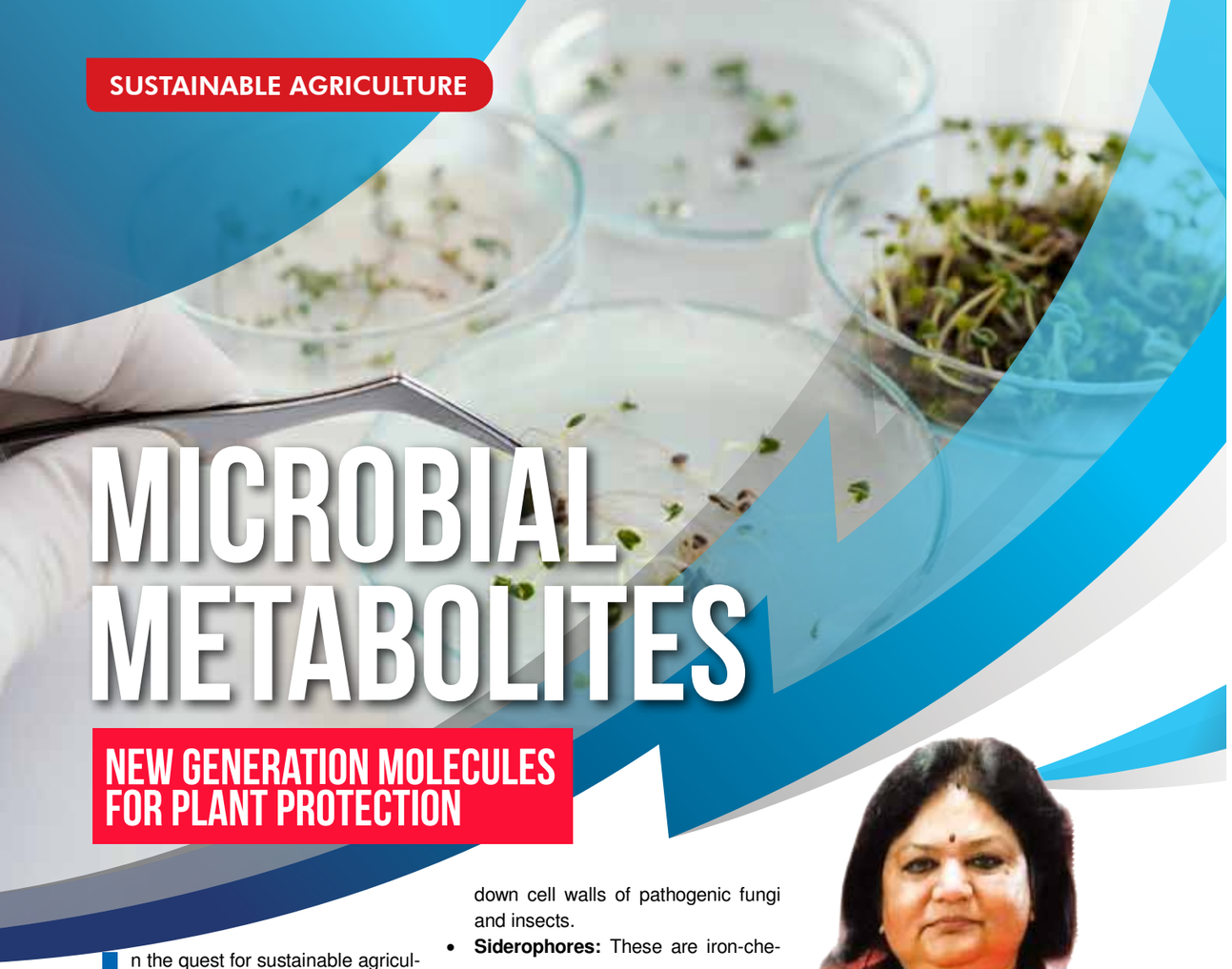
At higher CO2 levels, the C/N ratio in leaves is expected to increase due to higher carbohydrate concentration.

Pathogens

Pathogens can either be fungi, bacteria, or viruses. Higher temperatures in future can lead to more widespread fungal infections for the following reasons – 1) accelerated reproduction rate 2) increased spore germination 3) activation of dormant species 4) survival during off-season 5) introduction to cooler areas. Higher temperatures can lead to mutant strains of bacteria which are more virulent. Warmer temperatures are likely to increase the population of vectors, and therefore increase the chances of viral infections, as viruses reach the plants through vectors. Higher CO2 concentrations is likely to increase the foliage in plants and therefore offer more area for spore germination and pathogen infection. Higher CO2 concentration and elevated temperatures are also likely to produce morphological changes such as smaller stomatal openings which will reduce the uptake of fungicides. Also, the application of fungicide per area of the leaf will be lower.

Some of the approaches to manage the threat of greater disease prevalence due to climate change are – 1) crop breeding to provide disease resistance due to R genes 2) changing the planting dates to avoid periods of high disease propensity 3) new types of fungicide which are effective with morphological changes in the plant with respect to leaf area and stomatal openings 4) use of bio-control agents which are adapted to harsher conditions 5) development of disease prediction models so that agronomic practices can be adopted to minimise the likelihood and impact of infections. 6) crop breeding for tolerance to abiotic stress as this helps in resisting biotic stresses.

The more severe climatic conditions in future are likely to enhance the threats to agriculture from pests – weeds, insects, and pathogens.



MICROBIAL METABOLITES

NEW GENERATION MOLECULES FOR PLANT PROTECTION

In the quest for sustainable agriculture, the spotlight is increasingly shifting toward natural and environmentally friendly solutions. One such promising avenue is the use of microbial metabolites for plant protection. Microbial metabolites, the diverse chemical compounds produced by microorganisms, hold immense potential as biopesticides, growth enhancers, and agents that can bolster plant resilience against various stresses.

Types of Microbial Metabolites

- **Antibiotics:** These are compounds that can inhibit the growth of or kill other microorganisms. Examples include penicillin, streptomycin, and tetracycline.
- **Enzymes:** Microorganisms produce various enzymes that can degrade plant pathogens or enhance plant nutrient availability. For instance, cellulases and chitinases can break down cell walls of pathogenic fungi and insects.
- **Siderophores:** These are iron-chelating compounds that help in scavenging iron from the environment, thereby depriving plant pathogens of this essential nutrient.
- **Phytohormones:** Some microbial metabolites mimic plant hormones like auxins, gibberellins, and cytokinins, promoting plant growth and development.
- **Volatile Organic Compounds (VOCs):** These are low molecular weight compounds that can have antimicrobial properties or act as signalling molecules to induce plant defences.

Utilizing microbial metabolites aligns with sustainable agricultural practices, promoting soil health and biodiversity.

About the **AUTHOR**

Nutan Kaushik,
DG, Amity Food and Agriculture Foundation

Mechanisms of Plant Protection

Microbial metabolites protect plants through various mechanisms:

Antagonism: Some metabolites have direct antimicrobial activity, inhibiting the growth of plant pathogens. For example, antibiotics like bacitracin and iturin produced by Bacillus species can target fungal pathogens.

Induced Systemic Resistance (ISR): Certain metabolites can prime plant immune responses, enhancing their ability to fend off a broad spectrum of pathogens. Pseudomonas fluorescens, for instance, produces metabolites that trigger ISR in plants.

Competition: Microbial metabolites can outcompete pathogens for resources such as nutrients and space, thereby reducing pathogen proliferation.

Biofilm Formation: Some beneficial microbes form biofilms on plant surfaces, acting as a physical barrier against pathogens.

Detoxification: Certain metabolites can degrade or neutralize toxins produced by pathogens, thus mitigating their harmful effects on plants.

Benefits of Microbial Metabolites

The use of microbial metabolites in plant protection offers numerous benefits:

- **Eco-Friendly:** Being natural products, microbial metabolites are biodegradable and have minimal environmental impact compared to synthetic chemicals.
- **Target Specificity:** Many microbial metabolites target specific pathogens, reducing the risk of harm to non-target organisms, including beneficial insects and microbes.
- **Reduced Resistance Development:** Pathogens are less likely to develop resistance to complex natural metabolites compared to single-mode-of-action synthetic pesticides.
- **Sustainability:** Utilizing microbial metabolites aligns with sustainable agricultural practices, promoting soil health and biodiversity.
- **Safety:** These metabolites are generally safe for humans and animals, reducing the risk of toxic residues in food products.

Advancements in genetic engineering allow for the manipulation of microbial genomes to enhance metabolite production and efficacy

Innovations in Microbial Metabolite Research

The future of microbial metabolites in plant protection is bright, with several innovative approaches on the horizon:

Genetic Engineering: Advancements in genetic engineering allow for the manipulation of microbial genomes to enhance metabolite production and efficacy. CRISPR-Cas9 technology, for instance, can be used to create strains with optimized biosynthetic pathways for desired metabolites.

Microbiome Engineering: Understanding and manipulating the plant microbiome to favor beneficial microbes that produce protective metabolites is an emerging field. This approach can create a natural shield around plants, enhancing their resilience to pathogens and environmental stresses.

Metabolomics and Synthetic Biology: Advanced techniques in metabolomics and synthetic biology enable the discovery and synthesis of novel metabolites with tailored properties. This can lead to the development of next-generation biopesticides and biostimulants with superior performance.

Nanoformulations: Encapsulating microbial metabolites in nanocarriers can improve their stability, bioavailability, and targeted delivery, enhancing their effectiveness in field applications.

Smart Delivery Systems: Innovations in delivery systems, such as smart coatings for seeds and slow-release formulations, ensure that microbial metabolites are available to plants when needed the most.

Microbial metabolites represent a frontier in sustainable agriculture, offering a natural and effective solution for plant protection. By harnessing the power of these compounds, we can move towards a future where crop production is not only high-yielding but also environmentally friendly and resilient to the challenges posed by climate change and evolving pathogens. Continued research, technological advancements, and supportive policies are essential to unlock the full potential of microbial metabolites, paving the way for a new era of agricultural innovation.

Commercially Manufactured Microbial Metabolite-Based Biopesticides

Microbial metabolites have been harnessed to develop a variety of biopesticides that are currently available in the market. These products are derived from microorganisms such as bacteria, fungi, and actinomycetes and are used to control a range of pests and diseases in agriculture. These biopesticides offer a safer, environmentally friendly alternative to traditional chemical pesticides. Their adoption is increasing as farmers and agricultural professionals seek sustainable and effective solutions for pest management.

ENHANCING FOOD SECURITY

Through advanced crop protection solutions

Crop protection safeguards around 30% of global yields, equating to 550 million tons of food for over 2 billion people. Today, the convergence of advances in life sciences, digital technologies, and data science is transforming crop protection innovation, ensuring farmers can respond quickly and safely to threats. Target-based and profile-driven discovery allows us to design new crop protection solutions that achieve unprecedented levels of precision, safety, sustainability, and efficacy.

Since the dawn of the 21st century, we have seen significant advancements in agricultural technology, revolutionizing traditional farming practices. Today's farmers, including new-generation farmers, leverage innovative tools and techniques that enhance productivity and sustainability. Crop protection is at the heart of this shift. Without effective crop protection solutions, a significant portion of the food that farmers grow would be lost to pre-harvest pests.

Estimates from the Food and Agriculture Organization (FAO) state that up to 40% of food crops are lost due to plant pests and diseases annually. These losses not only threaten global food security but also have the potential to limit food access due to unavailability or sharp increases in food prices. Crop protection chemicals (CPC) play a crucial role in preventing crop losses both before and after harvesting. These solutions are vital for ensuring that the hard work of farmers translates into abundant harvests that can meet the global demand for food, besides enhancing their quality of life.

Key Trends in Farming Practices and Crop Protection

Advancements in data analytics and digital technologies are enabling researchers and farmers to build a more productive and resilient global food system. Digital tools are unlocking new possibilities in crop protection and plant breeding. For instance, Bayer scientists can now design new crop protection molecules with specific performance, safety, and sustainability profiles, resulting in the discovery of the first new herbicide mode of action in 30 years.

Accelerating the introduction of new technologies in crop protection and biotechnology is essential for matching the pace of agricultural advancements seen in other nations.

Cloud computing and data management solutions are connecting sustainable practices on farms with the food, feed, fiber, and fuel value chains, creating greater transparency for consumers. Bayer's strategic partnership with Microsoft is advancing solutions that address this growing societal demand, supporting sustainable sourcing, manufacturing, and supply chain improvements, as well as ESG monitoring and measurement.

Digital tools are helping farmers produce more with fewer resources, enabling real-time, data-driven decisions. Drones, for example, can identify weeds, pests, and diseases, allowing for localized application of crop protection chemicals. In regions like China and Southeast Asia, farmers are already benefiting from these technologies. Drone usage for crop protection has also been initiated in India, led by Bayer. In November 2021, we successfully conducted our first drone trial at a multi-crop breeding center in Chandipa, near Hyderabad. This initiative not only aids farmers but also supports Farmer Producer Organizations (FPOs) and progressive farmers. Furthermore, Bayer is empowering entrepreneurs by providing machinery, product knowhow, business support, and training on drone usage, thereby fostering a new wave of agricultural innovation and efficiency.

About the **AUTHOR**

K. Muthu, Crop Protection Lead, Crop Science Division Bayer in India, Bangladesh & Sri Lanka

Strengthening Smallholder Farmers

Bayer's global "Farmer Voice Survey" with a special smallholder deep dive on smallholder farmers in India, conducted last year, underscores the pressing need for enhanced crop protection products tailored to farmers' needs. According to the survey, smallholders in India face significant challenges due to changing weather conditions. They anticipate increased crop failures (43%), reduced crop yields (42%), and higher pest pressures (31%). Consequently, top priorities for these farmers include risk mitigation measures like crop insurance and the latest crop protection technologies (26%). The survey also revealed that 60% of over 2,000 smallholder farmers would benefit most from access to digital technologies and modern crop protection solutions.

Bayer's global "Farmer Voice Survey" with a special smallholder deep dive on smallholder farmers in India, conducted last year, underscores the pressing need for enhanced crop protection products tailored to farmers' needs.

Bayer's approach to strengthening smallholder farmers is deeply embedded in our commercial strategies. We are expanding our product and service portfolio for smallholder farmers, which includes integrated pest management with customized crop protection solutions, innovative business models and digital solutions. These solutions range from digital farming and market access to modified product portfolios and biotechnological advancements. We aim to create market models that reduce business risks for all partners in the value chain, including smallholder farmers, helping them gain access to the agricultural value chain, increase productivity and income, and build resilience to ensure long-term food security.

The "farmer voice" survey has revealed that farmers worldwide generally have a shared perspective on current challenges and future prospects, with climate change and economic pressures being primary concerns for everyone. This means that farming solutions and advancements should be sustainable and address these critical issues effectively. At Bayer, sustainability is at the heart of everything we do, aligning perfectly with the need for advanced yet regenerative agricultural practices. Our commitment to innovation and collaboration with farmers aims to build a world where hunger and climate change are terms relegated to history. Through innovative solutions that promote regenerative, low-emission and resilient farming, we help to protect the climate, the environment and biodiversity. By pursuing new agricultural possibilities, we address some of humanity's biggest challenges, working towards a more sustainable future for all.

India, especially has the potential to improve the productivity and quality of its crops, particularly in horticulture, for both domestic and export markets. Creating end-to-end crop value chains with focused state clusters and strong linkages to Farmer Producer Organizations (FPOs) is crucial for success. Accelerating the introduction of new technologies in crop protection and biotechnology is essential for matching the pace of agricultural advancements seen in other nations. This requires a holistic regulatory regime encompassing breeding, crop protection, and biotechnology. There has been a paradigm shift in farming practices, with farmers increasingly adopting tailored crop protection solutions, innovative technologies, and sustainable methods. A deep commitment to supporting farmers with these advancements is needed to ensure that we continue to enhance global food security and build a resilient agricultural system for the future.

BIO SOLUTIONS

A FUTURE PATH FOR CROP PROTECTION

Unlike broad-spectrum chemical pesticides that can harm non-target species and disrupt natural ecosystems, bio solutions are often species-specific and more selective in their action, minimizing collateral damage and promoting biodiversity.

In the realm of agriculture, the quest for sustainable and environmentally friendly solutions to ensure crop protection and enhance productivity has never been more crucial. As the world faces the challenges of climate change, soil degradation, and the need to feed a growing population, the traditional methods of crop protection using chemical pesticides are increasingly being scrutinized for their harmful effects on ecosystems, human health, and the long-term viability of agricultural systems. In this context, bio solutions emerge as a promising alternative, offering a path towards a more sustainable and resilient future for crop protection in agriculture.

Bio Solutions

Bio solutions, also known as biological control methods, involve the use of living organisms or natural substances to manage pests, diseases, and weeds in agricultural systems. These solutions harness the power of nature's own mechanisms to suppress or control harmful organisms, thus reducing the reliance on synthetic chemicals and minimizing the negative impact on the environment. Bio solutions encompass a wide range of approaches, including biopesticides, biofertilizers, plant extracts, beneficial insects, and microbial agents, all of which offer innovative strategies for sustainable crop protection.

One of the key advantages of bio solutions is their ability to target specific pests or diseases while preserving beneficial organisms and maintaining ecological balance in agroecosystems. Unlike broad-spectrum chemical pesticides that can harm non-target species and disrupt natural ecosystems, bio solutions are often species-specific and more selective in their action, minimizing collateral damage and promoting biodiversity. By leveraging the natural enemies of pests, such as predators, parasitoids, and pathogens, bio solutions can provide effective and long-lasting control measures without compromising the health of the environment.

About the **AUTHOR**

Debabrata Sarkar,
Vice President-Asia Pacific,
AlgaEnergy

Biopesticides

Biopesticides, a prominent category of bio solutions, are derived from natural sources such as plants, microbes, and insects, and offer a sustainable alternative to synthetic chemical pesticides. These products can be used to manage a wide range of pests, including insects, mites, nematodes, and pathogens, with varying modes of action that disrupt pest development, feeding behaviour, or reproduction. Biopesticides are often biodegradable, low in toxicity, and pose minimal risk to human health and the environment, making them an attractive option for integrated pest management (IPM) programs that combine multiple tactics for sustainable crop protection.

Biofertilizers

In addition to biopesticides, biofertilizers represent another important bio solution that can enhance soil fertility, promote plant growth, and improve crop resilience. Biofertilizers contain beneficial microorganisms such as nitrogen-fixing bacteria, phosphate-solubilizing fungi, and plant growth-promoting rhizobacteria, which help mobilize nutrients in the soil and facilitate their uptake by plants. By fostering symbiotic relationships between plants and beneficial microbes, biofertilizers can improve nutrient availability, reduce the need for chemical fertilizers, and enhance the overall health and productivity of crops.

Botanicals

Plant extracts and botanicals also play a significant role in bio solutions for crop protection, offering natural compounds with pesticidal properties that can repel, deter, or inhibit pest activity. Extracts from neem, garlic, chrysanthemum, and other plants have been used for centuries in traditional agriculture to control pests and diseases, and their efficacy is now being validated through scientific research and technological advancements. Plant-based biopesticides provide a sustainable alternative to synthetic chemicals, with reduced environmental impact and minimal residues on food crops, making them a valuable tool for sustainable agriculture.

Change of Course

With a massive 1.4 billion population and growing, India is the most populated country in the world. we must prepare ourselves to meet the food needs. The produce for 2020 was recorded at 296.65 million tonnes for the year 2020. By 2050, we must produce double of that to survive! But, the excessive use of chemicals has increased the toxic contents in soil. If this continues, there will be a mass shortage in food production.

The extreme use of pesticides has brought considerable changes in people's attitudes. People, nowadays, prefer healthy foods with less chemical residue and more healthy nutrients. Acknowledging this, the government has shifted towards eco-friendly pesticides prevention methods, given their low toxic nature and lower residue problems.

The Biocontrol method of pest prevention must integrate with other control measures to be effective. Some basic research is necessary before integration to enhance the efficiency of the process.

Just how electric, non-polluting vehicles are replacing the harmful fossil fuel-powered vehicles, biocontrol too will balance the chemical method of pest prevention. Biocontrol is one of the most popular methods to meet India's agricultural requirements in the future. It's an economical and more environmentally friendly approach to satisfy our agricultural needs.

Reasons that have contributed towards the stalled development of Biocontrol include:

- **Lack of consistency on its effectiveness**
- **Lack of research**
- **Lack of biotech startups and companies providing aid to farmers.**
- **Lack of awareness amongst the farmers & Indian audience about Biocontrol**

In addition to biopesticides, biofertilizers represent another important bio solution that can enhance soil fertility, promote plant growth, and improve crop resilience.

BIOCONTROL STRATEGIES FOR RESIDUE FREE CROP PRODUCTION

Indian agri exports are valued at Rs.1,50,000 crore, which mainly constitute grapes, pomegranate, banana, tea, rice, onion, etc. Meat exports are also increasing, valued at Rs.30,000 crore. Lately there have been lot of issues with respect to pesticide residues in tea, rice, spices which again puts the onus on farmers for strictly adhering to the pre harvest intervals in order to pass the MRL standards set in different countries.

Main driver when economy becomes affluent is need for safe food. Demand for vegetables, protein and fruits is rapidly on the rise. Codex standards for MRL or minimum residue limits are becoming stricter day by day as new studies with toxicity are gaining prominence. Regulatory bodies are vigilant and often after long deliberation if the balance of utility versus toxicity shifts far right, then phasing out of the pesticides is carried out periodically. Until now, around 30 pesticides have been phased out, and more than 50 are in the pipeline in many countries. The pre-harvest interval of many pesticides is being redefined in order to reduce the residues in food.

Since biopesticides tend to pose fewer risks than conventional pesticides, regulatory bodies generally require much less data to register a biopesticide than to register a conventional pesticide.

About the AUTHOR

Sandeepa Kanitkar
MD, Kan Biosys

Biopesticides: Safer and Low Carbon Foot Print Alternatives

- Inherently less toxic than conventional pesticides.
- Affect only the target pest and closely related organisms
- Effective in very small quantities and often decompose quickly
- Greatly reduce the use of conventional pesticides, while crop yields remain high.
- Preventive use can reduce cost, carbon footprint of crop cultivation and residues in food

To use biopesticides effectively (and safely), however, users need to know a great deal about managing pests and must carefully follow all label directions. Since biopesticides tend to pose fewer risks than conventional pesticides, regulatory bodies generally require much less data to register a biopesticide than to register a conventional pesticide. In fact, new biopesticides are often registered in less than a year in different countries, compared with an average of more than 3 to 5 years for conventional pesticides. The cost of developing and launching biopesticide also is less than Rs10 cr. It also has scope for IPR generation to develop economic sense to market.

Biopesticides in Integrated Pest Management (IPM)

The low risk and effectiveness of microbial biopesticides make them a valuable element to incorporate into IPM programmes. They are compatible with many other biological products, including macrobials like predators, and they perform even better when combined with scouting and monitoring methods. The use of microbial products in IPM can help decrease the reliance on chemical pesticides and, by doing so, farmers can establish more productive and environmentally sustainable agricultural systems, ensuring food security and ecosystem health. Microbial biopesticides can also be recommended in package of practices to reduce costs of farmers and opt for chemicals in case of emergencies when ETL levels are crossed.

From seed dressing to using biopesticides at flowering to reduce toxicity with respect to beneficials and pollinators, is an important practice which farmers need to adopt. Biopesticides are the only choice of option during pre-harvest interval as they have no pre-harvest interval. Biopesticides are being increasingly adopted by the farmers to control powdery mildew, thrips, mealy bugs specially in high value crops like horticulture. Product positioning of biopesticides plays an important role for effective adoption which needs to be backed by trials and demonstrations at massive scale. Use of biopesticides in IPM strategies is likely to reduce the resistance development of pests to various agrochemicals as pests are exposed to control agents with diverse mode of actions.

Impact of IPM in India from 1994

- **Crop yield increased from 6.72 – 40.14% in rice and 22.7 – 26.63% in cotton in IPM fields compared to non-IPM fields.**
- **Chemical pesticide sprays were reduced to the extent of 50-100% in rice and 29.96 to 50.5% in cotton.**
- **Use of biopesticides/neem based pesticides increased from 123 MT during 1994-95 to 7682 MT (Tech. Grade) during 2018-19.**
- **Over all consumption of chemical pesticide in the country reduced from 61357 MT (Tech. grade) during 1994-95 to 49438 MT (Tech. Grade) during 2018-19.**

Challenges and Future Prospects

The adoption of biopesticides faces challenges such as limited shelf life or variable efficacy due to environmental conditions. Several phenomena can explain losses in biological activity: the sensitivity of the microorganisms to various external factors can have an impact at different stages, from storage to application. In this context, optimized formulation strategies are necessary to enhance global bio-efficacy of such biopesticides.

In the market today, biological formulations are present in solid and liquid forms. In both cases, the main challenges are to identify suitable co-formulants that do not negatively impact the viability of the targeted beneficial microorganisms. For most microbial categories, it is also important to avoid water in the formulation medium. Another well-known challenge for formulators is that many microbial spores have a strong tendency to agglomerate which can cause significant application issues for the end user. Such problems, in turn, generate a lack of biological availability of microbial actives and their metabolites.

Microbial products have great potential not only as biopesticides but for bio-stimulants, biofertilizers and soil health management.

Additionally, lack of awareness among farmers can hinder their widespread use. Technology advances in the field are expected to overcome current limitations. Easier accessibility to information and increased knowledge on biopesticides can further boost adoption, making biological plant protection products a fundamental component of sustainable agriculture.

India has many bio-diversity hot spots which is the basis for discovery of new actives from microbes and plants. Microbial products have great potential not only as biopesticides but for bio-stimulants, biofertilizers and soil health management. We estimate that in coming decade microbials will constitute more than 30% of all inputs used for crop production. It means that with a CAGR more than 15 to 20% agri-biotech market is positioned to grow from the current Rs. 3000 crores to around Rs. 6000 crores in 3-4 years.

Lab to land approaches need to be mediated and supported by government policy. Make in India initiative should be such that the metrics to capture the benefits to farmer, consumer of food and environment must be set forth. India can be a pioneer in how food is grown and consumed with lowest environment footprint!

Scope for over a 100 start-ups in discovery

Discovery happens in small companies which is then taken up for distribution by the big companies. As the needle is moving towards sustainability big companies have to look at these options as ignoring them will be losing out in the dynamic market. BASAI – Biological Agri Solutions of India – an association of biological companies is trying to represent their concerns and needs. India cannot afford to lose out on the opportunity to be a global leader in this space. New lines of support for innovation, pilot facilities, regulation and market need to be thought of for agri-biotech companies.

The use of biological control products is important to farmers under at least three perspectives: environmental, human health and economic. The basic question is drivers are there – market is there - can policy and entrepreneurs create magic?

ADDRESSING CROP PROTECTION THE BIOLOGICAL WAY

June 5, 2024 as every year was celebrated as the World Environment Day with the Theme: Land restoration, desertification and drought resilience. We face a worrying intensification of the triple planetary crisis: the crisis of climate change, the crisis of nature and biodiversity loss, and the crisis of pollution and waste. This crisis is placing the world's ecosystems under assault. Billions of hectares of land are degraded, affecting almost half of the world's population and threatening half of global GDP. Rural communities, smallholder farmers and the extremely poor are hit hardest.

Biopesticides can be as effective as conventional chemical pesticides, offer short pre-harvest intervals, offer complimentary modes of action, are generally biodegradable, leave few (or no) harmful residues and are generally cheaper and easier to register.

Biologicals in Crop Protection

Biological products work within the soil system to enhance and protect crop productivity. There is even some overlap between biological activity in some products, so, a biopesticide can control pests and disease while simultaneously providing biostimulant activity.

Biopesticides can be as effective as conventional chemical pesticides, offer short pre-harvest intervals, offer complimentary modes of action, are generally biodegradable, leave few (or no) harmful residues and are generally cheaper and easier to register.

Generally, biopesticides have a low-risk potential for human health or as an environmental hazard. BioPesticides may be grouped based on their mode of action into Bioherbicides, Bioinsecticides & Bionematicides, and Biofungicides.

About the **AUTHOR**

Vipin Saini
Chief Executive Officer
Biological Agri Solutions Association of India (BASAI)

Bioherbicides

Generally, bioherbicides target specific enzymes and inhibit their normal function. By inhibiting enzyme function, bioherbicides inhibit the biosynthesis of organic plant constituents, for example, fatty acids, or metabolic processes such as photosynthesis which are necessary for plant function. While bioherbicides target many of the same plant metabolic processes targeted by conventional (synthetic) herbicides, not all bioherbicide mode of action is directly related to the photosynthetic process. Microbial bioherbicides include bacterial and fungal endophytes (microorganisms which colonize plants without causing disease) as well as viruses.

Bioinsecticides

Bioinsecticides include microorganisms (such as *B.thuringiensis*) that infect insects or nematodes, and natural compounds with insecticidal activity sourced from microorganisms, plants or animals.

Some strains of Bacillus thuringiensis (Bt) are specific to Lepidopteran species, while other strains may target larvae of Diptera and Hemiptera. Reports of Bt toxicity toward non-target organisms, as well as binding of the bacterial toxins to clay soils have been the topic of debate. Biochemical bioinsecticides may target specific insect neural functions, such as the uptake of ions across neural membranes. Generally, bioinsecticides have a high specificity towards insects, due to their greater affinity for insect neuroreceptors, relative to neuroreceptors in mammals.

BioFungicides

Biofungicides are formulations of living organisms or natural metabolites used to control the activity of plant pathogenic fungi. Microbial biofungicides include pathogenic fungi *Bacillus* species. Biochemical biofungicides include those able to induce endogenous plant defences in the form of secondary plant metabolites.

"Biopesticides are generally biodegradable"

Biopesticides are generally rapidly degraded, a factor cited as an ecotoxicological advantage. As many biopesticides are subject to microbial and UV degradation, the rate of degradation may significantly decrease under anaerobic conditions, and in the absence of sunlight.

"Biopesticides leave few or no harmful residues"

Biopesticides may be subject to exemptions from residual tolerance levels.

"Biopesticides are less likely to harm non-target species"

Microbial biopesticides: 'the microorganism and its metabolites pose no concerns of pathogenicity or toxicity to mammals and other non-target organisms which will likely be exposed to the microbial product; the micro-organism does not produce a known genotoxin; all additives in the microbial manufacturing product and in end-use formulations are of low toxicity and suggest little potential for human health or environmental hazard'. Biopesticides with a very specific MoA and rapid degradation could be considered to be less likely to harm non-target species – but this applies to both biopesticides as well as conventional pesticides.

As for conventional crop protection products, differentiation between risk and hazard is required: a Hazard is something that has the potential to cause harm, while a Risk is the chance that the hazard will cause harm. Risk is often defined as Hazard x Exposure

The global agricultural biologicals market size was valued at USD 13.44 billion in 2023 and is projected to grow from USD 15.29 billion in 2024 to USD 44.70 billion by 2032, exhibiting a CAGR of 14.35% during the forecast period. North America dominated the agricultural biologicals market with a market share of 31.62% in 2023. The exploitation of the environment due to the overuse of crop protection chemicals is expected to foster the demand for biological products. These products can be applied solely or in combination with synthetic pest-resistant chemicals. Their widespread applications in agriculture are projected to boost the global agricultural biologicals market growth in the coming years. The demand for agricultural biologicals is increasing to meet the demand for pre and post-harvest management of crops as well. The commercialization aspect of the same can be further facilitated by adopting product innovation strategies, developing last-mile comprehensive service, and laying a strong foundation of effective marketing and distribution.

Generally, biopesticides have a low-risk potential for human health or as an environmental hazard.

Biosafety – Biopesticide Risk Profiling and Evaluation

While microbial strains are widely prevalent in the environment, they tend to exist in equilibrium in nature which ensures a natural biosafety net. But when specific strains are selected for their biopesticidal activity, they are applied at rates sufficient to attain the desired effect levels.

The UN SDGs as indicated below totally support the advancement and adoption of biological agri-inputs, including for crop protection measures.

PREVENTING, HALTING AND REVERSING LOSS OF NATURE

Biological agri-inputs are the way forward, believe it or not. Time will be testimonial to its adoption and promotion in securing nutritional security, while maintaining food security while being adopted along with existing conventional crop protection measures.

**Views expressed by the author are personal.*

EMPOWERING FARMERS FOR SUSTAINABLE AGRICULTURE:
GLOBAL PERSPECTIVES ON PESTICIDE RESIDUES

Pesticides play a crucial role in modern agriculture, enabling farmers to protect their crops from pests and diseases that threaten yields and livelihoods. However, the widespread use of pesticides raises concerns about residue levels in food, environmental impact, and long-term sustainability. As the global agricultural community grapples with these challenges, it is essential to recognize the complexities of pesticide use and the need for responsible management practices. Farmers play a crucial role in the responsible use of pesticides and mitigating their potential adverse effects.

About the **AUTHOR**

Wasi Asghar,
Assistant Director (Technical),
Export Inspection Council,
New Delhi

What Farmers Need to Know?

Implementation of Good Agricultural Practices (GAP)

While farmers have already been following certain practices, they need guidance on the do's and don'ts to enhance productivity, minimize environmental impact, and ensure food safety. GAP provides a set of guidelines covering crop management, soil health, water usage, and pesticide application, aiming for sustainable agriculture and safe food production. By adopting best practices, including the use of latest technology, equipment, and tools such as precision agriculture, drones, satellite imaging, and data analytics, farmers can optimize their existing practices, leading to improved yields, reduced environmental footprint, and safer food.

Pre-Harvest Intervals (PHI)

PHI refers to the mandatory waiting period between the last application of pesticides and harvest. This interval ensures that pesticide residues on crops have degraded to safe levels for human consumption. Farmers need to adhere strictly to PHI guidelines specified for each pesticide to avoid exceeding maximum residue limits and ensure food safety.

Integrated Pest Management (IPM)

Awareness of IPM strategies that emphasize preventive measures, biological controls, and minimal chemical intervention to reduce reliance on pesticides.

Regulatory Compliance

Familiarity with local and international regulations governing pesticide use, including maximum residue limits (MRLs) and Pre-Harvest Intervals (PHI).

Safety Precautions

Understanding proper handling, storage, and application techniques to minimize exposure and risks to human health and the environment.

Environmental Impact

Awareness of the ecological consequences of pesticide use, such as soil and water contamination, and adopting practices that promote biodiversity and ecosystem health.

Peer Learning and Knowledge Sharing

Encourage farmer networks and community groups to share experiences, challenges, and successes in adopting GAP. Establish platforms for peer learning, where farmers can exchange knowledge on effective pest management strategies, soil conservation practices, and compliance with regulatory standards.

Who Will Educate Farmers?

While Governments, FPOs, and NGOs etc. have a crucial role in educating farmers about pesticide use and GAP implementation, other stakeholders can also play a vital role. Food Business Operators (FBOs) and Mandi Authorities are well-positioned to effectively communicate the implications of pesticide usage and the importance of adhering to PHI guidelines, understanding and implementation of Good Agricultural Practices.

FBOs, who purchase commodities from farmers, can :

- Provide training and workshops on GAP and pesticide management including understanding label requirements /awareness about PHI etc.
- Maintain a database of farmers and their practices, focusing on areas with high risk of pesticide residues exceeding MRLs
- Educate farmers, based on feedback through testing for Pesticide Residues
- Monitor the GAPs adopted by the Farmers or Group of Farmers
- Establish cardinal relation with the Farmers, keep on motivating them
- Collaborate with farmers to implement traceability systems, ensuring transparency in the supply chain
- Develop the sense of Ownership in the Farmers and let them understand the most critical role they playing in the society i.e. providing Food, ensuring sustainability

Farmers should know that their crop is being tested for Pesticide Residues and accordingly they should be taught to understand the effective and efficient use of pesticides, adhering to label instructions and GAP guidelines. By doing so, the likelihood of exceeding MRLs is significantly reduced. Practical training and education programs should prioritize teaching farmers how to:

- Identify pest thresholds and apply pesticides only when necessary
- Choose the right pesticide for the specific pest and crop
- Follow label instructions for application rates, timing, and method
- Use integrated pest management (IPM) strategies to reduce chemical reliance
- Monitor and adjust their practices to ensure optimal results

While farmers have already been following certain practices, they need guidance on the do's and don'ts to enhance productivity, minimize environmental impact, and ensure food safety.

Mandi authorities, who interact with farmers regularly, can:

- Disseminate information on pesticide use and PHI guidelines through regular announcements and demonstrations
- Organize training sessions and workshops in collaboration with FBOs and other stakeholders
- Encourage farmers to adopt GAP etc

Empowering farmers with knowledge and resources to let them take informed decisions about pesticide use and adopting GAP is crucial for promoting sustainable agriculture and safeguarding food security. By enhancing awareness, fostering innovation, and supporting regulatory compliance, we can build resilient agricultural systems that protect both human health and the environment. As global agriculture continues to evolve, addressing the complexities of pesticide residues and promoting GAP implementation among farmers is essential for ensuring safe and sustainable food production.

INDIAN AGROCHEMICAL INDUSTRY'S R&D LANDSCAPE

India's agrochemical industry had traditionally focussed on manufacturing generic products to address the immediate market demand. In the case of patented products, these have been typically imported from the US, Germany, China and other countries.

However, the importance of increased R&D and innovation to produce patented molecules is clear as India seeks to position itself as a global leader in the agrochemical space. As a result, a paradigm shift is underway since the agrochemical industry realises the benefits of investing in path-breaking R&D programmes. The transformation also reflects the rising awareness that novel, patented molecules could provide significant long-term benefits, both for the industry and the nation at large.

Opportunities Marred by Challenges

As the second-largest producer of agri commodities, India bears an annual loss of Rs 1.48 lakh crore because of pests, weeds and fungal diseases. This single factor highlights the need for more R&D and a greater focus on novel active ingredients. Such novel agrochemical molecules can provide better pest control together with modern weed management practices, enhancing agricultural output.

While Indian firms have invested more than Rs 3,000 crore in R&D, the growing demand means these investments need to be hiked substantially.

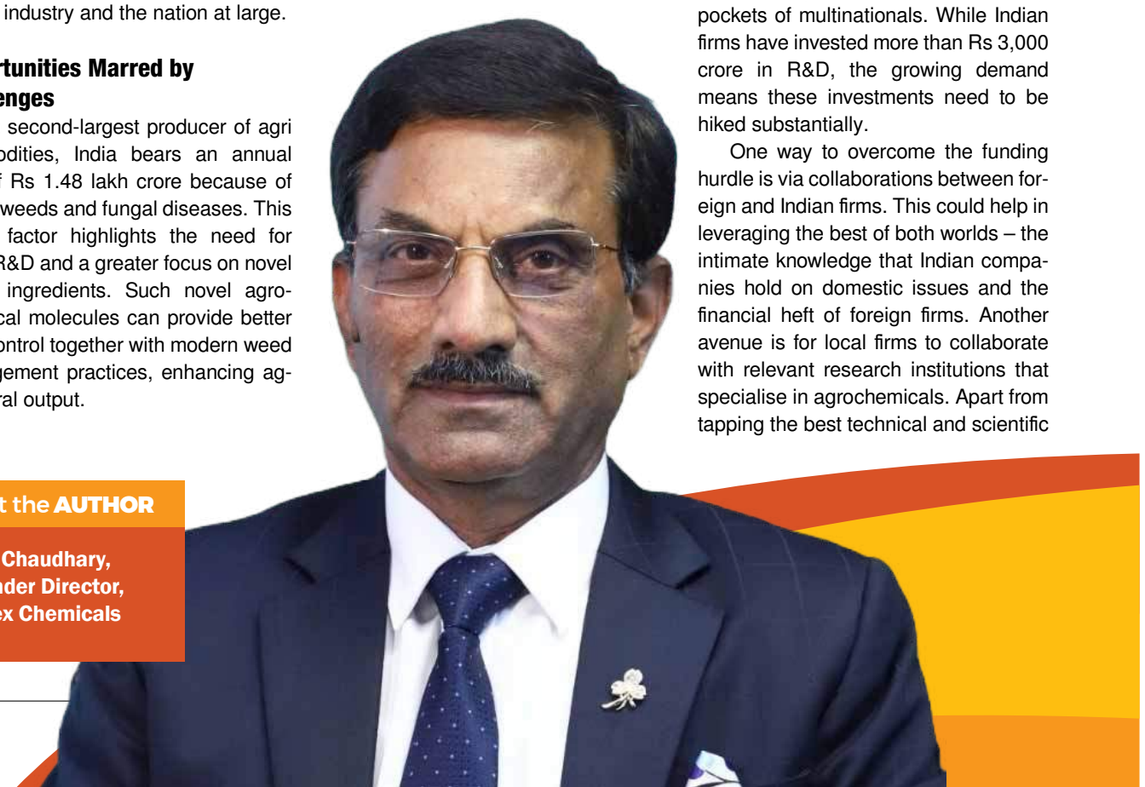
Nonetheless, introducing new active ingredients (AI) in the market is a prolonged and costly process that takes at least a decade to meet the highest standards of safety and efficacy. The agrochemical R&D field also poses unknown and unpredictable challenges, including unforeseen ecological issues.

The lengthy testing process covering crops, animals and humans is another big barrier causing more delays in introducing new products in the domestic market. The products also need to be tested across diverse markets to ensure proper efficacy and results in different geographies and farm conditions. Due to these constraints, the country's current regulatory framework for registration of patented agrochemical molecules is a costly, complex and time-consuming process. Strong data protection laws are also missing.

Funding and Allied Hurdles

Besides the above, funding is the other major constraint, especially for domestic companies that lack the deep pockets of multinationals. While Indian firms have invested more than Rs 3,000 crore in R&D, the growing demand means these investments need to be hiked substantially.

One way to overcome the funding hurdle is via collaborations between foreign and Indian firms. This could help in leveraging the best of both worlds – the intimate knowledge that Indian companies hold on domestic issues and the financial heft of foreign firms. Another avenue is for local firms to collaborate with relevant research institutions that specialise in agrochemicals. Apart from tapping the best technical and scientific human resources, such public-private partnerships could be better placed in securing R&D grants from the government.



About the AUTHOR

SK Chaudhary,
Founder Director,
Safex Chemicals

Production Hike via Policy Reforms and Prioritised R&D

By 2050, there will be an estimated 9.7 billion people to feed on the Earth. This would require a 50% hike in production, highlighting the criticality of introducing new seed varieties along with innovative crop protection products, which could only be possible by producing novel agrochemical molecules.

The World Trade Organisation notes that India became the second-largest exporter of agrochemical products in 2022. At $5.5 billion, India's exports have crossed that of the US at $5.4 billion. India needs to sustain and expand this lead through policy reforms, prioritised R&D initiatives and greater capacity building on several products produced under the 'Make in India' mission and the Production-linked Incentive scheme.

Evolving Issues and Current Challenges

Over the decades, pests, weeds and disease dynamics have kept evolving. This makes it imperative for the industry to drive more R&D and innovation to introduce novel products catering to dynamic demands. To date, whenever a pest issue arises, crop protection products remain the most widely practised management measure. Agrochemical formulations for seed treatment and crop protection (through insecticides, herbicides, fungicides and biocides) have been used by the industry for years. Consequently, around 70% of the agrochemical market is dominated globally by generic pesticides.

Considering the changing market dynamics, however, new issues and challenges keep emerging that the agrochemical industry must address. These include a decrease in arable land, low productivity per acre, falling soil fertility, decreasing water table across the country, heavy dependence on rains for irrigation, changes in the cropping patterns, variations in the pest complex and pest load and the growing resistance of pests to generic products.

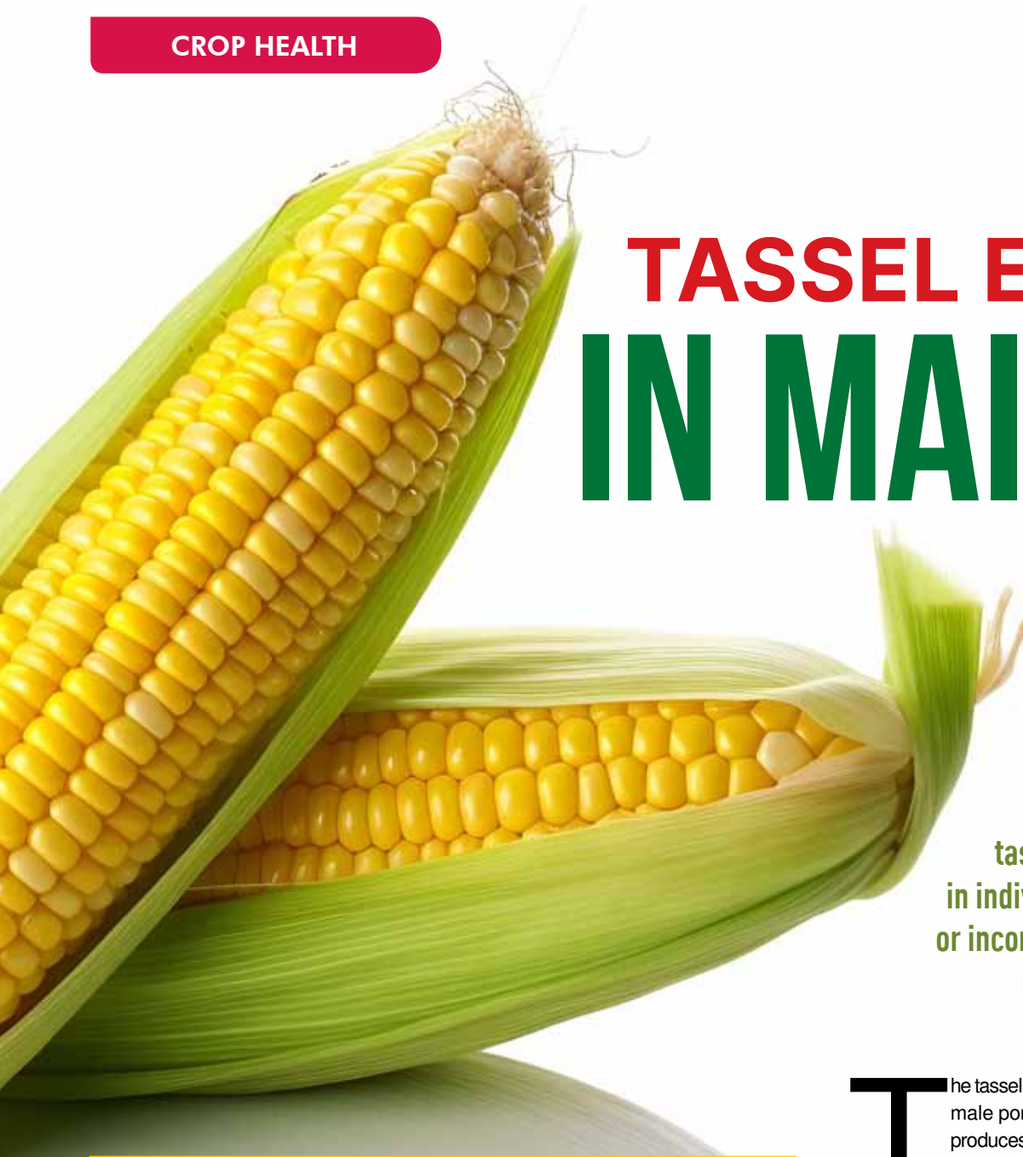
Moving forward, considering the sustained high-level R&D investments required, all major agri companies would need to invest a fixed percentage of their annual sales towards this objective.

Roadmap for R&D

As noted earlier, crop protection R&D requires a lengthy, cumbersome and expensive process to introduce novel AI in the market. Simultaneously, the regulatory challenges keep mounting, partly due to the stronger scrutiny that each new AI needs to undergo to evaluate its environmental impact. Before being approved for use in India, a company must provide scientific studies backed by voluminous data on safety and bio-efficacy covering toxicology, residues, environment, packaging and disposal.

Despite these difficulties, companies continue investing in R&D to ensure better crop protection products that safeguard yields. This is imperative, given the impact of climate change on agricultural output. Moving forward, considering the sustained high-level R&D investments required, all major agri companies would need to invest a fixed percentage of their annual sales towards this objective.

Additionally, government investments and public-private sector undertakings can be a game-changer, providing the necessary financial support and fostering an environment of innovation and growth in the Indian agrochemical industry.



TASSEL EAR IN MAIZE

Occasionally, some or most of the female flower parts survive and mature on the tassel, resulting in individual kernels or incomplete ears of maize in place

The tassel, which is normally the male portion of the plant that produces pollen, begins to develop kernels that resemble an ear of corn in an anomaly known as the tassel ear phenomenon in maize (corn). Part tassel, part ear to show, tassel ears are an unusual-looking tassel. The reasons behind tassel ears, but most people agree that they belong in the broad category of corny oddities and rarely have an impact on yield.

About the **AUTHORS**

Pratishruti Behera and Sumon Dutta, AAU, Jorhat

Tassel

A maize plant's male and female reproductive systems are physically separated in unisexual blooms (a flowering habit known as "monoecious" among trivia buffs). The tassel depicts a maize plant's male flower, while the ear stalks represent the female flowers. Interestingly, both reproductive systems begin as perfect (bisexual) flowers, which contain both male and female reproductive mechanisms. Soon after each reproductive structure begins, the female components (gynoecia) of the tassel and the male components (stamens) of the ear shoots abort, resulting in the unisexual flowers (tassels and ears) that we have come to expect.

Abnormal Tassels

Occasionally, some or most of the female flower parts survive and mature on the tassel, resulting in individual kernels or incomplete ears of maize in place. Part or the entire tassel. The physiological basis for the survival of the female floral components on the tassel is likely hormonal in nature, but the environmental "trigger" that modifies the hormone balance is unknown. There are also genetic abnormalities that affect normal tassel formation by allowing female flower components to survive.

A "tassel ear" is an odd-looking thing that is almost exclusively found on tillers or "suckers" of a corn plant around the boundaries of a field or in otherwise sparsely populated regions of a field. Tassel ears are quite uncommon on the main stalk of a maize plant.

Without a protective husk, the kernels that form on tassel ears are exposed to weathering and hungry birds.

As a result, harvestable, high-quality grain from tassel ears is rare. Some people associate the tassel ear symptom with the deformed tassel symptom of "crazy top" sickness. These two unusual tassel symptoms are unconnected and have very different looks. *Sclerophthora macrospore*, a soil-borne fungus, infects immature maize plants during ponding occurrences. This causes abnormal tassel and ear shoot development, resulting in a mass of leaf tissue.

Regular field inspections can detect early signs of stress or sickness, leading to timely intervention.

Causes

Tassel ears are frequently formed by tillers (suckers) that develop when the plant's growth point is lost or damaged by hail, wind (green snap), animal feeding, frost, flooding, herbicides, or mechanical injury. Some hybrids may also be more prone to tillering in certain environments, which might result in tassel ears. Low plant density may also encourage tillering. Tassel ears are commonly found around the edges of fields, when early season soil compaction and saturated soil conditions may have contributed to their aberrant development.

Factors Affecting Tassel Ear Development

- **Genetic Mutations:** Certain features can cause maize plants to sprout tassel ears.
- **Environmental Stress**: Droughts, nutrient deficits, and severe temperatures can cause aberrant development.
- **Hormonal Imbalance:** When the plant's hormonal equilibrium is disrupted, the tassels may develop kernels.
- **Pathogen Attack:** Diseases or pest infestations may cause developmental defects.

Impact on Crop

• **Production Reduction**: Tassel ears can redirect resources away from regular ears, thereby reducing overall production.

• **Pollination issues:** Abnormal tassel growth might impact pollination efficiency and grain fill in ears.

Management

- Avoid using overly low seeding rates. Some hybrids exhibit increased tillering, particularly under favourable early season growing conditions. However, such tillering and tassel ear formation have no effect on crop production.
- Planting resistant maize cultivars can reduce the risk of producing tassel ears.
- Optimal Agricultural Practices: Proper irrigation, balanced fertilisation, and pest management can help alleviate environmental stress and prevent anomalies.
- Regular field inspections can detect early signs of stress or sickness, leading to timely intervention.

DYEING FOR A CHANGE

THE UPCOMING FRONTIER OF ECO-FASHION

While purchasing clothes, one of the key visible ingredient influencing our choice is its colour. Living in a heritage-based country like India means enjoying the vast array of its traditional dyeing styles, such as, Bandha from Odisha, Telia Rumal from Andhra Pradesh, Patola and Bandhani from Gujarat and Lehariya from Rajasthan. One of country's oldest natural dyes, indigo, serves as a metaphor for the nation's struggle for independence. The art of dyeing with mushrooms is widely recognized, while the use of lichens for dyeing, historically referred to as "peasant dyeing," has deep roots in the northern regions of the world. However, after enjoying centuries of traditional natural dyeing, the discovery of the first synthetic dye, Perkin's Mauve, in 1850s initiated a long trail of petrochemical-based synthetic textile colours. They are stable, cheaper, offer an extensive range of hues and are employed in several commercial products from textiles and paints to cosmetics and food.

Sportswear dyed by Fabulous Fungi's fungal dyes (Source - https://materialdistrict.com/article/sportswear-dyed-with-fungi/)

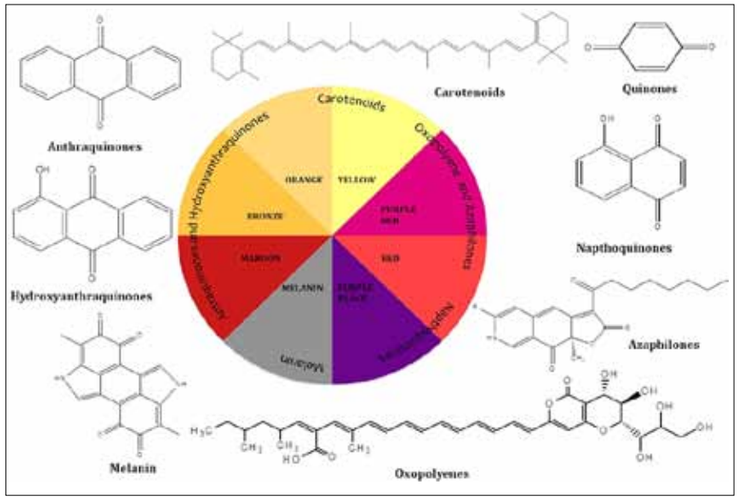
From Natural to Sustainable: Redefining Textile Dyeing

With increasing environmental concerns linked to synthetic colours, sustainable and natural colours are now crucial instrument to shift the country's textile industry closer to circular fashion. The entire process is taken into consideration to assess the sustainability of the process, accounting for all the components at each stage as well as the amounts of natural resources consumed. Pertaining to this, plant and animal based colours face one major issue - the availability of natural raw resources to satisfy the textile industry's demand. They require a large area while being subjected to seasonal variations and low yield. Studies are being done to develop colours and dyeing methods considering ecologically acceptable modules including microbial colours, supercritical fluid, ultrasonic, microwave, and electrochemical dyeing. Microbial colours (from bacteria, fungi, algae, and lichens), have an edge in scalability with lower production costs and no seasonal variations. They further have health benefits with anticancer, antimicrobial, antioxidant, and anti-fouling properties, giving them an upper hand in dyeing technical textiles.

Microbial colours (from bacteria, fungi, algae, and lichens), have an edge in scalability with lower production costs and no seasonal variations.

About the AUTHOR

Dr. Mayurika Goel,
Fellow, Sustainable Agriculture Division,
The Energy and Resources Institute (TERI)



Alternative Colours – A Reality in the 21st Century

Global fora such as Fashion for Good, Global Fashion Agenda, and Sustainable Fashion Forum work towards sustainable textile industry by giving a platform to initiatives in the dyeing process like Vienna Textile Lab, Living Colour, Colorifix, Pili, Huue and Fabulous Fungi. Life cycle analysis done by Colorifix showed microbial dyeing reduced water consumption by 77%, energy consumption by 53%, and carbon dioxide emission by 31%. In India, the DOEN Foundation, a Dutch organisation supported by the National Postcode Lottery and Intellecap, an Indian advisory firm, have jointly established the Circular Apparel Innovation Factory (CAIF) which aspires to form alliances with industries, innovators, and enterprises for introducing sustainable fashion in the country. Bombay Rayon Fashion Textiles Private Limited has developed a continuous dyeing process that recycles 4 million litres of water per day and the Sasmira Institute of Man-made Textiles has produced two patented waterless dyeing modules. TERI-Gram is exploring therapeutic microbial textile colours isolated from the biodiversity hotspot of India with a circular outlook of utilizing waste materials to grow pigmented microbes.

Life cycle analysis done by Colorifix showed microbial dyeing reduced water consumption by 77%, energy consumption by 53%, and carbon dioxide emission by 31%.

In the commercial sector, sustainable innovations are being introduced to the consumers in a comparatively slower but conscious pace. The supply chain for the synthetic colours is well established, while sustainable colours are still nascent requiring external interventions. Mandates for producers and dyeing houses, policy interventions by authorities and incentives by government should be utilised to force large industry players to create eco-friendly apparels. A brimming opportunity is there in front of our eyes to formalise, streamline and promote circular fashion through eco-friendly dyeing, and we should put forward our best efforts to seize the opportunity.

TRACEABILITY AND TRANSPARENCY

IMPACT OF BLOCKCHAIN TECHNOLOGY IN AGRI-FOOD SUPPLY CHAIN

Food loss and waste has become a serious issue since 30% of the global food produced for human consumption gets lost or wasted along the whole food supply chain. By 2050, there will be approximately 9.1 billion people on earth, requiring an increase in food supply by 70%. Therefore, addressing the issue is crucial to ensure food security and maintain ecological balance. Techniques for mitigating this problem include improving harvesting methods, constructing better storage facilities, and improving transportation infrastructure; fostering consumer awareness of appropriate measures; and implementing policies that encourage reduction at all stages of the supply chain. The process of development is centred around the agricultural markets and supply chain, as they offer wider consumer choice and producer incentives through the food and agriculture markets. Trade must operate well to ensure optimal resource distribution and allow for the diffusion of knowledge and technology among farmers. Thus, market mechanisms are essential for the structural transformation, growth, and development of an economy.

Traceability and Transparency

Transparency and traceability in the agri-food supply chain are multifaceted concepts that involve informing consumers and other stakeholders about the source, quality, and sustainability of food items, as well as the processes and methods employed in their manufacturing and distribution. Collectively, they serve as the foundation of an accountable supply chain. Transparent sourcing and production of food ensures responsibility among producers accountable for ensuring a safe food supply to consumers. This helps people make better decisions about what is ethical and sustainable to eat, and it also builds trust and confidence in the safety and quality of food. Traceability makes it possible to track every step in the agri-food supply chain backward and forward, which makes it easier to quickly identify and contain contamination outbreaks or problems with food safety. It maintains the integrity of the supply chain by assisting with regulatory standard compliance, expediting recalls, and enhancing food safety protocols.

In recent years, traditional traceability techniques have faced criticism due to their shortcomings in accurately gathering data and identifying fraudulent activity. The complex global food supply chain system has led to a notable increase in tampering, deception, and intentional substitution. Food categories that are most impacted are seafood, honey, olive oil, fruit juices, dairy products, tea, coffee and a variety of other foods. The 2008 Chinese Milk Scandal was a serious incident involving food contamination that resulted in the deaths of infants and over 54,000 hospital admissions in China. Other issues with the traditional supply chain approach include foodborne illness, illegal production, and food recalls.

Blockchain's Revolutionary Impact

Although blockchain technology is often associated with Bitcoin, a number of advancements have made it possible for blockchain to spread widely. These days, blockchain technology is democratizing a wide range of industries, including supply chains. The innovative system ensures safe and transparent transaction records by acting as a decentralized digital ledger. It is a series of linked data blocks, each one securely attached to the one before it.

In traditional supply chains, relationships between stakeholders are often based on mutual agreements and contracts. While collaboration exists, information exchange can be limited and fragmented due to reliance on individual databases and differing data management systems. This can lead to challenges such as delays in information sharing, discrepancies in data accuracy, and difficulties in tracing products across the entire supply chain. In contrast, in a supply chain based on blockchain technology, all components and drivers of the supply chain are interconnected through a distributed ledger. This enables transparent and real-time visibility into the entire supply chain network. Members involved in the blockchain-based supply chain have access to a shared, immutable record of all transactions and activities across all drivers. This transparency enhances trust among participants, facilitates faster and more accurate decision-making, improves the traceability of products, and enhances overall supply chain efficiency and resilience.

Ve Chain, IBM Food Trust, and Provenance are a few instances of prosperous blockchain businesses in supply chain management; they all emphasize various facets, including product authenticity, traceability, and efficiency.

Traceability makes it possible to track every step in the agri-food supply chain backward and forward, which makes it easier to quickly identify and contain contamination outbreaks or problems with food safety.

Benefits of Adopting Blockchain Technology

Adopting blockchain technology in the food supply chain offers several benefits, including:

- **Improved food safety**: Enables rapid traceability and quick response to food safety issues, enhancing overall safety protocols.
- **Enhanced quality control**: Monitors and records product quality indicators throughout the supply chain, ensuring consistent standards.
- **Ethical sourcing** : Provides transparency on product origins and sustainability practices, verifying ethical claims.
- **Consumer trust**: Increases confidence by providing verifiable information about the origin and quality of food products, fostering stronger brand loyalty.

Limitations of Adopting Blockchain Technology

- **Cost**: Implementation and maintenance can be expensive.
- **Scalability**: Public blockchains may struggle with high transaction volumes.
- **Data Privacy**: Immutability raises concerns about sensitive data exposure.
- **Interoperability**: Different blockchain platforms may not seamlessly integrate.
- **Regulatory Challenges**: Varied regulations can create legal uncertainties.
- **Adoption and Education**: Stakeholders may lack awareness and understanding.
- **Risk of Centralization**: Permissioned blockchains can lead to centralization risks.
- **Physical Supply Chain Challenges**: Blockchain doesn't solve logistical issues like temperature control.

Improving the agri-food supply chain's traceability and transparency is one way to assure security and safety during the food's journey from farm to table and the advent of blockchain technology offers a chance for radical change. It has many advantages, but there are also drawbacks that should be carefully considered, including cost, scalability, data protection, and regulatory complexity. Still, blockchain has a lot to offer in terms of innovation and cooperation to help build a more robust and sustainable global agricultural system.

Walmart's Initiative

In 2016, Walmart faced challenges tracing the origin of sliced mangoes within its supply chain, a process that took over 6 days despite having all relevant data. This inefficiency led Walmart to partner with IBM and develop a food traceability system using Hyperledger Fabric from the Linux Foundation. This collaboration dramatically improved traceability speed, allowing Walmart to track mangoes in its US stores in just 2.2 seconds.

Building on this success, Walmart announced a blockchain partnership in August 2017 with major players in the food supply chain, including Dole, Kroger, McCormick, Nestlé, Tyson Foods, and Unilever. The aim was to explore and implement blockchain technology to enhance food traceability and explore new applications for the entire supply chain network. This initiative marked a significant step forward in using blockchain to enhance transparency, efficiency, and safety across the global food supply chain.

About the **AUTHORS**

Laldinmawii, MBA (Agri-business Management), CPGS-AS, CAU(I), Meghalaya
and
Dr. Lalrinsangpuii, Assistant Professor, Agricultural Economics, CoH, CAU(I), Mizoram

15TH AGRICULTURE LEADERSHIP CONCLAVE

NAVIGATING AGRICULTURE THROUGH CLIMATE CHALLENGES

10-11th July , 2024 | Holiday Inn, Aerocity, New Delhi

INAUGURAL CEREMONY

The inaugural ceremony held on 10th July was resplendent with the attendance of Hon'ble. Justice P. Sathasivam, Former Chief Justice of India, Former Governor of Kerala; H.E. Mr Ali Achoui, Ambassador of the People's Democratic Republic of Algeria; Sh. Surya Pratap Shahi, Hon'ble Agriculture Minister of Uttar Pradesh; Dr. Manoj Nardeosingh, Secretary General, AARDO and Dr. MJ Khan, President, Agriculture Today Group and Chairman, ICFA.

The lighting of the inaugural lamp was followed by the welcome address by **Dr MJ Khan**. Welcoming the guests and the audience to the function, Dr Khan stressed on the relevance of climate challenge and gave glimpses of how the climate parameters have changed over the years. Dr. Khan stressed on the relevance of global collaboration and private public partnership in combating climate change. He also informed the audience that discussions were afoot for conducting 'Delhi Dialogue on Sustainability' that will showcase to the world India's preparedness and initiatives in combating climate change.

H.E. Mr Ali Achoui quoted that agriculture was life. He said that Algeria could learn a lot from India, especially in the area of millets. In South of Algeria, climate is dry where he thought millets could be a game changer. Sahara region in Algeria was earlier known for its oil and gas, whereas now it was known for vegetables, fruits and wheat. He said he is looking forward for the intense dialogues in the following days and cooperation between the two countries.

Dr. Manoj Nardeosingh introduced ARDO and its activities. He was of the view that agriculture sector needed more leaders to address challenges in agriculture. He encouraged the participation of all stakeholders in agriculture to address climate change. Dr. Nardeosingh remarked that climate change is significantly affecting climate change and vice versa. Agriculture was a contributor and victim of climate change, however he observed that agriculture should be a moderator and facilitator for finding solutions for climate change.

Justice P. Sathasivam pointed out that although there were many schemes to help farmers, all of those schemes were either in Hindi or English. He recommended that it would be to of great help if they were printed in regional languages also. He concluded by saying that agriculture is the cornerstone of Indian economy.

Sh. Surya Pratap Shahi while addressing the audience noted that Indian agriculture was dependent on climate and 55% of the population depended on agriculture for their livelihood. He reminded that India under the leadership of PM Modi was making strides in fighting climate change. Soil testing, One Drop More Crop, Promotion of Natural Farming were some of the many initiatives in agriculture that India was promoting. He observed that if there was a one degree rise in temperature there would be a loss of more than 3-4 lakh metric tonnes crop production. He urged for immediate action and suggested that the events like these could help arrive at solutions to many of the pressing problems in agriculture.

Anjana Nair, Group Editor, Agriculture Today Group extended the vote of thanks.

3rd MS Swaminathan Global Leadership Award for Sustainable Development

The 3rd MS Swaminathan Global Leadership Award for Sustainable Development was announced at the event. **Dr. Lindiwe Majele Sibanda** who took over as CGIAR Systems Board Chair was announced as the winner jointly by the dignitaries on stage. As a Farmer-Science-Policy Interface Champion, Dr Lindiwe Sibanda has transformed over 50 public, private, and non- governmental institutions, including farmer organisations, government ministries of agriculture, and academic and research organisations.

Dr Ambassador Kenneth Quinn, President Emiritus World Food Prize and 2nd MS Swaminathan Global Leadership Award, who joined the event online congratulated Dr Shibanda, at the same time reminiscing their decade long association. He likened Dr Shibanda to MS Swaminathan in terms of their passion and vision.

SESSION 1 : POLICY PUSH FOR CLIMATE SMART AGRICULTURE

The session was chaired and moderated by **Dr. Tarun Sridhar, Former Secretary, Department of Animal Husbandry and Fisheries**.

Sanjay Sethi, Human Utilization Advisor, South Asia, USSEC was of the view that policy should bring in technology or encourage innovation. He also stressed on the scalability of technologies and noted that policy makers should support youngsters who are bringing in change through startups.

Deepak Pareek, Managing Director, HnyB Tech-Incubations Pvt. Ltd., observed that agriculture is both culprit ad a victim of climate change. He noted that India is currently suffering from shortage of wheat as a result of climate change. Mr. Pareek opined that we needed grass root level innovation. He lamented the absence of data in the public domain that can be easily accessed by the start-ups to work on their innovation. He suggested that policy changes should be made to make available the data to the start-ups without any delay. He also wanted the government to fast track agristack.

Anand Bhaskar Rapolu, Former MP suggested tailor made solutions for each region of the country. He observed that farm level processing is low and if performed it would add to climate resilient agriculture .

Raju Kapoor, Director, Policy and Regulatory Affairs, FMC observed that policy directives needed to be focussed on feeding the large population of humans and animals, and to support the livelihood of people dependent on it. He was of the view that India should have a national cropping policy and wanted agriculture to be transferred into concurrent subject. Creating innovation ecosystem, Development of private public partnerships in R&D and delivery, Protection of IPR, inviting investments and newer technologies were some other important recommendations from him.

Dr Kalyan Goswami, DG ACFI enumerated the policies related to climate change that were in existence since 2000. He observed that there was no lack of policies, but we failed when it came to implementation. He also wanted that states to be made aware of the policies at national level.

SESSION 2: BIO-AGRICULTURE APPROACHES TO BUILDING CLIMATE RESILIENT AGRICULTURE

Mr Vipin Saini, CEO, BASAI moderated the session.

Ms. Sandeepa Kanitkar, MD, Kan Biosys Limited said that agriculture cannot happen without carbon sequestration. She noted that there was microbial technology that can be used to enhance fertilizer use efficiency and seed health. But noted that scalability was important. She also suggested that government should come up with carbon credit support which could be encouraging to the industry and farmers and also in standardisation of technology.

Mr. Ajeet Singh Chahal, Rice Team Lead – Asia, BAYER highlighted the need to increase our rice production globally by 30% by 2050 to meet the growing population. Mr Chahal observed that rice was the most vulnerable crop in terms of climate change and was also contributing to climate change. Although DSR was in vogue, it was not been able to scale, he commented. This required a deep understanding of the grass root level conditions and tailor made solutions, he opined.

Mr. Amit Rastogi, Executive VP, Coromandel International Ltd observed that drought was an important climate related issue affecting agriculture. He noted that farmers were resistant to shift from popular varieties to the drought resistant ones. So, it was important to take into consideration the local aspirations like quality and yield, while breeding for climate change parameters.

Mr Debabrata Sarkar, Vice President-Asia Pacific, AlgaEnergy stressed on bottom to top approach, where bottom layer was soil and top layer formed the plant. He was concerned about the deteriorating quality of top soil, and brought to the attention of the audience about the numerous microbial technologies that can reclaim the soil.

Dr Bakul Joshi, President & COO, T. Stanes and Company Limited called for integrated pest management, where biologicals would play a pivotal role in disease and pest management.

Mr. K Srinivasakumar, President, Inera, Absolute pointed out that biologicals could play a major role, while tackling MRLs. He said that the interest of the farmer needed to be put ahead.

SESSION 4 : GLOBAL COLLABORATIONS FOR SUSTAINABLE AGRICULTURE

Mr. Erwin Muhammad Akbar, Minister Counsellor, Embassy of Indonesian was of the view that climate change needed to be considered as a global challenge. Bilaterally between India and Indonesia, many delegates have come from Indonesia to India to learn. Technology transfer, capacity building, exchange of best practices between countries could facilitate sustainable agriculture, he opined.

Ms Ingeborg Bayer, Agriculture Counsellor, Embassy of Germany spoke about the sustainability plans that were in practise in Germany. She noted the collaboration and cooperation between private sector globally. Ms Bayer also pointed out the existence of a working group between Germany and India that was a platform for the two countries to closely work together in many areas. She was also confident that future held promise for more collaboration.

Mr Angelo Mauricio, Agriculture Attache to the Embassy of Brazil in India said that we needed good leaders in agriculture sector. According to him we didn't lack expertise or technology, but what we lacked was collaboration. He also suggested investment in research.

Ms. Rina Soni, Executive Director – Passing Gifts (A subsidiary of Heifer International) observed that sustainable agriculture was the solution to many problems in rural India. She cited the example of global partnership between Heifer and Cargill through Hatching Hope which had helped improve rural incomes. She concluded with the relevance of global collaboration in addressing concerns related to climate change.

Pankaj Pathak, Member, APEDA reminded the audience, that according to Indian culture world was one family. He cited the example of how India persuaded UN to make 2023 as year of millets, and how the millets had taken the world by storm. He also said that collaboration will lead to better solutions.

Dr. Ravinder Grover, Global Business Manager, HarvestPlus Solutions pointed out the declining nutritional values of cereals. The increase in CO2 is expected to bring down zinc, iron and protein levels in staples which indirectly meant that to meet the nutritional demand of the population, production needed to be increased.

SESSION 5 : INDUSTRY-ACADEMIA PARTNERSHIP FOR CLIMATE SMART AGRICULTURE

Anup Kalra, Ayurvet moderated the session and cited how industry and academia can come together to develop, scale and impellent solutions.

Dr. Indra Mani, Vice-Chancellor, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani said that without industry academia partnership change could not happen. He pointed out the triple helix model - AIG model – where apart from academia and industry, government was also involved. The job of academia was to find solution, the industry needed to implement it and government had to facilitate, he explained. While collaborating, duplication of research works should also be avoided as it will save time and resources, he opined.

Ashwini Bhakshi, CEO, ICFA said that the collaboration between industry and academia can move towards developing and implementing solutions for climate change induced challenges. He was of the view that events like this can bring together different stakeholders to discuss on relevant topics.

JS Yadav, MD, National Council of State Agricultural Marketing Board discussed the dearth of marketing in the curriculum of agricultural universities. He pointed out that climate change affects the quality of the produce. He also suggested that scientists must be aware of the national and international standards prescribed for an agricultural product.

Ramesh Mittal, Former Senior Director, NIAM closely examined the collaboration between industry and research institutes. He observed that industry could provide investment and institutes' research output. Academic institutes produced the human resources, whereas the industry absorbed it, he noted.

SESSION 6 : AGRO TECHNOLOGIES FOR SUSTAINABLE AGRICULTURE

Dr KK Unni, Chairman, Malabar Consultants Limited moderated the session.

Mr. MJ Saxena , Advisor, Dabur Foundation remarked that Indian farmers should be made aware of the new technologies. Technology adoption would definitely help our cause to bring sustainability in agriculture, he noted.

Sh. Chandrashekhar Hari Bhadsavle, MD, Saguna Sustainability Solutions Pvt Ltd. introduced Saguna Regenerative Technique (SRT) to the audience which did not require ploughing, removal of roots of previous crops and crop rotation. He noted that through this technique cost of production had come down and the soil qualities and soil carbon content had improved.

Dr. Murtaza Hussain, Principal Scientist, Indian Agricultural Research Institute introduced his work on urban farming. Dr Hussain explained how they were modifying microclimate in accordance with the requirements of crops with the help of low cost structures.

SESSION 7 : CEOs PANEL

Ms Manisha Gupta, Commodities Editor, CNBC moderated the session.

Mr Uday Anand, CEO, Parijat Industries Limited remarked the challenge of work force which was future ready and development of the same becomes important.

Dr Rahul Mirchandani, Chairman & Managing Director, Aries Agro Limited remarked that Integrated Nutrient Management should become a national imperative. Import substitution, and customised solution for farmers, would also be a good direction to pursue. He urged to follow residue free farming. He was of the view that technology should be kept simple for farmers.

Mr. Vishwa V Somannavar, VP, Tirth Agro Technology Private Limited called for a policy change in the northern parts of India with regard to sugarcane harvesting processes that would encourage mechanized solutions for the same. He enumerated the mechanized solutions for many challenges faced by farmers. He also suggested to use high density planting to increase yield. Policy changes are required to ensure this to materialize, he emphasised.

Mr Ravi Gupta-ED, Shree Renuka Sugars said that in sugarcane water conservation and mechanization were key areas. He remarked that work needs to be done to carry forward the sugarcane cultivation.

Mr Shantanu Pendsey CGM SBI pointed out that banks have been funding rural programmes. He remarked that the different stakeholders should come together to improve productivity. He suggested to make farmers part of value chain so that they get the advantage of extra income. He extolled women led SHG groups which had achieved many phenomenal achievements.

Ashudeep Garg, Sr Vice President and Head Corporate Development, Absolute described the mode of operation of Absolute and also the importance of connecting farmers to consumers. He also suggested the creation of a platform which gave validation to various agri inputs.

CONCLAVE DAY 2: 11/07/24

SESSION 1 : FOOD AND NUTRITION SECURITY DURING CLIMATE CHANGE

Mr. Deepak Pareek, Founder, HnyB Tech-Incubations Pvt. Ltd chaired the session.

Mr. Ravishankar Cherukuri, Customer Experience Lead, Asia Bayer Crop Science remarked that needs of food basket were rapidly changing. As incomes expand, the demand for nutrition would far exceed the demand for plain food. He noted that being on the agri input side had helped Bayer to be enablers and to provide solutions that were sustainable. Availability, Affordability and safety are three pointers in Food and Nutrition, he noted. He also said that we needed to create a better environment for farmers to produce safe, affordable food. He also cited the need for market linkages also.

Mr. Sourabh Bagla Senior VP, Upaj suggested optimisation of agri inputs for better yield realisation. As a first step, he suggested that the farmers needed to know what was there in the soil and for the same soil testing becomes very relevant. He was also quick to point out that most of the farmers were not able to get test results in the same day, and efforts must be afoot to reduce that time and to make soil testing more accessible.

Mr. Pushkal Upadhayay, Senior GM, Mahadhan Agritech Ltd. noted that 98% of farmers do not know RDF-Recommended Dose of Fertilizers. He was of the view that with proper and optimal use of fertilizers, crop yields could be increased. He remarked that there were fertilizer products that are designed to specific stages of crop growth and also mentioned Mahadhan's new product with Nutrient Unlock technology which released nutrients locked in the soil.

Mr Sanjay Sethi Human Utilization Advisor, South Asia, USSEC noted that growing legumes was sustainable however, their prices had skyrocketed.

He lamented the stagnation of soyabean productivity for the last 30 years. He called for tough decisions to enable India to find solutions for multitude of challenges in agriculture sector and also for collaboration among organizations

Dr. Hiresha Verma, Founder and Chairperson, Han agrocare narrated her story of how her chance visit to flood affected area in Uttarakhand led her to mushroom cultivation. She noted that mushroom cultivation was independent of climate as it was cultivated indoors. She said that it was a sustainable form of cultivation as nothing goes to waste and it offered good nutrition.

SESSION 2 :DIGITAL TECHNOLOGIES IN MEETING THE CLIMATE CHALLENGE

Dr Radhika Trikha, Chief Executive Officer (CEO-AWADH), IIT Ropar moderated the panel discussions.

Kunal Prasad, COO and Co Founder, Cropin Technologies remarked that technologies like remote sensing have evolved tremendously in the past few years and they could give the government an idea of how much area has been sowed, what was the expected yield, the existence of crop stress etc. At micro level, level of farmers, data could help to refine solutions for farmers, and help to bring specific advisory to farmers. He also discussed about the combination of GIS with agriculture sector and hoped soon India would lead in using the same.

Mr. Deepak Pareek, Founder, HnyB Tech-Incubations Pvt. was of the view to keep technology invisible to farmers. The results of technology should be tangible, he suggested. Mr Pareek observed that Biologicals, Re-

mote Sensing and AI were going to be important technologies in agriculture.

Mr Ashish Khetan, President & Chief Investment Officer - Indigram Labs Foundation said that there was a need for an ecosystem for the start-ups to work. He noted that there were a lot of agritech start-ups working in climate change area, trying to develop solutions. He remarked that start-ups must be sustainable profitable business ultimately bringing a solution to farmers.

Dr. Muneer Khan, Scientist discussed the soil quality assessment technologies and their relevance in agriculture.

SESSION 3 :AGRO VENTURES AND AGRIBUSINESSES IN EMPOWERING FARMERS

Mr. Kapil Mehan, Advisor, Deepak Fertilisers and Petrochemicals Limited chaired the session.

Dr Hulas Pathak, CEO IGKV R-ABI Raipur Chhattisgarh observed that agricultural universities were looking into how value can be increased across the agri value chain. He believed that instead of looking at problems of farmers as challenges, it should be seen as opportunities for creating solution.

Mr Sahu Pawar, CEO, IACG enumerated the challenges faced by the famer such as market linkage, technology, infrastructure building, financial inclusion etc. He said that the farmers needed to be empowered to become agropreneurs and Start-ups should have a domain expert as well.

Mr. Senthil Kumar Natarajan, Public Policy and Government Relations, Ninjacart elaborated on the operations of Ninjacart and how they had helped farmers in realizing better prices for their market.

Mr Rajiv Ranjan Guru, Founder & COO, Ecopreneurs suggested a bottom-up approach in Research and Development. He narrated his experience in implementing precision farming, biopelleting from biowaste, installation of storage infrastructure etc.in farms and how this has been transforming farmers' approach.

Ms. Shreyasi Agarwal, VP, Bharat Mandi narrated her project of preventing rural exodus. She pointed out that demand side was also an important area for start-ups to focus.

SESSION 4: ROLE OF AGRO PROFESSIONALS IN MEETING THE CHALLENGE OF CLIMATE CHANGE

Ms Laxmi Devi, Senior Assistant Editor, PTI chaired the session.

Dr. Dinesh Kumar Chauhan, CEO, Agribusiness & Innovation Platform of ICRISAT commented that each organisation had a role to play. We have to create an ecosystem for people to pursue agriculture as profession, he said. He also mentioned that there was a dearth of trained agri professionals and their opportunities were immense.

Mr Ansh Patidar, Founder & CEO Agriwa organics shared his vision and his business. He said that technology played a very important role in addressing climate based challenges. He debunked the vision that organic agriculture must steer clear of technologies. He commented that centralisation of data was important for farmers. He suggested advanced training for farmers and that the NPOP standards should be updated with time.

Mr Morup Namgail, Head Agritech Development, IFFCO Kisan Suvidha Limited was of the view that collaboration could go a long way in addressing climate challenges. He said that it was critical that whatever technology that was introduced in agriculture must be scalable and feasible for the farmers. He commented that offerings through advisories to farmers must be tailor made.

Mr. Manish Shankar, Director, Palladium discussed about voluntary carbon markets. He said that individual farmers might find it difficult to plug into the voluntary carbon market. He noted that agri professionals needed to be equipped to help farmers adapt. The knowledge set and skill set among agri professionals needed to be updated. He wanted climate smart agriculture to be included in the curriculum.

Mr Sanjay Chaudhary, Vice President of Indogulf Cropsciences Ltd., observed that all the stakeholders starting from farmer to government were agri professionals coming with a specified skill set. He commented that discovery of new molecules was not happening in India, however, we had good infrastructure and skill set. He noted that solutions developed for farmers must be simple.

PRESENTATION OF 3RD OUTSTANDING PROFESSIONAL AWARDS

Dr. MJ Khan, President , Agriculture Today Group and Chairman, ICFA addressed the audience. He outlined the objectives of the event and commented on how it would help in addressing climate change problems in agriculture. He remarked that both food security and farmers' livelihood was at stake, and hoped that all the stakeholders in the agriculture collaborate and develop

strategies to address them.

Sh. Tarun Shridhar, former Secretary, AHD&F, Government of India spoke about the discussion that happened on climate change during the past days. He was of the view that the recommendations that had emerged from these discussions might hold the key to outline strategies for government to develop a climate resilient strategy.

Anand Bhaskar Rapolu, Former MP was happy that discussions were focussed on such an important topic. He reminded the audience that there were many challenges in agriculture especially due to climate change, and strategies must be defined to address food security and farmer welfare.

Sh. Pasha Patel, Executive Chairman, Maharastra CM Task Force quoted that era of global warming was over and that of global boiling had started. This required quick action and he outlined the strategies of Maharashtra state in addressing climate change through bamboo cultivation. He also suggested that we needed to move away from long duration crops to short term crops that use less water like micro millets.

Shri Bhagirath Choudhary, Hon'ble Minister of State (Agri & Farmers Welfare) presented the Outstanding Professional Awards. While addressing the audience, he congratulated Pasha Patel for his vision. He also reminded the audience the hardships taken by the farmers to feeding the population. He also elaborated on the relevance of Sree Anna. He concluded the address by suggesting that trees must be planted. Anjana Nair, Group Editor, Agriculture Today Group extended the vote of thanks.

15th AGRICULTURE LEADERSHIP AWARDS 2024

The National Awards Committee this year met on 2nd July in New Delhi under the Chairmanship of Former Chief Justice of India, Justice P Sathasivam and announced the winners for 20 categories. The event was graced by **Sh. Nitin Gadkari, Hon'ble Union Minister of Road Transport and Highways; Sh. Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture and Farmer's Welfare; Sh. Eknath Shinde, Hon'ble Chief Minister of Maharashtra; Sh. Dhananjay Munde, Hon'ble Agriculture Minister of Maharashtra; Pasha Patel, Member, CM Task Force, Maharshtra; Hon'ble Mr. Justice P. Sathasivam, Former Chief Justice of India, Former Governor of Kerala** and **Dr MJ Khan, President, Agriculture Today Group and Chairman, ICFA.**

Justice P Sathashivam welcomed the dignitaries and remarked that the Agriculture Leadership Awards were one of the coveted agricultural awards. He called for reimagining the current agricultural approaches on account of dwindling resources. He remarked that India had tremendous opportunities and scope for achieving sustainable growth in food and nutrition by policy push and public private partnership.

Shri Eknath Shinde after accepting the award for Best State in Agriculture for Maharashtra remarked that the state had a rich heritage in agriculture from the days of green revolution. Dedicating this award to the farmers of Maharashtra, Shri Shinde said that the farmers of the state were very keen to innovate and interested in adopting new technologies. He suggested planting bamboos as a solution to carbon sequestration. Shri Shinde informed that the government of Maharashtra was working on food security, environment and sustainability and has formed, Chief Minister Environment and Sustainable Development Task Force. He informed the audience that many schemes have been developed and implemented successfully in Maharashtra. The Micromillet cluster in Iathur, free electricity to farmers, increasing irrigation potential were some among them.

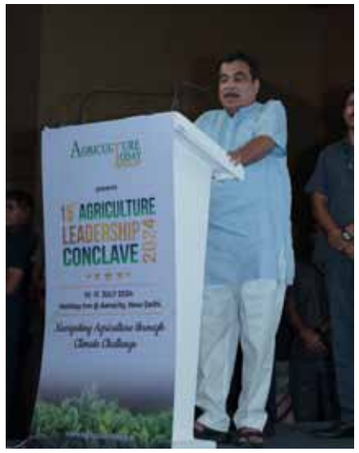
Shri Shivraj Singh Chouhan remarked that agriculture was the backbone of Indian economy and the farmers were the soul. He outlined the strategies to make India the food basket of the world. He said that primarily we had to increase yield and productivity. Seeds of HYV and new technologies can help in achieving this goal. Reducing cost of production is equally important as it would increase the profit margin of farmers. Investing in technology, assuring right price to farmers, providing crop insurance and crop diversification were other suggestions of the minsiter. While elaborating on crop diversification, he informed about the pulses mission of the government and special impetus given to Masoor, Tur and Urd. He also informed that the

government had assured MSP for them. He praised the Maharashtra government for giving impetus to Bamboo. Natural farming and benefits of micro irrigation too figured in his address. He concluded his address by reminding the audience of India's responsibility to work for the welfare of the entire world.

Shri Nitin Gadkari noted that even though agriculture and allied sectors contributed about 15% to country's GDP, 50% of the population depends on it for livelihood. He pointed out that India imported 55% of its vegetable oil requirements, and this indicated that the country needed to work on increasing vegetable oil production. He also pointed out India's dilemma where the MSP is more than the existing market price which is not healthy for India's economy. He also pointed out how bio ethanol would be revolutionary and be a solution to problem of surplus in crop production. He suggested to reduce cost of production and to depend on technology for the same. He narrated how the use of drones for fertilizer application considerably reduced the amount of fertilizers in comparison to applying them manually. Converting biomass to biofuels was another area of the minister's discussion. Shri Gadkari informed about 40 projects where 5 tonnes of rice straw yielded 1 tonne of CNG. In Panipat, rice stalk were used as the substrate that yielded 1 lakh litre Bioethanol, 1.5 tonne bio -bitumin and 76000 tonne bio aviation fuel per day. He suggested starting a nursery of international standards in each Taluk. This would help to produce good quality planting materials that would help to produce good quality fruits. He also lamented on the dearth of processing infrastructure in India. He suggested to provide loans at zero percentage interest for developing storage units. He also informed about the facilities that could increase the shelf life. He also explained the benefits of bamboo cultivation and its profits. He suggested the alternate uses of food crops that can make alternatives to fossil fuels and help in the fight against climate change.

Dr MJ Khan extended his gratitude through the vote of thanks.

GLIMPSES OF LEADERSHIP CONCLAVE



RECOMMENDATIONS

The 15th Agriculture Leadership Conclave held panel discussions with participation of veterans from agriculture industry. The two day long deliberations and discussions addressed many important concerns faced by the agriculture sector. Several recommendations emerged from these impactful and insightful discussions which are summarized below.

Policy level

- Encourage technology and innovation.
- Support startups
- Ensure data availability in public domain
- Fasttrack Agristack
- Provide subsidies to biological inputs.
- Promote Farm Level Processing
- Development of a national cropping policy
- Make agriculture a concurrent subject.
- Creating of innovation ecosystem
- Public Private partnership in R&D and delivery
- Protection of IPR
- Transformation of the regulatory system from being a controller to collaborator
- Updation of NPOP Standards
- Inclusion of Climate smart Agriculture in the curriculum

Bio Agriculture

- Supporting Carbon credits
- Standardisation of technology
- Scalability of technology
- Microbial technologies to reclaim the soil
- Global collaboration of research
- Global sharing of success stories and failures

Research and Development

- Triple helix model - Academia industry Government collaboration for technology growth
- Research in accordance with national and international standard s
- Creation of working group comprising industry and academia
- Avoid duplication of research
- Collaboration among like minded organization

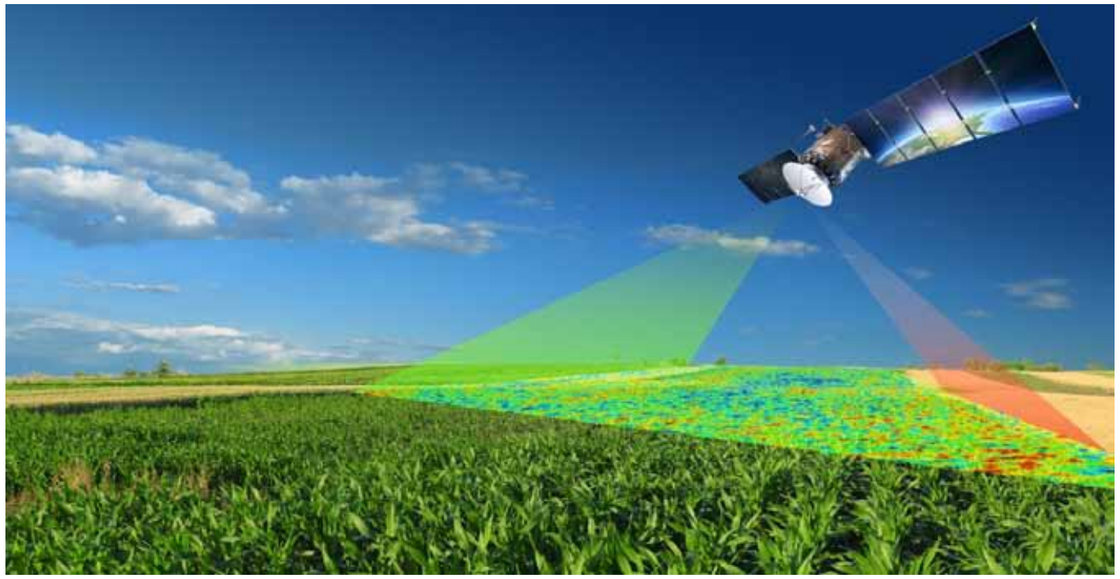
Technology and Innovation

- Aeroponics, aquaponic and hydroponics
- Protected cultivation
- Integrated Nutrient Management
- Customised solution for farmers
- Residue free farming
- Accessible and Faster soil testing
- Crop insurance advisories

Sustainable Agriculture

- Crop Diversification
- Exploring food crops for biofuels, bio bitumen and bio civil aviation fuel
- Balanced Crop Nutrition
- Nutrition according to specific stages
- .Advanced Training to farmers

GEOGRAPHICAL INDICATIONS (GIS) IN AGRICULTURE



About the **AUTHOR**

Mahadev Trimbak Kakade
Chief Manager (Research)
SBIRD, Hyderabad

Geographical Indications (GIs) are a form of intellectual property rights that identify a product from a specific location, where its quality, reputation, or other characteristics are intrinsically linked to its geographical origin. In the orbit of agriculture, GIs play a crucial role in protecting the unique identity and authenticity of regional products. Agriculture is a major component of the Indian economy, contributing approximately 15% to the Gross Domestic Product (GDP) and providing livelihoods for a significant portion of the population. India is the largest producer of numerous agricultural products, such as milk, spices, and pulses, and has the largest cattle population in the world.

The banking sector is essential to agriculture which provides financial services that support and enhance farming activities. Banks offer various types of loans, including short-term, medium-term, and long-term, to help farmers manage production cost, purchase equipment, and invest in infrastructure. Additionally, bank through insurance company provides risk management tools like crop and weather insurance to protect farmers from losses due to natural disasters and adverse weather conditions. Through savings and deposit accounts, banks help farmers securely save money and earn interest, fostering financial stability.

Moreover, banks play a crucial role in financial inclusion, extending financial services to remote and rural areas to ensure that small and marginal farmers have access to credit and other financial products. Banks also support agribusinesses with tailored financial products and participate in rural development projects to improve infrastructure and productivity. The integration of digital banking and fintech solutions further enhances efficiency and reduces transaction costs in agriculture. Overall, the banking sector acts as a vital backbone for agricultural development, promoting growth and sustainability in the sector.

GIS: A BOON FOR FARMERS

Premium Pricing

By establishing a distinct origin and superior quality, GIs enable farmers to acquire premium prices for their produce. This translates into increased income, improved livelihoods, and better financial security. For example, Darjeeling tea, a GI-tagged product, fetches a higher price compared to generic black tea due to its unique muscatel flavor.

Market Differentiation

GIs help farmers differentiate their products from unbranded commodities in a competitive marketplace. Consumers become aware of the origin and special qualities, leading to a preference for GI-tagged products. This allows farmers to acquire a niche market that is suitable for authenticity and quality.

Preserving Traditional Practices

GIs encourage the advancement of time-tested farming methods that have been honed over generations. These practices often contribute to the unique qualities associated with the product's geographical origin. The GI tag acts as an incentive for farmers to maintain traditional methods, ensuring the continued production of high-quality agricultural products.

Improved Bargaining Power

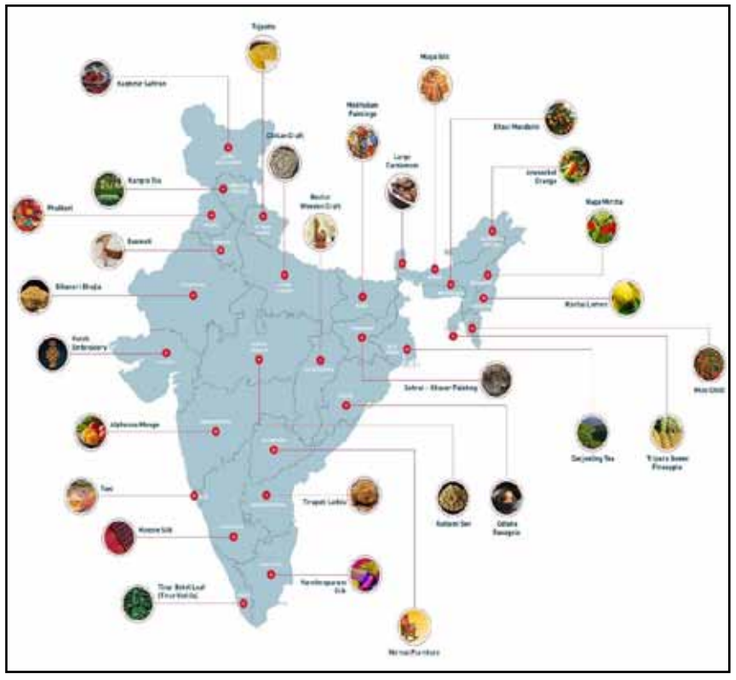
GIs equip farmers with a stronger voice in the market. With established brand recognition and premium pricing, farmers gain greater bargaining power when negotiating with distributors and retailers. This leads to a fairer share of the profits for their produce.

Economic Boost	Brand Recognition	Cultural Preservation	Rural Development
GIs enhance the market value of agricultural products, leading to higher incomes for farmers and producers.	Products with GI tags gain recognition and trust among consumers, both domestically and internationally.	GIs help preserve traditional knowledge and farming practices that are part of India's cultural heritage.	The protection and promotion of GI products contribute to rural development and can prevent migration to urban areas by creating local employment opportunities.

Simplifying the GI application process and providing legal and technical support can help overcome procedural hurdles.

Rural Development

GIs can act as a catalyst for rural development by promoting local agricultural practices and creating job opportunities within the GI value chain. It encourages investment in processing, packaging, and marketing of GI-tagged products, leading to economic growth in rural areas.



CHALLENGES OF GIS IN AGRICULTURE

While Geographical Indications (GIs) offer a promising path for empowering farmers and revitalizing agriculture, several challenges hinder their full potential:

Limited Awareness

A significant barrier is the lack of awareness among farmers, particularly small and marginal farmers, about the benefits and processes involved in obtaining a GI tag. Many are unaware of the potential premium pricing and market advantages associated with GIs. This limited knowledge leads to low participation in the GI system, restricting the overall benefits for both farmers and consumers.

Stringent Regulatory Procedures

The process of obtaining a GI tag can be complex and time-consuming. It often involves extensive documentation, technical specifications, and scientific evidence to establish the unique link between the product and its geographical origin. This complex process can be detrimental to some farmers, particularly those who have limited resources or access to legal and technical expertise.

Enforcement Mechanisms

Effective enforcement of GI regulations is critical to ensure the integrity and value of GI-tagged products. However, weak enforcement mechanisms can lead to misuse of GIs by producers outside the designated region. This dilutes the brand value of genuine GI products and confuses consumers who expect a certain level of quality and authenticity.

Marketing and Branding

Developing strong brand recognition for GI products, particularly in the domestic market, remains a challenge. Often, there is a lack of robust marketing strategies and infrastructure to effectively communicate the unique characteristics and value proposition of GI products to consumers. This can limit their market reach and consumer demand.

A significant barrier is the lack of awareness among farmers, particularly small and marginal farmers, about the benefits and processes involved in obtaining a GI tag.

Collective Action Issues

Promoting GIs often requires collective action from farmers within a specific geographical area. However, achieving cooperation among a large number of producers can be difficult. Challenges include free-riding behaviour by some farmers who benefit from the GI tag without contributing to its maintenance, and potential conflicts over resource allocation and decision-making within the GI association.

GIS AND BANKING OPPORTUNITIES

The increasing importance of GIs in agriculture presents a significant opportunity for the banking sector.

Targeted Credit Facilities

Recognizing the potential of GI-tagged products, banks can design specialized credit schemes catering to the specific needs of GI-certified farmers. These schemes could offer lower interest rates and access to working capital to support production, processing, and marketing activities.

Risk Management Solutions

The inherent risks associated with agriculture, such as weather fluctuations and pest attacks, can be mitigated through innovative risk management products. Banks can collaborate with insurance companies to offer customized crop insurance plans for GI-tagged crops, providing financial security to farmers.

Value Chain Financing

Banks can play a crucial role in financing the entire GI value chain, encompassing farmers, processors, and marketing entities. This could involve providing loans for infrastructure development in GI regions, storage facilities, and marketing initiatives.

Financial Literacy Programs

Banks can conduct financial literacy programs specifically tailored for GI-certified farmers. These programs can educate them on the benefits of GIs, credit management, financial planning, and effective utilization of banking products to support their GI-related activities.

Market Linkages

Banks can leverage network and expertise to connect GI-certified farmers with potential buyers and markets. This could involve facilitating participation in trade fairs, organizing buyer-seller meets, and promoting GI products through digital platforms.

WAY FORWARD

To fully utilize the potential of Geographical Indications (GIs) in agriculture, a concerted effort is needed to enhance awareness, streamline regulatory processes, and enhance enforcement mechanisms. Increasing farmer education through targeted outreach and financial literacy programs will empower them to leverage GIs effectively. Simplifying the GI application process and providing legal and technical support can help overcome procedural hurdles. Robust marketing and branding strategies, coupled with strong enforcement to protect against misuse, will enhance consumer trust and demand. Banks can play a pivotal role by offering specialized credit facilities, risk management solutions, and value chain financing tailored to GI-certified farmers.

MAIZE MATTERS FOR FOOD AND FODDER SECURITY

India's agricultural landscape is undergoing significant transformation, with maize emerging as a cornerstone for food security, economic stability, and sustainable farming practices. Known as the queen of cereals due to its highest genetic yield potential among cereals, maize has showcased remarkable versatility and adaptability across various ecological zones. Over the past seven decades, India's maize production has surged by 23 times, surpassing 38 million tons in the year 2022-23. This impressive growth is attributed to both the expansion in cultivation areas and significant enhancements in productivity. The domestic utilization of maize highlights its multifaceted importance: approximately 63% of the total production is dedicated to animal feed, while the remainder serves as industrial raw material (21%), food (8%), seed and storage (3%), and other miscellaneous uses (5%). These diverse applications underscore maize's pivotal role in driving global agriculture, positioning it as a critical commodity on the international stage.

About the **AUTHORS**

Dr Pitambara, Assistant Professor, BAU, Sabour, Bihar and

Dr. Choudhary is Scientist at ICAR-IGFRI, Jhansi

India's Production and Productivity

Empirical studies project that by 2025, India's domestic consumption of maize will be around 50 million tons (mt), with the feed sector alone demanding 32 mt. India's maize exports have also surged in recent years, reflecting the country's growing prominence in the global agricultural trade arena. There is an anticipated export potential of about 10 mt, necessitating an overall production of approximately 60 mt by 2025. Achieving this target necessitates the required annual growth rate of 7-8% in the production has been suggested in scientific literature. As scope of area expansion is limited, the emphasis must shift from merely expanding cultivation areas to significantly enhancing per hectare yields. When comparing productivity, our South Asian neighbour Bangladesh exhibits higher productivity rates (10.2 t/ha in 2022-23) compared to India's current level of 3.5 t/ha. This disparity highlights a substantial potential for improvement within India's maize sector. To bridge this productivity gap, both technological and policy interventions will be essential. While policy planning helps in removing the bottlenecks in the short-run, strategic research and extension focus is vital for sustainable intensification of maize-based cropping systems in the country.

Popularisation of Single Cross Hybrids

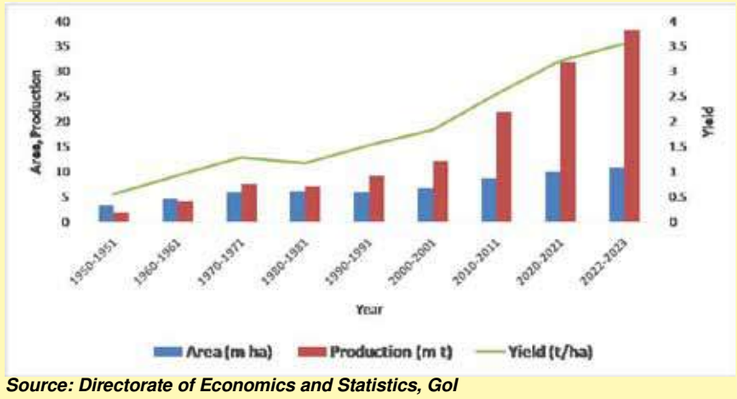
In maize cultivation, single-cross hybrids are the most productive, with some yielding over 12 tonnes/ha. Despite their potential, they reportedly cover around 50 % of maize acreage. Therefore, single-cross hybrids need to be popularized on a larger scale. Seed producers should target specific zones for their hybrids, while government extension programs should support dissemination through seed subsidies and field demonstrations. Additionally, innovations in seed production for reducing the cost of single-cross hybrid seeds and strengthening public-private partnership in production and marketing would catalyze rapid dissemination of newly released hybrids, leading to enhanced productivity and production.

Productivity Challenges

Identifying productivity constraints in various agro-ecological zones in within the country is also crucial. As per reports, in central and southern India, leaf diseases, stalk rots, and drought significantly limit productivity, affecting 25-30% of the region, while in thenorthern and eastern parts of the country, waterlogging, stalk rot and invasive pest fall armyworm are major challenges. Hill areas face issues with limited availability of suitable cultivars.Tailored scientific practices, such as improved seeds, soil and water management, pest and disease control must be customized for each zone and effectively communicated through extension services. Field studies and practical experiences suggest that India has the potential to double maize productivity and production by implementing two key strategies: covering 100% of the area with a single cross-hybrid variety equipped with biotech traits resistant to the invasive pest fall armyworm, and adopting high-input production technology.

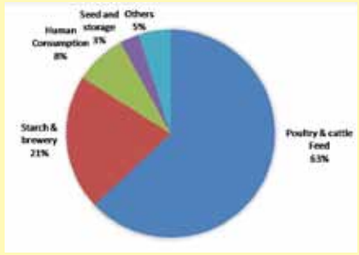
Policy Push

Ensuring maize farmers receive fair and stable prices is another area of policy concern. A stable and fair market price plays a vital role in encouraging farmers to adopt modern agricultural practices and would promote maize production across the country. Despite the annual announcement of Minimum Support Prices (MSP), there is minimal public procurement of maize, as it falls largely outside the scope of the public distribution system (PDS). Typically, market prices for maize have been higher than the MSP due to robust market demand. One notable aspect of maize marketing in India is its exposure to the export market. It is important to note that the fall in export volume triggered an exceptional domestic price crash in 2014-15, as seen in the major maize producing state Karnataka. Therefore, in the years of price crash, there should be some mechanisms for compensating the farmers through government supported price stabilization funds.



Source: Directorate of Economics and Statistics, GoI

Domestic Consumption break-up of maize in India, 2022-23



Source: ANGRAU Maize outlook report, 2022

A stable and fair market price plays a vital role in encouraging farmers to adopt modern agricultural practices and would promote maize production across the country.

Maize straw has been used as animal fodder since ancient times. Among non-legume cultivated fodders, maize stands out for its superior nutritional quality and high biomass yield, making it ideal for conservation as silage. Conserved forage is needed for sustaining milk production during lean periods and maintaining the health of farm animals. This dual-use crop is vital for food and fodder security in rural areas. India is witnessing several dual-purpose maize improvement programs that focus on enhancing the entire plant rather than just grain traits. These breeding efforts should be supported by multi-disciplinary research to better understand stover feeding practices across diverse agro-ecological and socio-economic contexts. By leveraging maize's multifaceted potential, farmers can boost their overall farm productivity and contribute to a more resilient, food-secure future.

SIGNIFICANCE OF SOIL HEALTH

Soil health is the cornerstone of sustainable agriculture, playing a pivotal role in ensuring the long-term viability of our food production systems. As the global population continues to grow, the demand for food is escalating, placing unprecedented pressure on agricultural practices. To meet this demand while preserving the environment, it is important to keep soil health on top priority.

What is Soil Health?

Soil health refers to the capacity of soil to function as a living ecosystem that sustains plants, animals, and humans. It encompasses various physical, chemical, and biological properties of soil, including its texture, nutrient content, organic matter, pH levels, and microbial diversity. Healthy soil supports the growth of crops by providing essential nutrients, water, and a stable physical environment. Enhancing soil health is crucial for multiple reasons, with the following being some of the most significant:

Crop Productivity

Nutrient Availability

Healthy soil is rich in essential nutrients such as nitrogen, phosphorus, potassium etc. These nutrients are vital for plant growth and development. Soil with optimal nutrient levels ensures that crops have access to the resources they need to thrive. In contrast, nutrient-depleted soil can lead to stunted growth, reduced yields, and increased susceptibility to pests and diseases.

Soil with optimal nutrient levels ensures that crops have access to the resources they need to thrive.

Water Retention

Well-structured soil with good organic matter content has improved water retention capacity. This is particularly crucial in regions prone to droughts or erratic rainfall. Soil that can store water effectively helps crops withstand periods of water scarcity, reducing the risk of crop failure and ensuring a more reliable harvest.

Root Development

Healthy soil provides an ideal environment for root development. Strong and deep root systems are essential for plant stability and efficient nutrient uptake. Adequate root growth contributes to increased crop resilience, enabling plants to better withstand adverse conditions like strong winds and heavy rains.

About the **AUTHOR**

Rahul Padwal,
Adjunct Research Scientist,
AICAD Organic Fertilizers Project Consultant Pune – India

Environmental Conservation

Reduced Erosion

Healthy soils are less prone to erosion. Erosion occurs when wind or water displaces the topsoil, which is rich in organic matter and nutrients. Erosion can result in the loss of fertile soil and contamination of water bodies. Sustainable agricultural practices that prioritize soil health help mitigate erosion, preserving the soil's integrity.

Carbon Sequestration

Soil health plays a vital role in carbon sequestration, which is the process of capturing and storing carbon dioxide from the atmosphere. Soils rich in organic matter act as carbon sinks, helping to reduce greenhouse gas concentrations in the atmosphere. Sustainable farming practices, such as cover cropping and reduced tillage, can enhance carbon sequestration in soils.

Biodiversity Conservation

Healthy soil is teeming with diverse microbial life, including beneficial bacteria and fungi. These microorganisms contribute to nutrient cycling, disease suppression, and overall ecosystem health. By promoting soil health, sustainable agriculture practices support biodiversity both above and below the ground, enhancing the resilience of ecosystems.

Food Security

Resilience to Climate Change

Climate change is increasingly impacting agriculture through extreme weather events, altered precipitation patterns, and shifting pest and disease dynamics. Healthy soil can help buffer these effects by providing crops with the resources they need to adapt and thrive in changing conditions.

By conserving soil and water resources, sustainable agriculture contributes to long-term food security.

Sustainable Resource Management

Sustainable agriculture practices, which prioritize soil health, promote responsible resource management. This includes efficient nutrient use, reduced chemical inputs, and improved water management. By conserving soil and water resources, sustainable agriculture contributes to long-term food security.

Strategies for Enhancing Soil Health

To harness the benefits of soil health enhancement, farmers and agricultural practitioners can adopt several strategies:

- Cover Cropping: Planting cover crops between main crops to protect the soil from erosion and improve organic matter.
- Crop Rotation: Alternating crops in a sequence to break pest and disease cycles and improve soil fertility.
- Reduced Tillage: Minimizing soil disturbance through no-till or reduced-tillage practices to preserve soil structure.
- Organic Matter Addition: Incorporating compost, crop residues, and organic materials to enhance soil structure and nutrient availability.
- Nutrient Management: Precise application of fertilizers to prevent overuse and reduce nutrient runoff.
- Integrated Pest Management (IPM): Implementing practices that focus on pest and disease prevention, reducing the need for chemical pesticides.

The significance of soil health in sustainable agriculture cannot be overstated. Healthy soil is essential for maximizing crop productivity, conserving the environment, and ensuring food security in a changing world. To achieve these goals, farmers, policymakers, and researchers must work collaboratively to promote and implement sustainable farming practices that prioritize soil health. Implementing strategies such as cover cropping, crop rotation, reduced tillage, organic matter addition, nutrient management, and integrated pest management can help farmers improve soil health while ensuring the long-term viability of their agricultural operation.

UNION BUDGET 2024-25

FROM THE PERSPECTIVE OF AGRICULTURE SECTOR

The Union Budget 2024-25 presented by the Finance Minister, Shri Nirmala Sitharaman carried forward the tone and tenor of the Interim Budget and the focus remAained on 'Garib' (Poor), 'Mahilayen' (Women), 'Yuva' (Youth) and 'Annadata' (Farmer). Emphasising on Productivity and resilience in Agriculture, the FM laid out a well endowed plan for agriculture. A provision of Rs.1.52 lakh crore was made for agriculture and allied sector.

Transforming agriculture research

- Focus on raising productivity and developing climate resilient varieties
- Funding provided in challenge mode, including to the private sector
- Domain experts both from the government and outside to oversee the conduct of such research

Release of new varieties

- New 109 high-yielding and climate-resilient varieties of 32 field and horticulture crops to be released

Natural Farming

- 1 crore farmers across the country to be initiated into natural farming supported by certification and branding in the next two years.
- Implementation through scientific institutions and willing gram panchayats.
- 10,000 need-based bio-input resource centres to be established.

Missions for pulses and oilseeds

- Strengthen production, storage and marketing.
- Astrategyin place to achieve 'atmanirbharta' for oil seeds such as mustard, groundnut, sesame, soybean, and sunflower.

Vegetable production & Supply Chains

- Large scale clusters for vegetable production closer to major consumption centres.
- Farmer-Producer Organizations, cooperatives and start-ups for vegetable supply chains including for collection, storage, and marketing.

Digital Public Infrastructure for Agriculture

- Implementation of the Digital Public Infrastructure(DPI) in agriculture for coverage of farmers and their lands in 3 years.
- Digital crop survey for Kharif using the DPI in 400 districts.
- Details of 6 crore farmers and their lands to be brought into the farmer and land registries. Issuance of Jan Samarth based Kisan Credit Cards in 5 states.

Shrimp Production & Export

- Financial support for setting up a network of Nucleus Breeding Centres for Shrimp Broodstocks
- Financing for shrimp farming, processing and export to be facilitated through NABARD.

National Cooperation Policy

- Fast-tracking growth of rural economy and generation of employment opportunities on a large scale

INDUSTRY REACTIONS

Dr KC Ravi, Chief Sustainability Officer, Syngenta India Pvt Ltd and Chairman Crop Life India

The Seventh Union Budget of the Finance Minister is a refreshingly no-frill budget that addresses the present realities and challenges of the agriculture sector. The announcement of releasing 109 high-yielding and climate-resilient varieties of 32 field and horticultural crops for cultivation marks a significant step forward in advancing agriculture. Collaborative research of public institutions with the private sector for development of newer climate resilient varieties and farm practices for the various agro-climatic zones in the country would help farmers navigate and manage the emerging challenges in coming years.

The Modi 3-0 government continues the emphasis on technology and digital advancements. The digital crop survey for Kharif in 400 districts is another important announcement and will strengthen the digital public infrastructure for agriculture. It will enhance transparency, empower farmers by providing them alternatives, and create more opportunities. We welcome the Government's commitment to comprehensively review the Agricultural Research Setup, highlighting the need to raise productivity and develop climate-resilient varieties. As a company dedicated to high-end R&D, we believe this will strengthen India's capacity to deliver solutions tailored to our diverse agro-climatic zones, benefiting a large number of farmers.

Strategy to bring "atmanirbartha" in oil seeds like mustard, groundnut, sesame and sunflower is a welcome move and would not only conserve precious foreign exchange but also unleash the potential of domestic production. The private sector can play a major role in this effort.

The agrochemical sector was also expecting schemes such as production linked incentive (PLI) scheme, income tax benefit of 200 percent weighted deduction on R & D and the rationalization of GST rates at par with other agri inputs.

Mr. Simon Wiebusch, President of Bayer South Asia and Vice Chairman, MD & CEO of Bayer CropScience Ltd (BCSL)

"The 2024 Union Budget outlines a strategy for achieving nine key priorities and aims to create opportunities for youth, farmers, and the rural population, pushing India closer to the vision of Viksit Bharat. The Finance Minister's commitment to agricultural reforms with measures like bringing 6 crore farmers into the farmer and land registries, establishment of bio-research centers and expansion of Kisan credit cards , backed by a significant Rs.1.52 lakh crore spend, will definitely boost the sector's growth. Despite being the second largest producer of fruits and vegetables, India accounts for merely 2% of global horticulture trade. The FM's announcement to set up large scale clusters for vegetable production and utilization of FPO's and start-ups to promote vegetable supply chains will not only help control food prices but set the stage for making India a major horticulture exporter. Similarly, focus on climate resilient crops and access to new technology will bring in food security as well as Atmanirbharta in key areas like oilseeds."

Mr. Raju Kapoor, Director, Industry & Public Affairs, FMC India

"The government has presented a forward-looking and growth-oriented budget that rightly prioritizes the transformation of Indian agriculture. The comprehensive review of agricultural research focusing on productivity and climate resilience is a much-needed step. We are also encouraged by the government's commitment to involve the private sector and domain experts to further enhance this endeavor, fostering a collaborative approach towards agricultural innovation and building a larger innovation ecosystem.

The introduction of 109 new high-yielding and climate-resilient varieties of 32 field and horticultural crops further showcases the government's dedication to providing farmers with the support they need to thrive in the changing environment. Similar efforts are needed to make the expedited availability of modern agricul-

tural inputs to enhance productivity. The digital public infrastructure for agriculture in partnership with States, integrating 6 crore farmers and their land into a digital registry will increase transparency and also democratize access to digital services. This will last lay a strong foundation for precision agriculture. The government's vision of developing vegetable production closer to consumption centers and promoting FPOs, cooperatives, and startups for efficient supply chains is likely to benefit both farmers and consumers. It is encouraging to see the government's increased focus on ease of doing business with Jan Vishwas bill 2.0 which will strengthen FDI in agriculture and also help in modernizing the agriculture sector with technology and R&D. Further decriminalisation of minor offences may be ensured even in the Insecticides Act 1968. The initiative to open 1000 ITIs is a timely initiative. Relevant centres of ITIs must start drone pilot training and maintenance as an option to feed the skill et needed to grow the drone led agricultural economy.

Overall, this budget has laid a strong foundation for a more resilient, productive, and sustainable agricultural sector in the country. We remain committed to partnering with the government in its endeavor to transform Indian agriculture and improve farmer livelihoods and the country's food security."

Mr. Balram Singh Yadav, Managing Director, Godrej Agrovet Limited

"In its quest for 'Viksit Bharat', the proposals in today's budget take care of both supply and input sides of Indian agriculture. While it is encouraging to see government's heightened focus on enhancing productivity and making Indian agriculture future resilient, with the ever-evolving climatic conditions in the world we live in, increased focus on research and development and introducing climate-resilient seeds is a step in right direction. Additionally, strengthening of vegetable supply chain by leveraging the entire value-chain of the industry should help the country refine its vegetable ecosystem and catapult the rural economy and employment. That said, increased digital penetration and enabling access to credit – both through Jan Samarth based Kisan Credit Cards and for Shrimp farmers, should aid the sector as a whole."

Dr. MJ Khan, Chairman, ICFA

"The agriculture and farmer-centric policies reflect the vision of the finance minister to bring socio-economic progress and prosperity in the hinterland while ensuring farmer well-being.

With agriculture focused budget, with proposed research and marketing reforms, the finance minister has announced a wide array of measures to fortify the agriculture domain and bring prosperity to the farmers. The policies such as providing support to farmer-producer organisation and cooperatives, augmenting rural infrastructure by launching phase IV of PMGSY, support for developing clusters close to consumption centres, Mission for pulses and oil seeds to raise domestic production, encouraging agri research, digital public infrastructure for agriculture, etc would make farming more remunerative.

The thrust given to natural farming and digital infrastructure, can be considered as a futuristic measure for producing safe food and reducing the cost of marketing through better producer–market connect, leveraging the digital technologies. I hope that the provisions made in the budget would be followed up by concrete steps to develop sustainable agriculture practices, boost agriculture productivity and augment farmer income."

Mr Ajai Rana, Chairman, Federation of Seed Industry of India (FSII) & CEO & MD Savannah Seeds

The seed industry welcomes the budget 2024-2025, which has allocated Rs 1.52 lakh crore to the agriculture and allied sectors, marking an increase from the Rs 1.25 lakh crore allocated in 2023. This budget has rightfully kept farmers at its core, identifying agriculture and its allied sectors as a top priority among the nine key focus areas. The emphasis on Productivity and Resilience in Agriculture highlights a strategic direction to strengthen the sector.

The push towards agricultural research in India is a significant concern for the seed industry. The Honorable Finance Minister has addressed this concern by announcing a comprehensive review of the agricultural research setup. This review will ensure high productivity and development of climate-resilient varieties, which is a crucial step forward for our industry.

Moreover, the announcement of the release of 109 high-yielding and climate-resilient varieties of 32 field and horticultural crops is a monumental step. This landmark initiative will address the detrimental effects of droughts and floods on agriculture, safeguarding farmers from crop losses and ensuring food security and stable incomes. Introducing these resilient crop varieties will support farmers through innovative agricultural practices.

India's agriculture sector has recently emphasized the need to achieve self-sufficiency in oilseeds and pulses. In 2022-23, the country imported 165 million metric tonnes of edible oils. The announcement of a mission for pulses and oilseeds is a strategic move towards achieving self-reliance (Atmanirbharta), potentially saving India substantial amounts in import costs and strengthening domestic production.

The launch of the fourth phase of the Pradhan Mantri Gram Sadak Yojana aims to significantly boost rural connectivity, thereby fostering rural prosperity and attracting substantial capital, particularly Foreign Direct Investment (FDI), in the agriculture sector. The government's steadfast commitment to facilitating the implementation of Digital Public Infrastructure (DPI) in agriculture, in collaboration with states, will modernize the sector and enhance its efficiency. Integrating the details of 6 crore farmers and their lands into centralized farmer and land registries will streamline agricultural management and support systems.

However, cotton should have also been included in this mission. A dedicated cotton technology mission is crucial to address the challenges faced by the cotton sector. Additionally, the budget missed providing tax benefits for the seed industry on research investments. Restoring the 200% IT deduction that the industry has been advocating for would have been beneficial & is a miss in the budget.

The budget 2024-2025 reflects a comprehensive and progressive approach to strengthening India's agriculture sector. The Federation of Seed Industry of India applauds these initiatives and looks forward to contributing to the nation's agricultural advancement.

Dr. Gyanendra Shukla, MD and CEO of Rallis India Limited

"Firstly, I would like to extend my heartfelt congratulations to Finance Minister Nirmala Sitharaman on presenting her seventh consecutive budget. We are pleased to see that the Budget 2024-25 allocates funds worth ₹1.52 lakh crore for Indian agriculture and another ₹2.6 lakh crore for Rural Development. This budget emphasizes a key performance indicator for the sector, highlighting the importance of agricultural research in our modern economy. It is heartwarming to see that in the next two years, 1 crore farmers across the country will be skilled, supported by certification and branding.

Developing high-yielding and climate-resilient seed varieties for different agro-climatic zones is crucial, and we are committed to supporting the government in this effort. At Rallis, we believe that focusing on digital public infrastructure is essential to bridging the urban-rural divide in agriculture. The budget's focus on natural farming, pulses, and oilseeds self-sufficiency aligns with our goals to promote environmentally friendly practices and ensure food security. The Budget has laid a strong foundation for making India Atmanirbhar in agriculture, ultimately leading to a more resilient agricultural system in the country."

Mr. Hemant Sikka, Co-Chair, FICCI, National Agriculture Committee and President – Farm Equipment Sector, Mahindra & Mahindra Ltd.

"Budget 2024 balances fiscal prudence with growth and sets the tone for the next wave of reforms for the growth of the country. It facilitates all the key elements to sustain high growth of Viksit Bharat and primarily that of the agri economy, with a focus on the country's youth, its farmers, women and the weaker sections of society. This is in the areas of skilling, employment and higher education. With a 4% increase in allocation for rural development at Rs. 2.66 lakh crore, and a 5% YoY increase in allocation for agriculture and allied sector of Rs. 1.5 lakh crore, this budget will strengthen the 'Annadata' – our farmers, the backbone of our nation, while providing a much needed fillip for growth of the overall economy."

Mr. Ankur Aggarwal, Managing Director of Crystal Crop Protection Limited

"We welcome the government's allocation of Rs. 1.52 lakh crore for the agri and allied sectors. The introduction of 109 high-yielding and climate-resilient varieties of 32 field and horticulture crops is a

significant step forward for our farmers community. The comprehensive review of agricultural research, led by domain experts, will ensure the effectiveness and relevance of developing climate-resilient seeds. Additionally, the promotion of digital public infrastructure for agriculture in partnership with states is a forward-thinking initiative.

At Crystal Crop Protection Limited, we are ready to support and contribute to these efforts, believing they will significantly enhance productivity, ensure food security, and strengthen our agricultural sector against climate change."

Mr. Narinder Mittal, Country Manager & Managing Director – CNH India & SAARC

“With its focus on farmers, this forward-thinking budget is set to enhance the livelihoods by promoting sustainable practices, boosting productivity, and developing digital and financial infrastructure. By introducing 10 million farmers to natural farming techniques and emphasizing on agricultural research will help develop climate resilience for a more secure future. Furthermore, the three-year plan and framework for digital infrastructure will benefit farmers with access to vital information, such as weather forecasts, crop advisory services, and market prices. This will enable informed decision-making, better crop management, and increased financial resources for investing in advanced farm equipment and precision technology, driving growth, productivity, and crop quality.”

Ayush Gupta - Business Head, India market, KRBL Limited

"KRBL commend the government for coming up with a very progressive and pragmatic budget that will provide a strong foundation for transforming Indian agriculture. Productivity and resilience, through initiatives such as comprehensive review of agri-research, release of high-yielding and climate-resilient crop varieties, and promotion of natural farming, completely resonate with India's vision of sustainable and prosperous farming.".

We particularly welcome the government's drive for promoting FPOs, cooperatives and start-ups for vegetable supply chains involving collection, storage, and marketing. The partnership proposed with states for facilitation of implementation of Digital Public Infrastructure in Agriculture during the next three years is also one major step in the revolution. Increased digital infrastructure will help much in improving supply chains and farmer support systems, enabling self-sufficiency and growth.

We welcome such progressive steps and remain committed to making the vision of the government towards a 'Viksit Bharat' a reality."

Harsh Vardhan Bhagchandka, President IPL Biologicals

“The PM’s Vision-2047 for a Viksit Bharat cannot be achieved without the focus on Agriculture. We are happy to note that the Hon’ble Finance Minister listed 9 government priorities, with Agriculture Productivity being on the top. The allocation of ₹1 lakh crore for private sector innovative R&D and commercialization support shall help in bolstering an environment of innovation and progress. The government’s initiative to review the agriculture research setup shall help us focus more on products that increase productivity and developing climate-resilient varieties will drive innovation and efficiency in the sector. Additionally, the attractive Employment Linked Incentive (ELI) scheme and the withdrawal of the angel tax is a positive step that will encourage more investment and growth in the sector.

IPL Biologicals is committed to developing advanced biological products that support resilient and sustainable farming practices. The initiative of government will develop 1 crore “natural” farms supported by certification and branding, will pave the way for a more eco-friendly and sustainable agricultural landscape. This, coupled with the establishment of 10,000 need-based bio-input resource centers, will provide a robust support system for farmers transitioning to natural and organic farming methods.

We look forward to contributing to and supporting these initiatives, continuing our commitment to transforming agriculture through biological innovations."

UNION BUDGET 2024-25

Amit Vatsyayan, Leader GPS-Agriculture, Livelihood, Social and Skills, EY India

“The government efforts reflect a comprehensive strategy to transform agriculture, focusing on climate-resilient practices, boosting productivity, enhancing efficiency. The initiatives aim to equip farmers with the tools needed for sustainable growth in changing climates. The budget also sets its intention on enhancing productivity and marketing in the sector, evident in initiatives focusing on development of clusters across major FPO and consumer centres, push for shrimp breeding and exports. Enhancements in research in partnership with private sector and digital public infrastructure for agriculture in the form of a land crop survey underscore a forward-looking approach, ensuring efficient resource management and innovation. These efforts not only aim to modernize farming practices but also strengthen the sector's resilience against future challenges. It's a proactive step towards creating a robust agricultural ecosystem and economy that supports sustainable development and enhances farmer livelihoods.”

Shashi Kant Singh, Partner -Agriculture, PwC India

“Union Budget has laid down a clear path for ensuring sustainable growth of the agriculture sector. Allocation in excess of INR 1.5 lakh crore, coupled with a clear focus on productivity and resilience, provides a much-needed thrust to the sector. Significant emphasis has been given to climate and productivity-responsive research and use of technology. A dedicated National Cooperation Policy is a welcome step, and will positively impact the agrarian and rural economy. New models of collaborative research involving the private sector exemplify the government’s steadfast commitment towards agricultural transformation. A strategic approach to strengthen the pulses and oilseeds sector gels well with the government’s self-sufficiency mission. In a nutshell, the budget has indeed tried to address the key aspects shaping the agriculture sector.”

Ashish Agarwal, Co-Founder & CTO, Weather Risk Management Services (WRMS)

"Budget 2024-2025 marks a significant milestone towards a thriving and innovative agritech future, with a strong emphasis on climate resilience and adaptation. The introduction of 109 high-yielding, climate-resilient crop varieties and the comprehensive review of agricultural research for climate-smart seeds are substantial advancements for the sector.

The budget’s allocation of Rs 2.66 lakh crore for rural development and the promotion of digital infrastructure aligns well with our objectives. The focus on natural farming and the goal to engage one crore farmers in the next two years further supports sustainable agriculture.

Additionally, the budget underscores the importance of collaboration among the government, private sector, and research institutions to drive innovation and scalable solutions. To fully harness this progress, increased investments in IoT, AI, and data analytics are crucial. These technologies will enhance climate risk assessment and response, providing real-time data and predictive insights to improve climate adaptation strategies and ensure more effective interventions.

We are optimistic that these initiatives will drive economic growth and promote sustainable development."

Atul Garg, Managing Director, GRM Overseas Limited

Agriculture remains a cornerstone of this budget, with a provision of ₹1.52 lakh crore aimed at boosting productivity and resilience. The introduction of high-yielding and climate-resilient crop varieties, promotion of natural farming, and digital public infrastructure for agriculture underscore the government's forward-thinking approach to sustainable development.

The emphasis on digital infrastructure, support for farmer cooperatives, and startups marks a new era of efficiency and innovation in farming. The plan to initiate one crore farmers into natural farming is a visionary step that will enhance productivity and promote eco-friendly practices. Addressing long-standing challenges like fragmented supply chains, limited credit access, and outdated techniques, the introduction of the Jan Samarth-based Kisan Credit Card and the focus on bio-input resource centers will empower farmers with essential resources and financial support. Strengthening the production and marketing of pulses and oil seeds will improve self-reliance and boost incomes.

The government's commitment to capital expenditure and support for irrigation projects further reinforces its dedication to a robust agricultural infrastructure. These initiatives reflect a strong vision for the future, ensuring our farmers are well-equipped to face challenges and seize new opportunities. This budget paves the way for a more resilient and prosperous agricultural sector.

Vimal Kumar Alawadi, Managing Director, Best Agrolife Ltd.

“The Hon’ble Finance Minister must be congratulated for the Budget’s compassionate vision with its focus on the poor, women, youth and farmers. Since climate change has been impacting agricultural output, it requires a sustained emphasis to shift Indian farming from its reliance on rains to an irrigation-led ecosystem. Accordingly, the FM mentioned that the Budget’s key priorities include productivity and resilience in agriculture. With this in mind, the decision to opt for a comprehensive review of India’s agricultural research setup to create climate-resilient varieties and boost productivity will benefit domestic food security. Plans to release 109 new high-yielding, climate-resilient seeds for 32 field/horticulture crops are also commendable, as is the move to promote increased production via large-scale vegetable production clusters as well as the use of treated water for irrigation.

The move to initiate 10 million farmers into natural farming over two years is also welcome, although one should not overlook the key role of reliable agrochemical products in safeguarding crops to boost productivity. Other beneficial measures include the proposed partnership between the Centre and the states to advance digital public infrastructure for agriculture; strengthening the production, storage and marketing of pulses and providing finance for shrimp farming/marketing, among others. However, one was hoping for a higher capex allocation that would have been an increase on the interim Budget outlay of Rs11.11 lakh crore, which equates to 3.4% of the GDP. Here, the FM choose to maintain the status quo. Nevertheless, the overall measures announced should give a fillip to the agriculture industry and allied segments.”

Anand Ramanathan, Partner and Consumer Products and Retail sector Leader, Deloitte India

"The budget focuses on important areas such as Crop resistant seed variety distribution, scaling digital public infrastructure and natural farming which will improve farm level productivity. Mission for self-sufficiency in pulses, encouraging shrimp production and focus on vegetable production clusters will help in aligning production to emerging changes in consumption of fresh produce and proteins."

Sameer Jain, Managing Director at Primus Partners

“A very explicitly laid out plans on Climate Action bodes well esp. in harnessing the areas of Renewables, Agriculture, etc. PLI interventions to promote the industry in Renewables will lead to the much needed Corporate action.”

Vivek Iyer, Partner, Grant Thornton Bharat

"Digital Public Infrastructure in agriculture will provide more farmer data, enabling fintechs to access mainstream credit information. This will improve credit quality and increase financial inclusion for farmers."

Swarup Bose, Founder & CEO at Celcius Logistics

“Food wastage has been a grave concern for the country. The government’s focus to strengthen vegetable production and supply chain through the development of large-scale clusters near major consumption centres is a crucial step in curbing the wastage issue and be self-sufficient. By promoting farmer producer organizations, cooperatives, and startups, the government is nurturing an ecosystem that encourages innovation and collaboration. These steps are crucial for reducing food wastage and improving market access for farmers and new age Agri-startups. Additionally, the commitment to digital public infrastructure for agriculture is a transformative move that will enable better tracking, transparency, and efficiency across the supply chain. These initiatives will optimize cold supply chain logistics, ensuring fresher produce reaches consumers faster and more efficiently. The allocation of Rs 1.52 lakh crore for agriculture and allied sectors will significantly enhance the efficiency and reach for logistics services provider.

The emphasis on infrastructure development and road connectivity will further streamline the supply chain sector’s operations, allowing us to better serve consumption centres.. This budgetary aid will help strengthen the cold supply chain ecosystem and connect rural India, where most agricultural foods are produced. Moreover, The government's infrastructure push will also benefit companies across various sectors, including new-age food companies, quick-service restaurants (QSR), and quick commerce companies. These companies will be able to tap new markets because of the enhanced road connectivity and deliver goods to aspirational Bharat. The improved connectivity will help last mile delivery of temperature sensitive pharma products. More and more temperature sensitive products will be delivered to remotest of the area due to robust infrastructure. This budget reflects a strong commitment to sustainable agricultural growth and efficient logistics management, and we look forward to contributing to these goals.”

Mr. Deepak Bharadwaj, co-founder and Director of IoTechWorld Avigation

"We at IoTechWorld welcome the Modi 3.0 government's transformative budget, emphasizing agricultural research and innovation. The comprehensive review of the farm research setup to develop climate-resilient crop varieties is a crucial step towards sustainable agriculture. The push for natural farming, with plans to initiate one crore farmers, aligns with our mission of promoting eco-friendly practices. The introduction of a digital crop survey in 400 districts marks a revolutionary stride in leveraging technology for precision farming. We at IoTechWorld is dedicated to provide technologically advanced solutions to enhance agricultural output. Through Agribot drones from IoTechWorld in farm spraying, increasing crop yields and farm productivity, and surveillance drones for research and survey, we are excited to support these initiatives. "

Dr, Aman Mittal, Vice President, LPU

"The government’s provision of Rs1.52 lakh crore for agriculture and allied sectors marks a significant step toward enhancing the country’s agricultural landscape. The establishment of 10,000 bio-research centers and the initiation of 1 crore farmers into natural farming with robust branding and certification over the next two years will foster sustainable practices. Developing large vegetable production and supply clusters closer to consumption centers and providing financial support for shrimp breeding through NABARD will strengthen the supply chain and boost exports. The introduction of Kisan Credit Cards in five states, the release of 109 varieties of 32 crops, and efforts to ensure self-sufficiency in pulses and oilseeds underscore the commitment to empowering farmers and ensuring food security."

Mr. Priyam Patel, MD, NK Proteins Pvt Ltd.

"The Union government has maintained a strong focus on enhancing agricultural productivity and resilience. The substantial allocation of Rs 1.52 lakh crore for agriculture and allied sectors underscores this commitment. Initiatives for self-sufficiency in pulses and oilseeds, particularly groundnut, sesame, and sunflower, are pivotal for Atmanirbharta in the edible oil sector. The emphasis on digital crop surveys and strengthening storage and marketing infrastructure will greatly benefit farmers, ensuring a robust and stable agricultural sector. These measures will significantly support the growth and stability of our industry, fostering sustainable development and economic growth."

Mr. Chirag Sharma, CEO, Drone Destination

“We welcome the budget’s focus on creating digital agriculture, employment generation, skill development, and women in the workforce. At Drone Destination, we continue to be a lead player in the Namo Drone Didi program to train and empower women drone entrepreneurs from self-help groups in rural areas. We look forward to carrying our extensive drone mapping experience from schemes like SVAMITVA to support creation of digital public infra in agriculture. Additionally, our recent MoU with NSIC to establish drone training centres nationwide aims to skill and develop a future-ready workforce for the growing demands in the Indian drone eco-system"

Navneet Ravikar, Chairman & Managing Director, Leads Connect Services

"The emphasis on transforming agricultural research and introducing climate-resilient technologies marks a pivotal moment for Indian agriculture. The comprehensive review of the farm research setup and the development of 109 high-yielding climate-resilient crop varieties will significantly enhance productivity and sustainability.

Increased funding towards the sector, coupled with the initiation of natural farming practices for 1 crore farmers, truly underscores the commitment to sustainable and eco-friendly agriculture.

More than that, the establishment of more gram panchayats, the encouragement of FPOs, agri-startups, and vegetable supply chain companies, and a focused push on oil seeds such as mustard, soybean, and sunflower to achieve atmanirbharbharat are strategic moves that will strengthen the ecosystem.

The 2024 budget also takes a forward-thinking approach by integrating technology with agriculture. The enhancement of digital infrastructure and the introduction of digital crop surveys for Kharif crops, along with the rollout of farmer credit cards in five states, reflect the same.

The allocation of ₹1.52 lakh crore for agri and allied sectors and the collaborative efforts between the central and state governments to implement these initiatives will go a long way in bolstering not just agriculture but the entire economy."

WHY AGRICULTURE MATTERS TO INDIAN ECONOMY?

The Reserve Bank of India's (RBI) monthly bulletin highlights a positive outlook for agriculture due to the early monsoon, a gradual decrease in headline inflation primarily driven by a decline in core inflation, and ongoing challenges with volatile food prices affecting the disinflation process. Additionally, it notes a recovery in domestic demand post-pandemic and India's shift to a net borrower status, reflected in the current account deficit for the financial year 2021-22.

Why Agriculture Outlook Matters to Policy Makers &Indian Citizens?

Impact on Inflation

Agriculture significantly influences food prices, which are a major component of headline inflation. A positive agricultural outlook with higher yields can lead to lower food prices, helping to control overall inflation.

Rural Economic Stability

Agriculture is a primary source of income for a large portion of the Indian population. Improved agricultural productivity boosts rural incomes, enhancing economic stability and demand in rural areas.

Monetary Policy Decisions

Understanding agricultural performance helps the RBI in making informed decisions on interest rates and other monetary policies. Lower inflation due to good agricultural output might allow for more accommodative monetary policies.

Supply Chain Effects

Agriculture affects various sectors such as food processing, retail, and transportation. A robust agricultural sector can have positive spill over effects across these industries, influencing overall economic growth.

Food Security and Imports

A positive agricultural outlook reduces dependence on food imports, improving the trade balance and maintaining food security. This stability is essential for long-term economic planning and policy formulation.

Sub Group	Weightage
Cereals and products	9.67
Meat and fish	3.61
Egg	0.43
Milk and products	6.61
Oils and fats	3.56
Fruits	2.89
Vegetables	6.04
Pulses and products	2.38
Sugar and Confectionery	1.36
Spices	2.5
Non-alcoholic beverages	1.26
Prepared meals, snacks, sweets etc.	5.55
Total Food and beverages	45.86
Pan, tobacco and intoxicants	2.38

How it is affecting?

Major Component of CPI

Agriculture-related products, particularly food and beverages, constitute a significant portion (approximately 45.86%) of the Consumer Price Index (CPI). This means fluctuations in agricultural output and prices have a substantial impact on overall inflation.

Impact of Irregular Rainfall

Irregular rainfall and poor agricultural yields over the past year have led to increased prices for vegetables and grains. These price hikes directly affect

Component	Weightage (%)
Food and Beverages	**45.86**
Housing	10.07
Fuel and Light	6.84
Clothing and Footwear	6.53
Miscellaneous	28.32
Pan, Tobacco, and Intoxicants	2.38

the cost of living for common Indian citizens, as food expenses are a major part of their daily and monthly budgets.

Economic Backbone

Agriculture is more than just a sector in India; it is the backbone of the economy. It provides employment to a significant portion of the population and sustains rural livelihoods. Variations in agricultural productivity can have widespread effects on economic stability and growth.

Daily Life and Budgets

For the average Indian, especially those who are not rich or affluent, the cost of food is a crucial part of their budget. When agricultural production is hit by adverse weather, it leads to higher food prices, straining household finances and affecting their overall standard of living.

Broader Economic Impact

Agricultural performance influences not only food prices but also the broader economic environment, including industrial and service sectors that are linked to agriculture. Poor agricultural output can reduce rural demand, impacting industries that depend on rural consumers.

About the AUTHOR

Jayesh Suryawnashi

Regular Posting Date 27-28
Date of Printing 23
Post Office: Lodhi Road

DL(ND)-11/6128/2024-25-26
RNI No. 68745/98

SBI
The banker to every Indian

KISAN KI UNNATI SE HAI DESH KI PRAGATI.

SBI Agri Loan Products for your every agricultural need.

AGRI GOLD LOAN

- Digital sanction on YONO KRISHI
- Low interest rate

KISAN CREDIT CARD

- Interest rate at 7% p.a., up to ₹ 3 lakhs*
- 3% incentive for prompt paying farmers, up to ₹ 3 lakhs*
- Collateral-free loan for up to ₹1.6 lakhs

MUDRA LOAN

- No collateral up to ₹10 Lakhs
- Simple documentation

LOANS FOR SELF-HELP GROUPS

- Loan for livelihood
- Flexible repayment

TRACTOR LOAN

- Landholding required: 2 acres
- Flexible repayment
- Low intrest rate

ASSET-BACKED AGRI LOAN

- Loan up to ₹ 2 Cr.
- Low interest rate

ATMA NIRBHAR BHARAT SCHEMES:

- Loans available under Agri Infra Fund, PMFME scheme, AHIDF scheme
- To establish cold storage, warehouses, silos, food processing units, etc.
- Credit Guarantee available
- Interest subvention available

FARMER PRODUCER COMPANIES (FPCs)

- Loans available for all activities of FPCs
- Attractive interest rates
- Credit guarantee available
- Interest concession available

*T & C Apply

For more details, visit bank.sbi or contact Branch Manager