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BIO AGRICULTURE *the evergreen revolution*

Dr Trilochan
Mohapatra



OUR MISSION:

TO CREATE A SUSTAINABLE FUTURE FOR PEOPLE AND NATURE.



The core challenge is to produce more with less. In the decades to come, the world's growers will need to cope with a harsher, less predictable climate and a growing scarcity of natural resources while meeting an ever-increasing global demand for food. That's why we have distinguished ourselves on the market worldwide by our ability to offer high quality and effective solutions for plant nutrition and health.

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BIO AGRICULTURE

the evergreen revolution

Indian agriculture has battled all kinds of wars against natural calamities, market fluctuations, pest and diseases, international policies, and every time we have emerged victorious.

Right now we are waging another war! Our past achievements in agriculture are unfortunately marred by aggressive use of chemicals in the form of fertilizers and pesticides. **Our soils are dying.** Water – both underground and above – is contaminated. The food that we eat has residues of hazardous chemicals. The air is dangerously polluted. Somewhere in the process of producing food, we have lost our way.

The good news is that we can still reverse the trend. We can make our natural resources healthy and alive once again. **Organic Agriculture and Natural Farming** can help us restore the life and health of our soils. Many states have come forward with the desire to turn organic and they are doing some commendable work in this field. It is a positive step.

However, there are several concerns among experts. Some may have doubts regarding its economic viability. Some others consider this as a threat to food security. Some are concerned about the availability of authentic organic inputs. Also, a few may be disturbed for the lack of expertise among the extension personnel who have been extensively trained in conventional chemical based agriculture.

We are also looking for answers. We cannot simply convert into an organic state overnight. But we can take a few steps cautiously. We can reduce inorganic chemicals and supplement the nutrient requirements by organic inputs. We have to devise a plan that will address the concerns of each stakeholder. I believe we are in the process of creating another revolution in agriculture. A revolution that is environment-friendly, sympathetic to nature and its dependents.

Agriculture Today's BioAg Asia 2022 was a master stroke. Global expertise and wisdom converged at New Delhi to brainstorm on the blue print for the Evergreen Revolution. BioAg Asia created a momentum to move towards agriculture that is sustainable, safer and healthier, without threatening food security.



Happy Reading

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DR PREM WARRIOR





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OF AGRICULTURAL
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DR. M.J. KHAN

URGENTLY NEEDED: BETTER AIR CARGO FACILITIES FOR AGRI PRODUCE

Agriculture export crossed the 50 billion dollar mark this year. While this is good news, we can do better. We should be eyeing 100 billion dollar agri-export by 2025. This is not impossible. We produce a number of high-value, low-volume crops. India ranks second in fruits and vegetable production globally. But our contribution to the world market is negligible.

What happens to our high production? Shockingly, one-third is lost. Our logistics are poor, and post-harvest management continues to lag. A few years ago, a report suggested that our post-harvest losses are to the tune of Rs 2 lakh crore per year! A focused improvement in the post-harvest management sector can make India achieve wonders in the global market, and also improve domestic supply.

The demand for quality agri-produce is far from the centers of production. Better transportation shall ensure that farmers earn well. Indian agriculture urgently needs the support of the air cargo sector. Such perishable cargo with limited shelf-life is susceptible to deterioration or uselessness if not delivered on time. Fruit, vegetables, chilled meat, flowers – all these need refrigerated warehousing and transportation to extend their commercial life.

The transportation of perishable produce requires specific care regarding packing, labeling and transport equipment maintenance. Logistical operations must protect products from mishandling during loading and unloading; compression due to excess weight, impact, vibration and shifts in cargo in transit; possible damage from surrounding air; temperature and humidity above or below recommended levels, and odor contamination from other produce or residues. The sector needs specific protocol for each category of produce to maximize the benefits of air transportation. Most agricultural products are seasonal. They are harvested only in certain times of the year. A schedule adjusting the same is important.

The main obstacle to the export of agricultural perishable by air cargo is the high freight cost, added to fuel costs. This significantly increases the total

cost of the logistics. This needs to be addressed. New commercial and logistical incentive schemes can be implemented for farmers. Many sectors of agribusiness shall flourish with better air cargo for agri produce. The perishable produce market must identify new opportunities for air transportation. It shall be a win-win for the complete value chain.



DIGITAL REVOLUTION IN AGRICULTURE 1.0

Agri Meet Foundation & Aviana HV Bioscience Pvt. Ltd. are organizing the 21 days International Training cum Certificate Course on 'Agriculture Drones – Revolutionizing the Future of Agriculture' in joint collaboration with ICAR, Indian Institute of Sugarcane Research, UPKAR, MPUAT Udaipur and NAHEP, New Delhi, via virtual mode, from 21 May to 10 June.

Aviana HV Bioscience is a drone-manufacturing agritech company that works to bring agritech devices to farmers at an affordable price. The company has in-house manufacturing facilities for all types of agritech device manufacturing, including agricultural drones, robots, soil sensors, artificial intelligence, precision farming and IoT based devices, all manned by professionals.

According to a statement issued by the organizers, Agri Meet & Aviana have an expert team of 20+ Vice Chancellors of ICAR-governed universities, 15+ Directors of ICAR Institutes, CEOs of six MNCs who are working towards developing smart agriculture and are continuously involved in many Professional Certificate Courses, Training Programs, Workshops, Conference, Seminars, RAWE, ELP, for agricultural students and farmers to fulfill the dream of 'hunger-free India'. They have jointly trained more than 3000 students/trainees in various farm-related activities. They have also collaborated with many state and central universities, companies, agencies and colleges for providing the training.

The 21 days training program gives complete exposure to the trainees regarding the application of drones in agriculture and how to use the technology for the betterment of farming.

Participants will get the opportunity to learn from experts who are working on this technology, and get the chance to interact with them. Organizers say that the program has been conducted online, and in-field video sessions will be included for better knowledge transfer to the trainees.

Every trainee who successfully learns the program shall receive a certificate accredited by central and state universities and authority boards. This will add value to their learning and will open new vistas of opportunities for them.

Organizers say that they are currently organizing the fifth training program on agriculture drones. They have got a very good response from state and central agriculture students. They have trained more than 600 students on this topic in both online and offline sessions.

The organizers add that many of their students have started their journey in the agri-tech sector. Some have taken their franchises for serving the local farmer community. Many are involved in upgrading the present technology for making farming activities simpler and easier.



RAJNI SHALEEN CHOPRA



BIOAG ASIA 2022 ORGANIZED BY AGRICULTURE TODAY GROUP

TIMELY, SUCCESSFUL INITIATIVE



BioAg Asia 2022 was thus organized by Agriculture Today Group in New Delhi from April 20-21, for bringing all bio-stimulant and bio-input companies from around the world and other key stakeholders on one platform for an insight into the future trends and dynamics and to provide a dynamic platform to explore market opportunities and forge business linkages.

Objectives

- To provide a global platform to the industry, institutions and international bodies to showcase the potential, achievements, latest products, advanced technologies, bio-ag models, and to connect with



the farmers and agri industries.

- To discuss the policy, trade, technology, business and investments environment for growth of bio-control, biofertilizer and bio-stimulant industry in India and Asian

countries and sharing global success models, products, technologies and regulatory systems.

- To discuss the research and technology interventions happening globally, trends, development dynamics and their application in Asian countries through partnerships and collaborations.
- To discuss the opportunities and scope, and problems faced by chemical intensive farming in India and Asian countries, the issue of access and equity in technologies, policy and the challenges.
- To facilitate opportunities for global companies to explore potential businesses, trade and investments, technical and marketing

collaborations, exports and partnerships and signing of MoUs towards business expansion, trade and technologies for bio-control and bio-stimulants products.

Eminent Speakers

Bio Ag Asia brought a galaxy of important speakers throughout its two day meet who discussed and deliberated around several important issues in bioag sector. Some of the speakers are Dr. William Dar, Secretary of Agriculture, Government of Philippines; H.E. Dr. Manoj Nardeosingh, Secretary General, African-Asian Rural Development Organization; Dr. Trilochan Mohapatra Secretary – DARE and DG Indian Council of Agriculture Research Government of India; Dr. MH Mehta Chairman - ICFA Working Group on Eco Agriculture and Gujarat Life Sciences; Dr. SK Malhotra Agriculture Commissioner Government of India; Dr. Douglas Wagner President, International AgriBusiness, AlgaEnergy, Spain; Dr. K.V.S.S. Sairam Managing Director Prathista Industries Ltd; Mr. Prem Warrior Chief Operating Officer and Executive Member Board of Directors at Valagro; Prof. MS Reddy Chairman, Asian PGPR Society, Auburn University, USA;

BioAg Asia Expo 2022

Apart from discussions and deliberations, the event also hosted BioAg Asia Expo 2022 which was a chance for the Bio Ag input and service providers to display their products, technologies and techniques. A dedicated platform for bio agriculture, BioAg Asia Expo 2022, provided exhibiting opportunities for the industry, government and research institutions, agri services and development organisations.

BioAg Asia B2B Meetings

BioAg Asia 2022's objective to serve as an effective platform for B2B meetings for the Asian and global bio-control and bio-stimulant companies, research and technology institutions and services industry so as to collaborate for technologies, products and businesses



was also realised . These facilitated delegates to explore business and technology opportunities and maximize networking. Separate meeting rooms and trade tables adjacent to conference venue were provided for B2B meetings.

Launch of Asia BioAg Forum

There is rapid pace of development taking place in bio-control and bio-stimulant sector globally with a large number of technology start-ups as well as large groups in crop protection and fertiliser businesses entering this futuristic segment. There is need for seamless sharing of experiences, exchange of information, holding meetings, drive policy changes and fostering trade, businesses and partnerships to catalyse growth and unleashing potential of this sector among the Asian countries and collaborating globally. With these objectives, The Asia BioAg Forum was launched by the Agriculture Today Group.

BioAg Asia Awards 2022

Agriculture sector is undergoing a rapid transformation in India and globally. There are defining trends obtaining in favour of bio agriculture as central component in organic agriculture and safe food production strategies. This development has been possible by active support of policies, research system, commercial

initiatives and farmers themselves. The experts, institutions andmcorporate, who have played seminal role in making bio-agriculture a success, need to be recognized for their tremendous contributions. The institution of the BioAg Asia Awards is a significant step in this direction to recognize the contributions of various stake-holders in bio-agriculture and bio-inputs sector. The awards were constituted in different categories to those individuals and organizations, who have made outstanding contributions in the fields of bio ag, bio-control, bio-stimulant research, extension, policies, production, delivery and commercialization.

BioAg Asia 2022 Outlook Report

BioAg 2022 Outlook Report was released at the inaugural of the BioAg Asia 2022. The BioAg outlook report by Agriculture Today Group is an attempt to provide readers with credible information and an in-depth profile of the Bio Agriculture sector viz. bio-fertilizers, biopesticides, bio-stimulants, amino acids, sea weed extracts, organic manures etc. The report will provide an insight into the global as well as national market scenario, market dynamics, trade and industry issues, policy, regulatory and technology environment and advances, R&D and innovations and challenges in bio-agriculture sector.

Union Agriculture Minister Shri Narendra Singh Tomar launched Asia Bio Ag Forum to boost adoption of sustainable agriculture practices



Union Agriculture Minister Shri Narendra Singh Tomar launched the Asia Bio Ag Forum to boost the adoption of sustainable agricultural practices in Asia that shall ensure food and nutritional security and farmer prosperity.

The Asia Bio Ag Forum was launched at BioAg Asia 2022, a two-day conclave organized by the Agriculture Today Group at National Agriculture Science Centre (NASC), New Delhi. During the conclave, agriculture experts from diverse nations in Asia shall brainstorm on ushering in the Evergreen Revolution for food safety without threatening food security.

Speaking on the occasion, Shri Tomar said that the government is in mission mode to bring greater prosperity to farmers. Shri Tomar highlighted that the government shall do away with the practice of middlemen in the agriculture value chain so that the farmers get the rightful price for their produce and do

not face discrimination in any way. Shri Tomar inaugurated the two-day conclave and also the impressive BioAg Exhibition organized on the occasion.

Speaking on the occasion, Dr MJ Khan, President of the Agriculture Today Group and Chairman, Indian Chamber of Food and Agriculture (ICFA), said that since the decades when India had to focus on food security, the entire curriculum of agriculture universities has been designed around chemical farming systems. Dr Khan said that there is need to reorient the curriculum so that the upcoming generation of agriculture professionals is geared towards organic, natural and allied environment-friendly farming systems. He added that the global learning in these sectors needs to be available to all nations and should be contextualized to local needs.

Dr KVSS Sairam, Chairman, Prathista Industries Limited said that BioAg Asia is a unique forum bringing eminent stalwarts from ICAR and other premier

research institutes, the bio agriculture industry, the farmers and others on a single platform to maximize the gains for all stakeholders.

Dr William Dar, Agriculture Minister of Philippines and Mr Hugo Javier Gobbi, Ambassador of Argentina in India and Dr Douglas Ry Wagner, Global CEO, AlgaeEnergy, Spain, stressed that cooperation between nations is key to the global adoption of sustainable agricultural practices.

Ms Mamta Jain, CEO of the Agriculture Today Group, said that the synergy between all stakeholders shall enable the shift to environment-friendly agricultural practices both nationally and globally.

On April 21, the BioAg Asia Awards 2022 were conferred on the various awardees by Dr Trilochan Mohapatra, Director General, Indian Council of Agricultural Research (ICAR). Dr Ashok Dalwai, CEO, National Rainfed Area Authority also graced the occasion.



**Brainstorming
at BioAg Asia
2022**

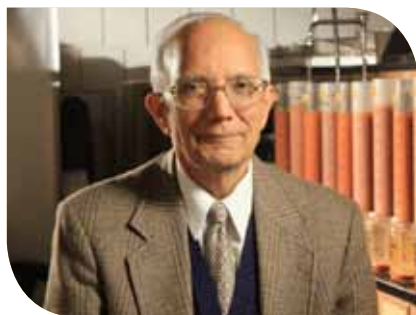


BioAg Asia 2022

Sessions And Speakers

POLICY AND BUSINESS ENVIRONMENT IN MAJOR ASIAN COUNTRIES

CHAIR - Dr William Dar, Hon'ble Agriculture Minister, Philippines



Dr Rattan Lal, Renowned Soil Health Scientist and World Food Prize Laureate (Online address)

Private sector can help us translate science into action. We need appropriate policy framework; ecologically sustainable agriculture; legal and institutional reform and support



CO CHAIR: H.E. Dr Manoj Nardeo Singh, Secretary General, AARDO

Rapidly and radically changing consumer food preferences and societal concerns for environment are dictating policies and investments in agribusiness.



Dr Tarun Bajaj, Director, APEDA

Complete control on supply chain is essential in order to sustain. We want to compete and sustain in the global market, so we cannot afford to compromise on quality.



Dr MJ Saxena, Managing Director, Ayurved

There should be more exchange programs between scientists and farmers. There is great potential and acceptability for adopting technology. The world is ready to make the shift



Mr Sanjay Sethi, Executive Director, Plant Based Foods Industry Association

The world market is opening up for plant-based protein. India has major advantage in this sector. After the pandemic, people want food to serve as medicine. Can we ride these trends?

POLICY INITIATIVES BY INDIAN STATES FOR NATURAL FARMING

CHAIR: Dr Ashok Dalwai, CEO, National Rainfed Area Authority



Dr Arjun Saini, Director General Horticulture, Haryana

Haryana government has directed that natural farming shall be taken up in a phased manner. In the first year, the target area has been kept at 2500 acres. In the Haryana model, farmers are incentivised based on three parameters – microbial content, organic carbon and pesticide residue.



Dr PVSM Gauri, Executive Director, Association of Indian Organic Industry

Natural farming practices practised in different agro climatic conditions need to be curated to bring global learning to farmers. We must collectively work on shortening supply chains and supporting farmers scientifically.



Dr Ashok Jhadav, Former Director, National Center for Organic Farming

The nation will see a separate mission in Natural Farming, where the objective will be continuous capacity building and handholding for a longer period of time. The mission may convert 7-10 lakh ha into natural farming over a period of time. Organic and natural farming have been found to be more productive in rainfed areas.



Dr Arvind Kumar, Vice Chancellor, Rani Lakshmi Bai Central Agricultural University

UP Government has taken up a programme covering 11 districts encompassing 21,000 farmers for organic farming. The state is creating awareness and providing master trainers. We also need to address issues related to marketing, certification, post harvest processing, crop diversification, infrastructure, crop insurance etc.



Mr Saurabh Pandey, Director, Imperial School of Agribusiness

From the marketing perspective, we need to know what is good for the health and position the agro products accordingly. There is a huge emerging market for organically and naturally produced foods. Our youth shall be able to find immense potential in this sector as entrepreneurs.



Dr Poonam Malakondaiah, Special Chief Secretary, Govt of Andhra Pradesh

The state is promoting integrated system of farming which uses lesser chemicals. Every season the usage of chemicals is reduced. The state is also keen on promoting Good Agricultural Practices. Andhra Pradesh is creating a state level accreditation agency which will be liaised with APEDA for certification in natural farming.

BIO AGRICULTURE – GLOBAL PERSPECTIVES AND ASIAN MARKETS

CHAIR - Dr William Dar, Philippine Agriculture Secretary. Moderated by Dr KVSS Sairam, MD & President, Prathista Industries Limited



Prof MS Reddy, Founder, Asian PGPR Association (Online Participation)

With cooperative effort, mutual agreements and removal of bureaucratic hurdles, acceptance and adoption of biological can be improved. We need to have a platform which shall collect ideas from forums like these and present it to the government.



Dr Prem Warrior, Chief Operating Officer, Valagro

We cannot have universal solutions. We need customised solutions. We need to form partnerships to help each other with technologies, processes and resources.



Mr Huzefa Khorakiwala, Director, International Business, Biostadt

There will be growing demand for bio-stimulants in the future. We need to look into our own country for the source of bio-stimulants.



Dr Harsh Bais, Professor, Plant & Soil Interface, University of Delaware

Good science leading to good technology and cheap usage of technology, especially in the direction of microbiome research will drive biologicals to better heights.

Dr William Darr launched the book, 'Policies and Repository Ecosystem for Biologicals in Agriculture, India' by Mr Vipin Saini.

POLICIES AND REGULATORY ECOSYSTEM FOR BIOLOGICALS

CHAIR: Dr S K Malhotra. Moderated by Mr Vijay Sardana



Dr SK Malhotra, Project Director (DKMA) & Former Agriculture Commissioner

Protocols need to be developed for testing biological application through drones. New innovations like organic nano products need to be adopted.



Mr Vijay Sardana, Advocate Supreme Court & Dispute Resolution IPR

Regulation and strict compliance are important if we want to bring credibility to the sector.



Dr AK Yadav, Former Director, National Center for Organic Farming

Small players are distorting the biologicals market. We need wider, stable and long lasting products and integrity in our actions.



Dr Gagnesh Sharma, Director, National Center for Organic and Natural Farming

For organic farming we have good certification system and standards. In natural farming too, we need national and global standards. We need a self regulatory system for bio-fertilizers.



Mr Vipin Saini, CEO, BASAI

We need common biological legislations and adherence to quality control at

all levels. We need to harmonise our solutions if we want to sustain in a global market.

TECHNOLOGICAL ADVANCES IN BIO CONTROL AND BIO STIMULANTS

CHAIR - Dr Prem Warrior, Chief Operating Officer, Valagro

Since the past decade, we are looking at other sources like plant extracts, amino acids, peptides etc, and we are acquiring knowledge of microbiome.



Dr Nutan Kaushik, Director General, Amity Food & Agriculture Foundation

On technology front, we have to move on from traditional microbial based pesticides to the new dimensions of microbial metabolite based pesticides as they are more stable and have longer shelf life.



Dr S Narayanan, Director, Green Star Fertiliser

We have to come to the stage where we can formulate plant specific and soil specific products because of the flexibility of multi-level fermentation processes.



Ms Vaishnavi Machiraju, MD, Vaishnavi Biotech International Ltd

Quality parameters are very important. These need to be standardised and uniformly implemented across India.



Mr Dev Bharadwaj, Founder Fascorp and Kissan Manch

"We want to move to GA4 and GA 7 apple quality to meet the standards of our global competitors. Unfortunately we are not able to do so due to regulation issues.



Dr Mahesh Sharma, Professor, SKN Agriculture University, Jobner

We have to seriously pursue organic and natural forms of agriculture. It is also important to increase the organic carbon content of soil. The pesticides and chemicals used in production are leading to serious diseases like cancer. It is time for the evergreen shift to happen.



Dr Mukesh Patel, Founder Agriland Biotech

We have developed 80 insect sex pheromones of many notorious pests. We have also developed a technology of decomposting microbes, especially lignin, cellulose and hemicellulose.

SUCCESSFUL INNOVATIONS IN BIO-INPUTS

CHAIR: Dr Ajit Varma, Group Deputy Vice Chancellor, AMITY University

We have miles to go where the adoption of environment friendly agriculture practices are concerned. Food security is a major concern. Equally, the sustainability of agriculture must concern us all. We have to identify and follow the set of practices that shall ensure the prosperity of farmers, protection of the environment and food security for the nation.



Dr Krishna Sundari, Dean Biotech, Jaypee University and Coordinator, CEMAP & TSSR

Food production targets are getting higher. This is a huge global challenge. If we keep dumping pesticides, fungicides, weedicides and chemical fertilizers into the soil, what kind of food are we producing? What about the residues left in the soil? These are important concerns for us all.



Dr Shailendra Singh, COO Agro, Zydex

We have developed a system of bio farming where farmers can shift from chemical farming to non-chemical farming in one crop cycle.



Sh Debabrata Sarkar, Vice President, Asia Pacific, AlgaEnergy

Innovation in bio inputs shall play a major role in strengthening this sector. It shall also play a key role in addressing the issue of food security, and improving soil fertility. Post-harvest technology is important to minimize the losses.



Dr Rajaram Tripathi, Chairman, Central Herbal Agro Marketing Federation of India

The budget for organic farming is a fraction of the budget for chemical farming. IRgabus farmers face many challenges at ground level. The irony is that agricultural scientists have not reached all farmers but the traders have reached us and taken us in their grip. Now they are exploiting us.



Mr TS Mann, Director Marketing, Heli Electro Solutions

Enhanced production demands innovations. Nano fertilizers are a successful innovation. The organic tea spray oil developed by us is another successful innovation. New thinking and new breakthroughs are essential to address the concerns of the farmers.



Dr L Joji Reddy SJ – President, Xavier Board of Higher Education, India

With all our research and all our intentions to help the farmer and sustain the environment, we are still going wrong. Chemical agriculture is not the right pursuit. We have to examine where we are headed.

CEOs SESSION ON GLOBAL OPPORTUNITIES FOR INDIA

CHAIR & MODERATOR: Dr Douglas Ry Wagner, President Agribusiness, AlgaEnergy

The opportunity for India in global BioAg

is phenomenal. The success of BioAg is going to depend on the participation of companies. The commercial aspect of this is extremely important. We need commercial channels and aggressive marketing for growers to adopt these new practices. Equally important is innovation and the use of breakthrough technologies.



Mr Raju Kapoor, Director, Corporate Affairs, FMC Corporation

Solutions to the challenges we face in agriculture have to be integrated. There is a lot of science that goes behind the development of agro-chemicals. We all need to work together, and not in isolation by playing one against another. Most of all, we believe in safe and sustainable food.



Dr Santosh Sahane, CEO & Founder Forecast Agrotech Innovations

Global opportunities shall be available for those who have innovations, who have regulations in place, and who follow a proper education system for farmer awareness. Globally, organic growers face shortage of essential organic nutrients. India has the potential to meet this demand.

Mr Rahul Mathur, National Marketing Head, IPL Biologicals

We can restore soil health with microbial solutions. It is a highly viable solution for long-term benefits and



rejuvenation of soil layer. We can partner in these areas for regenerative agriculture.



Mrs Madhu Dixit, Co-Founder, Organikrishi

There are multiple opportunities opening up for India globally. The Russia-Ukraine war has impacted sunflower oil import. It is a new area of opportunity for our farmers to meet the demand. Our farmers can grow vanilla flower. It has a huge market. Jivamrit and Ghan Jivamrit can be exported. Better organic preservatives can be developed by us for longer shelf life of products.

Road Map For Sustainable Bio Agri Model

CHAIR – Sh Tarun Shridhar, Former Secretary, Animal Husbandry, Dairy and Fisheries

For following bio-agriculture, we have to give precedence to science and imbibe wisdom from traditional models. There is eroding customer confidence in food products, and fears of food safety. These must be appropriately addressed.

Dr MJ Khan, Chairman, Indian Chamber of Food and Agriculture

Food security is national pride. It is linked to national security. Sustainability has come to the centre stage of world food production. We have to discuss



policy framework and help the states in achieving the objectives.



Dr AK Singh, DDG Agriculture Extension, ICAR and Agriculture Commissioner GOI

Different states adopting are different models for bio agriculture. Clusters are being developed all over the country to promote production of organic or naturally produced foods. More and more business tie ups are happening for the marketing of organic produce. The government is helping and boosting these efforts to strengthen the sector.



Dr Sairam, MD & President, Prathista Industries Limited

Importing biologicals with micro organisms can be risky. It needs long term study. The import of live organism based products has to be addressed very seriously. It is important to bring foreign technologies. Equally, we must make optimum use of traditional Indian knowledge.

Dr MH Mehta, Chairman, Working Group on Eco Agriculture, ICFA

Evergreen eco-revolution is possible if we



follow the 20:20 model. This is a viable method by which there is no discouraging fall in yield. Gradually, the farmer is able to make a complete shift to organic farming in a sustainable manner.

Sh Harpal Singh Grewal – Chairman, Heavenly Farms

Organic farming must be done with the principles of Ayurved. Farmers who want to pursue organic farming need proper guidance and hand-holding. But even proper seeds are not available.



Mr Ashudeep Garg - Corporate Development Head, Absolute Foods

It is essential to have control over the residue-free food chain. Traceability is essential for competitiveness in the export market.



RECOMMENDATIONS

- Simple protocol for testing of new products
- A platform which shall collect ideas from different sources and present it to the government
- Stringent guidelines to manage quality
- Separate biological legislation
- Decentralized independent authority for biologicals
- Transition from microbial products to metabolite based microbial biologicals
- Scientific validation of traditional knowledge
- Transition to liquid based formulations
- Stop promoting solid formulations
- A self regulatory system for biofertilizers like PGS
- Protocols need to be developed for testing biological application through drones
- New innovations like organic nano products need to be adopted
- Formation of sub-committees to focus on specific dynamics of the sector
- Small expert groups to do simulation modelling
- Need for systematic implementation of science-based technologies and innovations to attain the maximum potential of food production areas
- Essential to judicious and balanced use of organic and inorganic farm inputs to enhance crop yields, ensure quality of produce, and subsequently increase farmers' incomes
- Ensure traceability
- Collective actions towards increasing productivity must always be backed up by extensive research and field validation
- Find common cause in global food security and agricultural technology benchmarks
- Finalize free trade agreement between countries, thereby pushing for solid trade partnership for agricultural technology

BIOAG ASIA 22 AWARDEES

Best BioAg Startup 2022		ORGANIKRISHI
Best Bio-Agriculture Products		BIOSTADT INDIA LIMITED
Best Bio-Stimulant Products		ALGAENERGY, MADRID, SPAIN
BioAg Innovation		AGRILAND BIOTECH LIMITED
BioAg Market Impact		GREENSTAR FERTILIZERS LIMITED
Best BioAg Company in R&D		PRATHISTA INDUSTRIES LIMITED
Best BioAg Company		IPL BIOLOGICALS LIMITED
Best BioAg CEO		MR DEBABRATA SARKAR
Best BioAg Farmer		SH HARPAL SINGH GREWAL
Policy Leadership		DR SK MALHOTRA
Best District in Bio-Agriculture		PILIBHIT DISTRICT, UP
Best State in Bio-Agriculture		ANDHRA PRADESH
BioAg Asia Leadership		VALAGRO
BioAg Global Leadership		UPL GROUP
Special Recognition		DR ASHOK K YADAV
Special Achievement		DR NUTAN KAUSHIK
Lifetime Achievement		DR AJIT VARMA
Special Recognition		DR MS REDDY



IMPROVING SOIL HEALTH, ELIMINATING MALNUTRITION MANAGING CROP RESIDUES

The record high food production (million metric tons, MT) in India in 2022 includes grains at 316.06, horticulture at 331.05, milk at 210.0, meat at 8.50, eggs at 122.11 B, and fish at 14.5. Despite record production, prevalence of undernutrition in India has increased from 13.8% in 2018 to 15.3% in 2020. Income inequalities, driven by the pandemic, have aggravated food insecurity. Despite plenty of food stocks, excess food availability has not translated into food security for every household.

Conflict, political instability, and climate change are among the causes of hunger in Africa, Eastern Europe, and elsewhere, but these factors are not immediate threats to food insecurity in India. Amidst bumper harvest, prevalence of undernourishment in India increased from 18% in 2001 to 22% in 2004, steadily decreased to 17% in 2017, but increased again to 18% in 2019.

About the **AUTHOR**

Prof Rattan Lal, CFAES
Rattan Lal Center for
Carbon Management and
Sequestration, The Ohio State
University, Columbus, USA



Innovative Thinking

Farmers and policy makers in India and in other South Asian countries must transform agriculture from a major cause of problem to a principal solution to environmental issues. Rather than a sectoral thinking, sustainable soil and agriculture must be based on the concept of a wholistic or nexus thinking. In nature, everything is inter-connected as is vividly stated in the One Health concept: 'Health of soil, plants, animals, people, ecosystems and planetary processes is one and indivisible'. The inter-connectivity or the nexus thinking is critical to sustainable management of soil and other natural resources. Similar to management of MSW and WWM, which involve a sequence of steps: collection, segregation, recycling, and disposal, agricultural residues and other wastes must also appropriately institutionalized for developing a viable management system. The cost of collection transport, processing, utilization, and recycling of amendments generated from value addition of residues back to the land must be minimized to make the entire operation cost-effective and a profitable option for farmers and nature. Cooperation between private sector, farmers, policy makers and academic institutions is critical to institutionalize this innovative thinking.

The Covid-induced loss of employment, closure of small businesses, and lack of demand for street vendors had adverse impacts on food security. In addition to undernutrition, there is also a prevalence of malnutrition related to deficiency of Vitamin A and Iron.

The recent National Family Health Survey in India indicated that 56% of the women of reproductive age, 59% of pregnant women and 70% of young children are anaemic. Research and policy discussion have continued to focus on hunger but have ignored hidden hunger and micronutrient and malnutrition. Thus, restoration of soil health and biofortification of crops are critical to addressing the problem of undernutrition and hidden hunger and micro-nutrient malnutrition in India.

Unsustainable Soil Management Practices in India

Agricultural and soil management practices, adopted without the consideration of ecological principles, can adversely affect soil health and environmental quality. The cost of environment restoration (i.e., soil, water, air, and biodiversity) can be high. Nature-negative agricultural practices include in-field burning of crop residues, excessive plowing, flood-based irrigation, unbalanced and excessive use of chemical fertilizers, indiscriminate use of pesticides, and monocropping over a long time.

India is the largest producer of

pesticides in Asia, and excessive and indiscriminate use of pesticides is unnecessary. India's water usage in agriculture, estimated at 93% of fresh water withdraw is also wasteful and unnecessary.

In-field burning of crop residues is a major cause of air pollution and sources of greenhouse gases (GHGs) emitted into the atmosphere. Intensive cropping, removal of crop residues, and indiscriminate use of unbalanced fertilizer has depleted soil organic carbon (SOC) content and degraded soil health. These are some of the ramifications of the Anthropocene, and soil recovery is a

daunting challenge.

There has also been a distinct loss of indigenous crops under long-term and intensive mono-cropping. Thus, there is a strong need for innovation in farming to address malnutrition, hunger, and soil and environmental degradation in India.

In-Field Burning of Crop Residue

India produces about 500 MT of crop residues per year. While most of the crop residues is used as fodder (360 MT), but 92 MT out of 140 MT of surplus residues is burned each year. The amount of residues burned in India is more than the entire amount of crop residues produced by the neighboring countries: Bangladesh (72 MT), Indonesia (55 MT) and Myanmar (19 MT). Despite significant efforts to minimize residues burning through policy, a significant increase in residues burning (+60%) was observed for rice straw in the Indo-Gangetic plains during 2020.

The adverse effect of residues burning on environmental chaos goes beyond India and must be immediately addressed. Adverse effects include GHG emissions, climate changes, depleting SOC content, declining soil health, and reducing agronomic productivity. Such an impact has caused a severe ecological imbalance affecting local and regional air quality during the post-monsoon season when the meteorological conditions lead to formation of smog and haze. There is need for an effective policy development to address this severe issue.

**fun
FACT**



Dr Rattan Lal and Sadhguru recently discussed the Save Soil movement.

Save Soil, a global movement envisioned by Sadhguru, seeks to bring about a concerted, conscious response to rescue soil from extinction. Welcoming Dr Rattan Lal, Sadhguru said, "Namaskaram Rattan Lal ji. You've spent a lifetime doing this; I'm seeing how to drum it up a little bit!"

Converting Waste into Asset Through Innovation

Agricultural waste includes manure and other wastes from farms, poultry and slaughterhouses, harvest waste, fertilizer runoff from fields, pesticides that enter water, air or soils, salt and silt drained from fields. Of this, crop residue management has become a serious environmental issue throughout Asia, but especially so in South Asia and the Indo-Gangetic Plains. Identification of alternative, economically profitable and environmentally sustainable options is a timely and an urgent issue which must be addressed.

In this context, prudent management of agricultural waste can benefit from municipal solid waste (MSW) and Waste Water Management (WMM). Both MSW and WMM involve a sequence of steps: collection, segregation, recycling, and disposal. These steps are appropriately institutionalized for developing a viable management system. A similar strategy is also needed for the management of agricultural waste. The cost of collection transport, processing, utilization, and recycling of amendments generated back to the land must be minimized to make the entire operation cost-effective and a profitable option.

Crop residues and other agricultural waste products can be converted into asset through numerous agro-based applications and industrial raw material for the benefit of society, restoration of soil health and improvement of human health and well-being. As much as 80% of agriculture in Northwestern India is based on the rice-wheat cropping system. While there are several options to seed wheat after mechanical harvest of rice, but farmer motivation is driven by profitable and time-saving options. As many as 2.5 million farmers adopt the option of in-field burning of residues, facilitated using a conventional seed drill. Using a no-till drill (e.g., Happy Seeder), that can cut through the wet and dense residue of rice (~5 tons/ha) increases farm profit by 10%.



Crop residues can be used in the gasification process for making syngas, which can be used for production of electricity, ethanol, gasoline, and diesel. Agricultural residues are also a source of bioactive compounds and as raw materials for industrial processes

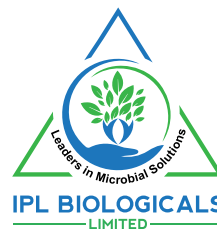
Need for Operational System

Similar to MSW and WMM, there is an urgent need for development of an operational system that is appropriately institutionalized to collect, transport, process, utilize, and recycle the bi-product on land. Involvement of the private sector is critical to translate science into action and to reward farmers for adopting the innovative technological options. Education, at all levels involving farmers and community along with policy makers and the private sector, is essential to enhance awareness about the importance of managing soil health. Identification and implementation of innovative options of crop residue management are critical to restoring soil health and environment processes so

that humanity can live in harmony with nature.

Crop residues can be used in the gasification process for making syngas, which can be used for production of electricity, ethanol, gasoline, and diesel. Agricultural residues are also a source of bioactive compounds and as raw materials for industrial processes. Important among the industrial products are biofuels, enzymes, vitamins, antioxidants, animal feed, antibiotics, and other products. These products are generated through solid state fermentation (SSF) by using a variety of micro-organisms to create value added products. Rice hulls can be used to produce reactive silica which can be used for making acid-resistant hydraulic cement and reinforcing filler for rubber. Judicious management of crop residues can improve use efficiency of inputs, enhance agricultural sustainability and help produce more from less. Based on biogas production, India has developed the National Thermal Power Corporation (NTPC) to mix crop residue pellets with coal for co-combustion. Policy interventions may involve rewarding farmers through payments for ecosystem services. Payment should be made through just, fair, and transparent system at the societal value of soil carbon.

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Agripreneurship Development

THIS CENTURY AND BEYOND WILL BE DRIVEN BY DISRUPTIVE INNOVATIONS

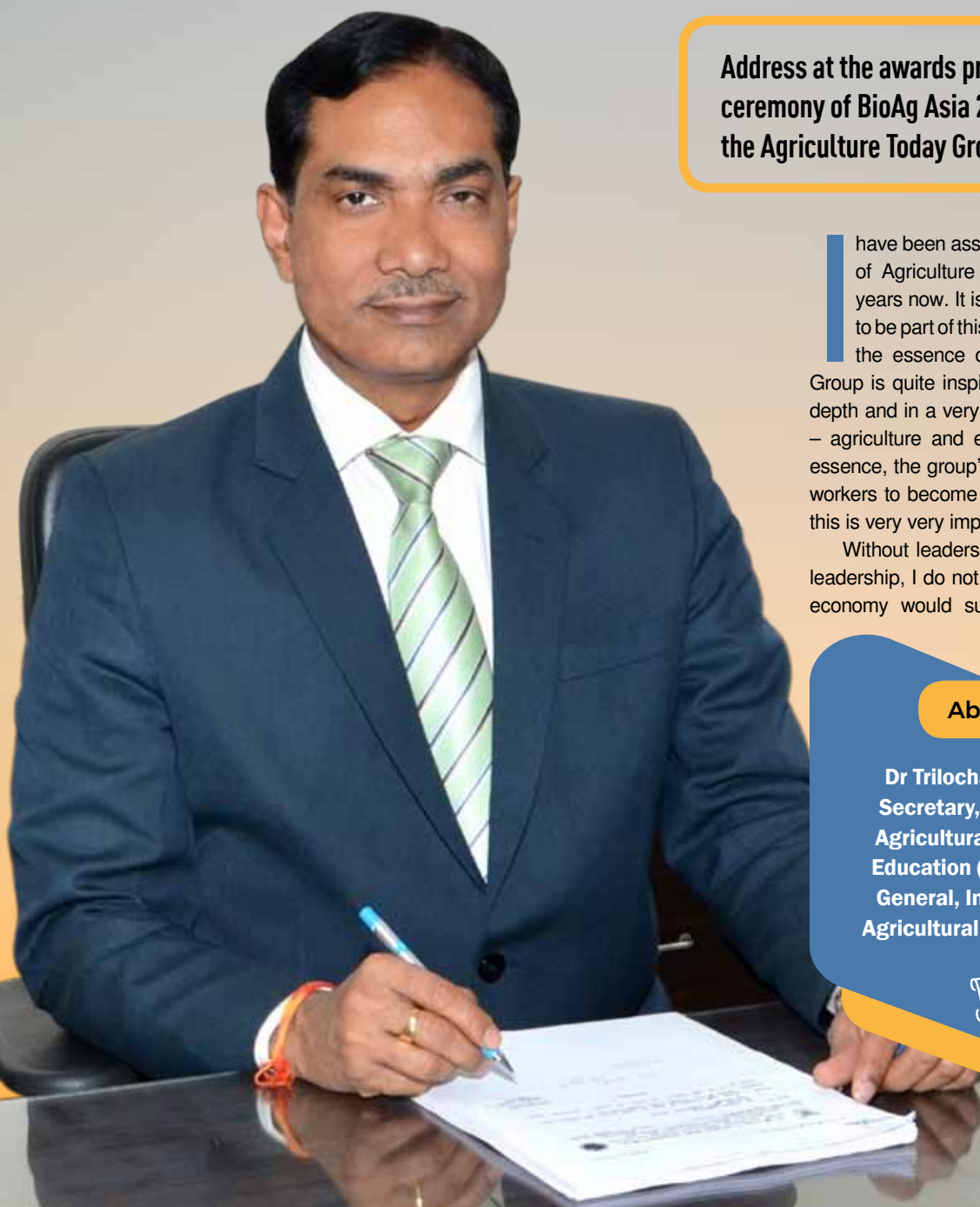
Address at the awards presentation ceremony of BioAg Asia 2022 organized by the Agriculture Today Group

I have been associated with the activities of Agriculture Today Group for a few years now. It is always a great pleasure to be part of this group's activity because the essence of the Agriculture Today Group is quite inspiring. It encompasses in-depth and in a very wide and broad concept – agriculture and economy as a whole. In essence, the group's activity inspires today's workers to become tomorrow's leaders. And this is very very important.

Without leadership and without inspiring leadership, I do not think any aspects of our economy would succeed. You know how

About the **AUTHOR**

Dr Trilochan Mohapatra,
Secretary, Department of
Agricultural Research and
Education (DARE); Director
General, Indian Council of
Agricultural Research (ICAR)



important agriculture is for the country's economy. Not just for food security, as was highlighted by Dr Dalwai. Even for energy security. For sustainability of the whole ecosystem.

You know that the civilizations which came up and subsequently perished were largely agriculture-centric. The total civilizational needs of present and future generations require agriculture and agriculture-related activities, which need to be strengthened. And for that to happen, it needs in-depth deliberations, deeper insights. Agriculture Today Group provides a platform of that kind.

To express, to innovate, to ideate, to collaborate, to partner and prosper in the process.

That is the reason why the Indian Council of Agricultural Research, while appreciating the efforts of the group, entered into a kind of understanding to work together and explore and exploit the complementarities which can further strengthen what we are doing in agriculture.

While I appreciate what the group is doing, what Dr MJ Khan has been pursuing and what way the country is deriving mileage and benefit and advantage out of all these activities, I do take into cognizance the theme of these

The next Green Revolution has to come from post harvest management and addressing the issues thereof. Conquering the global market would depend on how we address post-harvest issues

two-day deliberations (BioAg Asia 2022).

Awards, honours do inspire and support and promote leadership. A small contribution by way of recognition ignites the fire which is latent within. That is actually the objective of such programs. Very eminently designed, strategically delivered and very successfully implemented.

And in that context, Dr Khan, you deserve all appreciation. Thank you very much.

Certainly this is not the time to deliver a long lecture and give you sermons. Do this and do that. You all are so knowledgeable. You are all not just workers but performers. In your own right, in your own respective fields, you have done exceedingly well, for which you have been recognized.

Few points, which I would like to emphasize. This century shall be driven by innovations. This century and beyond will be driven by disruptive innovations. Disruptive innovations without deeply motivated science, original science would fail. That is why at the root of all this future Bio Ag and other fields of study is motivated science. We should not forget that.

Science needs original thoughts. Are we having original thoughts to lead the world? That is the fundamental question. Or we always would be the followers?

Something happened at global level. We just copy it. Do some minor changes here and there, and then claim leadership.

I believe that if we have to have disruptive innovations, we have to have original thoughts, deep research surrounding that original thought. Adequately solving the problems that we face today and visualize for tomorrow. And then build leadership. Otherwise we, in India or we in Asia would not be the leaders.

This is where I would emphasize that Khan Sahab, in one of our deliberations, said our focus should be highlighting this. Because that original idea of zero, or whatever you call, from the ancient times. They are all original thoughts.





We are not actually able to give any original thought to the world in recent times. Why is it so? Why are we becoming copycats and then not really contributing to that kind of advancements and advancing the frontiers?

So I believe that should be the fundamental point. And we must deliberate further. How do we bring original thinking to our research and development? Of course there are many aspects to actually deliberate. What should be our approach?

Obviously, if we say that the 21st century agriculture should belong to India. If I have to say that 21st century agriculture leadership should be with India – 22 years gone. Another 78 years to go. How do we build India's leadership?

Digital agriculture? Do we have that capacity to lead?

Youngsters at IITs, the best brains of India – can they lead in digital agriculture? Some of them are coming back to agriculture to have something here and there. Nibble. But can they have a deep dive and provide global leadership in this area?

We say that the next Green Revolution has to come from post harvest management and addressing the issues thereof. And not only that revolution, but also conquering the global market would

We need to be conscious of these challenges. Take cognizance of these challenges while defining, designing our future path. Through partnership we shall succeed. Through higher investment we shall succeed. Through innovative science, we shall succeed

depend on how we address the post-harvest issues.

Largely, also the pre harvest issues, of course. What is that innovation that we need to do in that space? Can we innovate in our IITs? Can our industry invest to innovate and develop those disruptive innovations for India to be a global leader?

If we have to decide our future path for India's global leadership in BioAg, or other fields. Could be Nano Ag. There could be various other aspects of agriculture added to this. For example, if you have to have a drone for imaging and sensing, do you have sensors? Get sensors here and there and assemble some pieces and then say I have a drone.

Our presence is abysmally poor, I would say, at this point in time. As the leader of the whole agriculture research institutions and organizations, leading all these institutions and universities, I say

that we are very badly lagging behind. We have such a huge resource with regard to bio resource. We say – bio resource to bio economy.

And bio resource to bio economy – it is a huge long, winding path. It is not just bringing them from the wild and domesticating them and then saying and claiming that I have added value. But real sense, adding great value there, and becoming world leaders. I believe that there is a great deal of innovation gap there. We need to really work on that. How to convert bio resource to multi-billion dollar industry in the sense of strengthening the bio-based economy. And in the process, improving the rural economy.

So we keep talking about it. There are small interventions here and there. But it is a long way to go.

For example, Prof Verma's area of microbes. We have some of these

prescriptions for natural farming. We say that we collect soil, and then multiply using cow dung. And then we have some agricultural produce added there, multiply it further. This is only the tip of the iceberg. The whole microbial world is greatly unknown.

Deep sea microbial resource, for instance. What gives rise to these corals? Corals becoming big hills. Reefs. Civilizations getting established on them. Imagine the contribution of biology there.

Dr Dalwai was mentioning materials. Biology contributing to material. And today we say - and there is some innovation there. Today we say that you can have microbial resource for building material products.

I believe that the microbial world is unexplored. Unexploited. And we know only the tip of the iceberg. 21st century bio agriculture would require this area to be actually deeply explored and exploited. We know very little.

You are all knowledgeable and learned. I highlighted some of these areas. We are initiating. I would say, it requires investment.

Unless there is investment, we would be losing out. The competitive advantage of the Indian industry would not be there. Indian industry cannot just borrow technology and be global leaders. Indian industry – to be global leaders – has to base their business on solid original research and technology. That needs investment.

You can flourish for some years. But not very far. We have brilliant minds in the country. That can be deployed, can be utilized in a strategic manner with appropriate investment and partnership.



Partnership – not just public-public or public-private, but global partnership. So in that context – Asian partnerships or anywhere – global partnership should be explored. I believe that this platform would provide that.

Entrepreneurships should be promoted. For what? For small interventions here and there, entrepreneurs are born. After five years, they perish.

I believe this aspect needs to be thoroughly examined. What needs to be really promoted to have those kind of entrepreneurships which thrive, which succeed and which flourish.

So your platform certainly would be serving this cause as we go along. There is plenty of opportunity for all of us to move forward and to do this soul-searching. How do we bring in original thoughts?

In our sleep, in our subconscious state or conscious state, we need to really work on this and discover new microbes, new bio molecules. For our pesticides, how many molecules have we discovered? What is the research we are doing to discover new molecules? Bio molecules?

Some work we did. There is a long way to go. When I say you, I mean we. We are also part of it. We have many successes. It is not that we have failed miserably. Feeding 80 crore people for more than six months. Providing free food. Think of 1950s or 60s when you were going with a begging bowl to get some food to feed the hungry here.

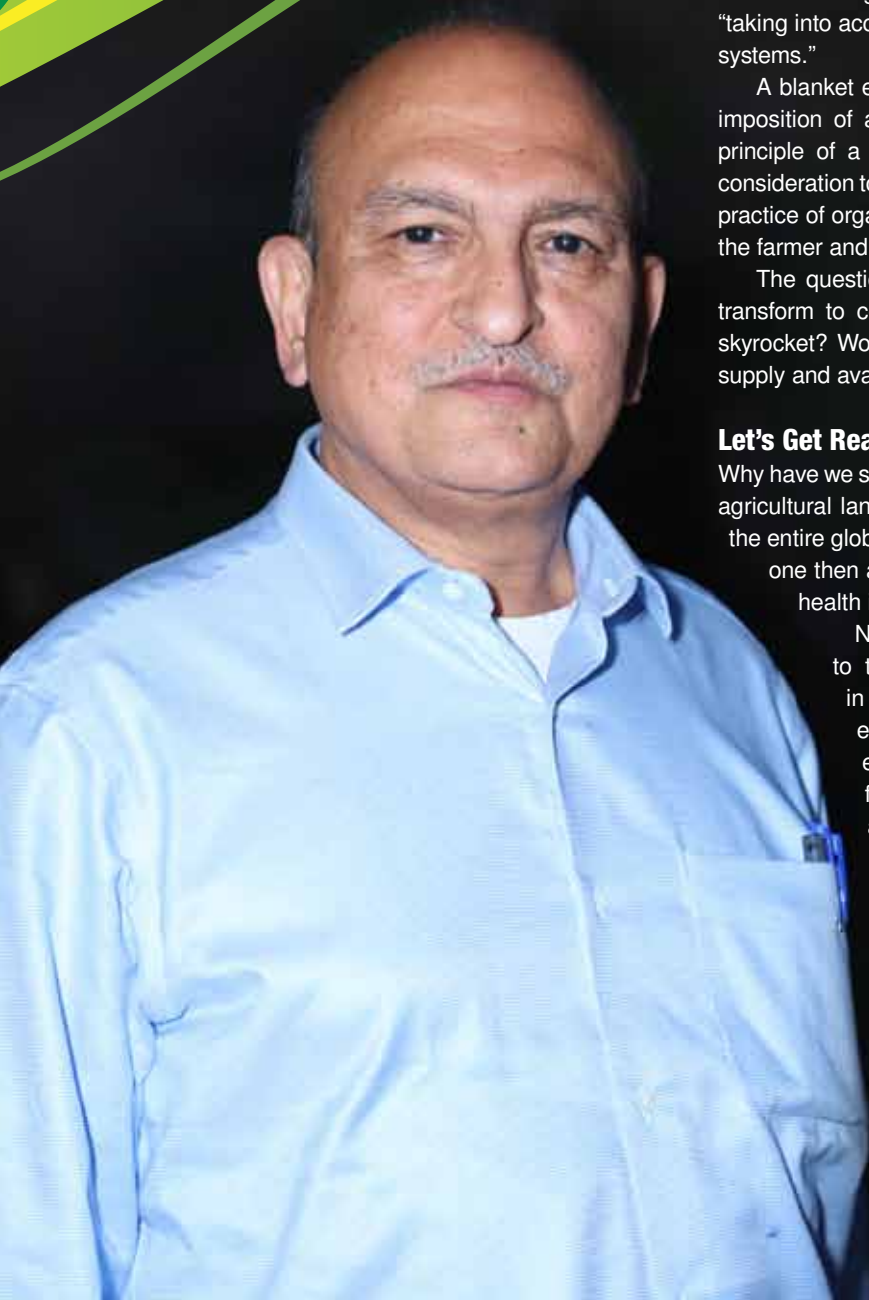
We have moved very far. 50 billion USD export. Certainly it would not happen if you did not have that kind of technology, that kind of production systems in place.

But – sustainable food systems for tomorrow. Sustainable food system doesn't include just production. Post production, value chains and all that. Consumer requirement. Markets. Everything. Sustainable food systems. At global level, the way they are being talked about. Immediately meeting the Sustainable Development Goals. It is a big challenge. Life on earth, life under water. What do we understand about life under water? How much do we understand? It is such a big challenge.

These are big challenges for all of us. Long way to go. I only brought these issues not to discourage you. Not to demolish the good work all of you are doing, for which you have been recognized. The purpose is just to highlight some of these challenges so that we are conscious of these challenges. Take cognizance of these challenges while defining, designing our future path. I am sure, through partnership we shall succeed. Through higher investment we shall succeed. Through innovative science, we shall succeed.

Unless there is investment, we would be losing out. The competitive advantage of the Indian industry would not be there. Indian industry cannot just borrow technology and be global leaders. Indian industry – to be global leaders – has to base their business on solid original research and technology. That needs investment

ECO-AGRICULTURE TOO MANY QUESTIONS, TOO FEW ANSWERS



An organic agriculture production system is robust and rewarding only if it is “holistic.” The objective is preservation of the health of the agro-ecosystem, including soil, through biological/natural methods as against synthetic materials “where possible” and after “taking into account that regional conditions require locally adapted systems.”

A blanket exclusion of all other systems and practices, as also imposition of a one size fits all approach, would go against the principle of a flexible “holistic” management which accords due consideration to the local environment. The policy, management and practice of organic agriculture should centre around the interests of the farmer and the consumer – the primary stakeholders.

The question that is often asked is this: If the world were to transform to completely organic then will not the prices of food skyrocket? Would it not severely compromise the stability of food supply and availability?

Let's Get Real

Why have we stigmatised our agriculture crops? Globally, only 1.2% agricultural land is said to be organic. So is it anyone's case that the entire global population is consuming harmful food? How does one then account for increasing life spans and ever improving health indicators?

No doubt humans are prone to harmful diseases due to the presence of hazardous and toxic compounds in certain food items, and the regulatory regime to ensure food standards and safety must be strong and effective to eliminate these. Equally worrying is the frequent incidence of worm infestation, especially amongst infants and children, in the developing countries. Why does this widely prevalent ailment

About the AUTHOR

Mr Tarun Shridhar is former Secretary, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India

not find voice?

How do we address the tragic consequences of farmers' suicides due to crop failure? Is organic agriculture a solution or would a sudden shift compound the misery?

The current economic crisis in Sri Lanka is attributed, to some extent, to an abrupt prohibition upon the use of chemical fertilisers and pesticides.

Should the strategy not lie in better governance and enforcement rather than portraying the entire agriculture and its produce as toxic? Eliminate the toxic compounds and keep a vigilant check on environmental contamination. Organic food is great and healthy. Correspondingly, it is wrong to infer that food not grown the organic way is bad and unhealthy. Scientifically enriched varieties of crops help the vast majority to get better nutrition at affordable prices. An enlightened farmer and a vigilant consumer, along with support from government institutions can surely ensure that food safety and quality standards are not compromised with. Activism seeking a complete transformation to ecological or biological farming would be akin to throwing the baby with the bath water.

The Challenges

Chronic and acute hunger are on the rise, admit both the Food and Agriculture Organisation (FAO) and the World Bank. Proclaiming itself to be a global technical agency created to fight hunger and poverty, the FAO admits, "As we approach a world of 10 billion people, we face the fact that since 2015 the numbers of undernourished and malnourished people have been growing. While there is no silver bullet to fix this problem, there is little doubt that we will need to use innovative solutions to produce more food, ensure access to it, and improve nutrition."

Feeding ten billion people by the year 2050 will be a challenge if agriculture driven growth is put to risk by abandoning agriculture models that have revolutionised productivity. Do we wish

Should the strategy not lie in better governance and enforcement rather than portraying the entire agriculture and its produce as toxic? Eliminate the toxic compounds and keep a vigilant check on environmental contamination



to head from today's surplus situation to an outcome of food insecurity, particularly so in developing economies such as ours?

That one third of the food is wasted or lost is another tragic dimension we need to tackle in all earnest. Against this background, should we not be discussing sustainable agriculture leading to sustainable growth to sustainable food supply, and how could organic/bio/eco-agriculture contribute? Why should the debate be relegated to the narrow confines of either or? Why not both?

Undoubtedly, organic makes good business sense. It adds value across the chain and is a fast growing market. Continuing urbanisation shall ensure a continuous increasing demand for

organic food products. Let us capitalise on this situation to create investment opportunities.

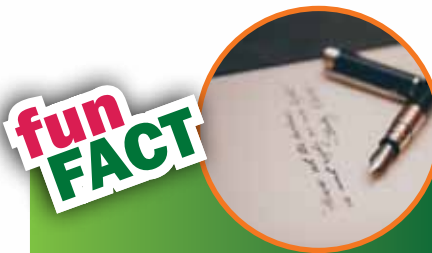
It is a matter of pride that we now boast of surpluses. So why not organic contribute and supplement our production, rather than substitute it? After all, we too are now amongst the top in the world in production of almost all agriculture products, a huge feat of our farmers and scientists.

In any case, we are largely "organic". More than 80% of our farmers are small and marginal, who can ill afford expensive large quantities of fertilisers and pesticides. Before we doubt the integrity of our agricultural produce, we would be well advised to base our conclusion on facts and reliable data.

When it comes to organic or natural farming, we are in an extremely data poor situation. Opinion, belief and ideology based narratives in public space are dictating our response to our agriculture and its produce rather than science, empirical evidence and common sense.

India, by the number of producers, is the biggest producer of organic agriculture products. Thirty percent of global organic producers are from India.

Our traditional knowledge and practices are sound. They enjoy the support of our agriculture science. Why not make it an unbeatable partnership instead of following the path of mutual exclusion.



Mr Shridhar is fond of sharing and receiving rich, delightful Urdu sheir, Hindi and English poetry in his friends' circle

CREATION OF DOMAIN EXPERTS IS ESSENTIAL FOR PROMOTION OF NATURAL FARMING

- Union Minister of Agriculture Shri Narendra Singh Tomar



Ministry of Agriculture & Farmers Welfare has initiated Natural Farming to improve the soil health, encourage bio-diversity and to ensure economic and ecological sustainability in the long run. Union Minister of Agriculture & Farmers Welfare, Shri Narendra Singh Tomar recently stated that 30,000 Gram Pradhans will be sensitized on Principles and Practices of Natural Farming through 750 Awareness Programmes covering all districts and all states before August 15, 2022, as part of *Azadi Ka Amrit Mahotsav*. Shri Tomar stated this





Shri Tomar complimented MANAGE for the active implementation of this ambitious programme of the Prime Minister

Ministry of Agriculture & Farmers Welfare has identified MANAGE as the Nodal Agency for promotion of Natural Farming. To start with, MANAGE is creating a pool of experts on Natural Farming by organizing a Master Trainers Program for the officials drawn from different State Agricultural Universities, ICAR Organizations, SAMETIs, ATARIs, KVKs, ATMAs and experienced professionals and farmers from civil societies and private sector organizations. About 225 officials are attending the Master Trainers Training Program across the country. These trained Master Trainers will be used for creating awareness to Gram Pradhans.

The Master Trainers Training Program was attended by Minister of State, Agriculture and Farmers Welfare, Shri Kailash Choudhary along with Minister of State, Agriculture and Farmers Welfare, Mrs Shobha Karandlaje Ji, Shri Manoj Ahuja, IAS, Secretary (A&FW), MoA&FW, Shri Priya Ranjan, IFoS, Joint Secretary, MoA&FW along with other Ministry officials, MANAGE faculty and resource persons. The dignitaries and participants were welcomed by Dr P Chandra Shekara, Director General, MANAGE. He also explained the objectives of the programme.

during the inaugural address at the five-day Online Master Trainers Training Program organized by National Institute of Agricultural Extension Management (MANAGE).

Shri Tomar said that India being a food secure nation, we can concentrate on producing good quality and safe agriculture produce through organic and natural farming, which will enhance the health of the soil, benefit consumers

and fetch good price for the farmers, since the demand for naturally produced agriculture products is keep increasing. Shri Tomar said that four lakh hectare is covered at present by Bharatiya Prakritik Krishi Padhati (BPKP). He stressed that FPOs should be involved in promotion of Natural Farming. He also complimented the role played by MANAGE in active implementation of this ambitious programme of the Prime Minister.

NANO TECHNOLOGY

Revolution

Past productivity data shows that our yields have stagnated. The soil has lost its natural life. Water table has depleted and water bodies have become reservoirs of chemicals. Dumping of fertilizers and pesticides has affected the balance of the ecosystem. The soils became unhealthy and so did the crops grown on them and the produce harvested. If we continue to ignore these problems, some years from now, we will be staring at food shortage. We have to find ways to invigorate our soils and replenish the nutrients. Organic farming can be a solution to this problem.



Reliable Source Of Organic Fertilizers

India ranks eighth in terms of world's organic agriculture land and first in terms of total number of producers as per 2020 data. Many areas in the country are organic by default. We can also bring the rest under organic farming by sustained efforts from the government and some very practical solutions.

One of the challenges faced by organic farming is the availability of reliable sources of organic fertilizers. About 80% of the products for organic cultivation available in the market are spurious. Then the only solution left among the farmers is therefore to depend on natural sources such as cowdung or composts. In either case the quantity required would be very high causing problems in transportation and storage.

Prathista incorporated the nano nutrients technology with their 3G lacto-gluconates technology. The cost of these nutrient fertilizers is at par with subsidised fertilizers and can be used with all traditional fertilizers. Nano nutrients are 100% safe for humans/ livestock and are 100% eco-friendly

The need of the hour is to have a fertilizer that is organic which can be trusted with quantities comparable to that of inorganic fertilizers, if not less.

Nano Revolution in Agriculture

Nano technology has gained attention in recent years with

application potential in a wide spectrum of domains ranging from medicine, industry and even agriculture. Indian Council of Agriculture Research (ICAR) has developed nano technology for production of fertilizers. The research data reveals that, the nano nutrients doses are just in ppm level to meet nutrient requirement for crops, against to 150 to 200 kgs traditional fertilizer dose per acre.

Prathista Industries Ltd entered into a licensing agreement with ICAR for commercialization of nano nutrients for crops. Prathista incorporated the nano nutrients technology with their 3G lacto-gluconates technology. The cost of these nutrient fertilizers is at par with subsidised fertilizers and can be used with all traditional fertilizers. The scalability of technology is commercially and economically feasible. Nano nutrients are 100% safe for humans/livestock and are 100% eco-friendly.

By using them farmers would gain an average of 20 per cent additional yields coupled with an increase in micro organism levels in soil by shifting to these nutrient fertilisers, while they can totally avoid using the traditional murate of potash (MOP) and diammonium phosphate (DAP) fertilisers.

Nano technology for Better Soil Health

Prathista has also developed "organic nano polysaccharides powder", a heat stable and 100% water soluble product that can improve soil health. 1 kg of "organic nano polysaccharides powder" is equivalent to 4 truck/tractor loads of

fun FACT

Doing multiple works in wash room with cell-phone, as I generate innovative ideas only in the wash room in the morning

Organic Nano Nitrogen, Nano Potash, Nano Phosphours, Nano NPK

Prathishta has developed organic Nano Nitrogen, Nano Potash, Nano Phosphours and Nano NPK. They are all required only in very small quantities. Therefore it is cost effective for the farmers . They can effectively replace chemical fertilisers. From 2000 onwards, Prathishta has been working to replace chemical fertilizers. National Centre for Organic Farming Ghaziabad has reported that on using 50 pc of Prathishta's Organic fertilizer and 50 pc of chemical fertilizer, 40 pc increment in yield was recorded.

Each of their products has undergone rigorous clinical trials and has been certified safe by competent authorities from around the world.

any manure like cow dung which are sources of soil borne diseases. Organic nano polysaccharides can be mixed with water for flood irrigation. They provide bio available carbohydrates and proteins for the soil to improve soil micro-flora and thereby soil health.

Prathista "organic nano polysaccharides" powder is already being used by some pesticide companies in India to provide organic carbon along with pesticides for improving soil health. It is being supplied to few ASEAN countries to coat with chemical fertilisers (like urea/ DAP) to provide organic carbon for the soil health while improving efficacy of chemical fertilisers/pesticides.

Prathista Organic nano nutrients are 100% water soluble and totally bio available for all crops/plants/horticulture/ species and medicinal plants and all type of crops where chemical fertilisers can be partly replaced. Prathista Organic nano innovations are totally compatible with any chemicals or pesticides.

Prathista always advocates gradual (2 or 3 years) adoption of natural farming or organic farming which will help us to produce chemical and residual free agricultural produce to protect future generations from health disorders while

protecting soil health, environment and food safety and food security.

Rural Development Through Nano Technology

Prathista's mission is to popularise its innovative and patented concept for rural development activities across India. "Prathista Farmers Welfare Foundation" was established with a vision to improve living standards of poor farmers and to encourage and inspire the young generation to stay back in their homeland.

The foundation aims to create rural entrepreneurs. Each project is envisaged for providing employment for 120-125 rural youth with 80% woman participation. With two such projects in each district with initial investment of Rs 20000 crore, the foundation is looking at creation of 2000 manufacturing units for production of natural and organic inputs.

The production plant uses locally procured raw materials, especially non edible grade

carbohydrates. Usually, farmers are not able to get a good price for these grade commodities. They are disposed off or sold at paltry prices to trader to be used up by the feed industry.

The Prathista Group is considering developing groceries as "one stop shop" of natural products for all house needs in some states. Farmer clusters will be partners in each natural products grocery or Supermarket, where they can sell quality and residual free agricultural produces starting from vegetables to all commodities required by each home.

About the AUTHOR

Dr Sairam is MD & President, Prathista Industries Limited



Let's Care, Let's Nurture, Let's Sustain



It is now known, that our Universe, the one that we belong to, is just one of the multiverse system.

Our Universe commenced 13.8 billion years ago with the Big Bang.

Thereafter, it was a painfully long journey for the formation of life on earth that began with single cell amoeba about 4.3 billion years ago. The complex web of evolution continued over these billions of years, resulting in the most sophisticated species, The Man.

The Man belonging to the Genera *_Homo_* appeared on earth around 4.5 lakh years ago. Of the several Homo species, just one species – Homo Sapiens – the modern man, came to dominate and remain as the only human species to populate the earth since the last about 40, 000 years.

The human civilization took definitive steps with the beginning of the settled agriculture since 12,000 years ago, which brought a more secure access to food.

Over these 12, 000 years the human population has grown

About the **AUTHOR**

Dr Ashok Dalwai is CEO, National Rainfed Area Authority (NRAA), Ministry of Agriculture and Farmers' Welfare and Chairman, Committee on Doubling Farmers' Income



Mother Earth Recognizes No Boundaries

Beginning in 1970, year after year we mark Earth Day on April 22 to demonstrate support for environmental protection. We need to reflect on the path traversed so far, and introspect on the sustainable and balanced path needed to be truded in the future.

Let us commit ourselves to Mother Earth. Let us Invest In Our Planet.

The needed investment is understanding that:

- * all forms of life are one
- * all humans are one
- * all geographical & political constructs called nations and the like have no meaning
- * Mother Earth recognizes no boundaries

All the nature's components like water, soil and air share trans-boundaries. There is only One Health, that includes the health of all the sub-systems on our planet.

Earth is our common heritage. She is our common mother. We all have a common responsibility to care for our Mother – Our One Mother.



this incredibly rare probability of just right placement, one cannot but experience a spin in one's head.

We – the Home Sapiens – are uniquely placed. We have the rare and most discerning tool – cognitive power. It is this that lets us choose between the right and the wrong based on assessment of the consequences of our decision. Hence, we have the primary responsibility of nurturing and sustaining all forms of life on earth.

Life on earth is an ecosystem. All its sub-systems including human life, animal life, plant life, microorganism life, and the world of soil, water, air and climate at large are organically linked. Any disruption at any one point of this integrated system impacts all other sub-systems. We the humans have been puncturing the system not at one, but at multiple sites to the detriment of its sustainability. Our behaviour is like that of a child playing with water bubbles and, piercing it to derive some fun. But the earth system brooks no such play.

It is time we woke up before we crossed the Rubicon, and arrive at a point of 'No Return'.

As Mahatma Gandhi told us, "There is enough on this earth for everyone's need, but not for our greed."

Let's care.

Let's nurture.

Let's sustain.

Let's remember, that every generation is a trustee of Mother Earth and is accountable to the next generation.

to an elephantine size of 7.6 billion and is expected to cross 10 billion by the turn of the 21st century. Compare this with our size at 1 billion as we entered the 20th century.

Humans Have Primary Responsibility Of Nurturing, Sustaining Life On Earth

Earth is the only planet known so far in the Universe that supports life. Our planet is placed just at the right distance from Sun (neither closer nor more distant) that could support life. Ruminating over



Let us remember that every generation is a trustee of Mother Earth and is accountable to the next generation



PHASED PROGRAM HARYANA TO BOOST NATURAL FARMING

The Government of Haryana is in the process of implementation of a comprehensive plan on natural farming in the state to promote climate resilient farming in harmony with nature, to reduce cost of cultivation and make farming a sustainable livelihood option, to improve soil fertility, to boost micro flora and fauna, improve water holding capacity, water infiltration and porosity, to promote chemical free agriculture, to reduce soil environmental and aquatic pollution, to create awareness amongst farming community and society to adopt Natural Farming. Farmers will be trained and encouraged to promote *Prakritik Kheti Yojana*. The state government will provide assistance to the farmers for product certification, marketing and branding.

Natural Farming will get a boost in a phased manner in the state. Farmers'



determination, dedication and motivation will be the stepping stone to implement this scheme on ground. The government will support the farmers to keep them motivated, encouraged and reliable.

SUPPORT FROM AGRICULTURE & FARMERS WELFARE DEPARTMENT

Identification of Farmers, Fixation of Target

At initial stage, a target of 2500 acre

has been kept to cover under Natural Farming. A dedicated portal on Natural Farming has been developed on which district wise farmers will show their intention for adopting Natural Farming. Such data will help in keeping track of the dedicated farmers.

Farm Visit By Department Officials

Taskforce will work at ground level by visiting farmers' fields for better understanding of their intension for adopting natural farming and likely area

About the AUTHORS

Dr Sumita Misra, IAS, is Additional Chief Secretary to Government of Haryana, Agriculture Department. She has headed diverse departments in Haryana Government & also served as Senior Advisor, Economic Advisory Council to Prime Minister, GOI



Dr Hardeep Singh, IAS, is Director General, Agriculture and Farmers Welfare Department, Haryana

to be covered. This will help to farmers to understand the objectives of the scheme. The department will come to know the requirement of the farmers for adopting the scheme.

Training Programs

To make this concept more familiar and approachable among the identified and interested farmers, the training programs will be conducted jointly by Agriculture & Horticulture departments at different identified centers for natural farming in the State. This training program will help the farmers to understand the concept of Natural Farming and will boost the confidence of farmers.

Input-Based Subsidy

To increase the risk taking capacity of farmers and diversification of traditional farming to Natural Farming, subsidy component has been added. Drums will be given on subsidy to farmers that are required for decoction of Jeevamrit, Beejamairt and Ghanjeevamrit.

Exposure Visit

Learning by seeing: Farmers will be provided an opportunity to visit other states to learn from areas where Natural Farming is being implemented successfully.

Awards

Awards will be given to the farmers who adopted Natural Farming.

Incentive On Yield Loss

To compensate for yield loss due to adoption of natural farming.

Marketing Support/ Brand Development

Dedicated mandis will be identified and notified for marketing of natural produce.

Parameter Wise Description

• In microbial count, two different micro-organisms will be focused namely bacteria and fungi. It is further divided into 3 categories, viz. green, yellow and

Prime Minister Shri Narendra Modi's vision is that instead of chemical farming, natural farming methods will prove to be a milestone in doubling the income of farmers. GOI is promoting natural farming as Bhartiya Prakritik Krishi Paddhati Programme (BPKP) under Paramparagat Krishi Vikas Yojana (PKVY). BPKP's objective is to promote traditional indigenous practices which reduce externally purchased inputs for farmers.



red. Category green indicates the best range.

- In first year, incentive may be provided to all farmers whose parameters lie at any of three ranges.
- During second year, incentive may be provided to those farmers whose parameters value increases from initial range and lies in next range.
- Same increase in pattern may be followed in third year.
- Incentive will not be provided to those farmers whose values of reference range will not increase.

Details of Categories

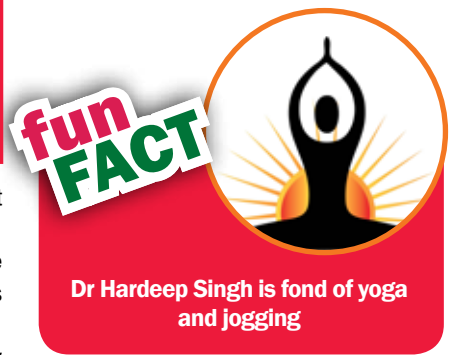
Total Bacterial Count (cfu per gram of soil)

- Red : Below 104
- Yellow: 104 to 107
- Green : More than 107



fun FACT

Dr Misra is one of the pivots of the literary circles of Chandigarh and always encourages budding writers and artistes towards excellence. She loves to read and sketch in her leisure time



Dr Hardeep Singh is fond of yoga and jogging

- ii. Total Fungal Count (cfu per gram of soil)
 - Red: below 103
 - Yellow: 103 to 105
 - Green : More than 105

• Metagenomic Sequencing

In third year one sample per cluster may be taken for Metagenomic sequencing. This is done at State Agriculture Universities for their reference and research.

If in any cluster there is pathogen build up, test will be done at farmer's level and certification will be suspended.

Organic Carbon

Organic Carbon of soil shall be tested and categorized as under. It takes time to build up organic carbon. Therefore criteria may be applied from second year.

- Red: less than 0.4%
- Yellow: 0.4% to 0.75%
- Green : More than 0.75%

Pesticide Residue

- First year: Whatever amount present in soil
- Second year: Less than 50% of 1st year
- Third year: Less than 10% of 1st year

BIOLOGICAL INNOVATIONS FOR SUSTAINABLE AGRICULTURE

A NOVEL SOLUTION FOR CROP WATER PRODUCTIVITY

Water is a critical input for agricultural production and plays an important role in food security: Farmers worldwide are facing challenging conditions – from soil health, biodiversity and extreme weather conditions from climate change. A changing climate affects growing seasons, water availability and crop productivity. This hinders farmers' ability to produce better and more abundant food for a growing population. The question is how can we ensure global food security by increasing yields, while limiting water consumption? This is urgent to develop practical tools and innovative solutions that can be used in the field to improve the productivity of water resources.

This is simply NOT sustainable!

Our core challenge is to produce more with less. In the decades to come, the world's growers will need to cope with a harsher, less predictable climate and a growing scarcity of natural resources while meeting an ever-increasing global demand for food.

SUSTAINABLE FOOD SYSTEMS

According to Food & Agriculture Organization of the United Nations, "a sustainable food system (SFS)" is a food system that delivers food security and nutrition for all in such a way that the economic, social, and environmental bases to generate food security and nutrition for future generations are not

compromised.

At Valagro, sustainability is at the core of everything we do. Valagro is currently the world's leading developer and producer of biostimulants. Our challenge as a leading player in agricultural nutrition and biologicals (includes biostimulants and biocontrol) is integrating and delivering advanced technology/products and value-added services to farmers globally. Forty years ago, that is exactly what Valagro did when it developed the concept of "Biostimulants".

A VITAL BIOSTIMULANT

Valagro identified an unmet need for their agri chemical customers – the importance of addressing the needs of the plants beyond traditional fertilizers and pesticides. For a plant to perform at its best, they recognized need for ingredients beyond N-P & K – they looked at nature for answers and realized that certain

About the AUTHOR

Dr Prem Warrior is Chief Operating Officer, Valagro SpA, Italy. Currently, he manages the global operations of the R&D, Marketing, and Technology Assessment teams



VALAGRO'S TALETE

Talete is a totally novel concept in crop management; it is a “technological breakthrough” to manage use of water by the plant and optimizing crop productivity and hence was awarded 2021 Crop Science Award for the Best New Biological Product (Biostimulant). The product is based on natural products that modulates the water use efficiency genes, the physiological mechanism of stomatal closure and eventually provides yield benefits under reduced water conditions. We know water is cheap; but already identified as a precious resource in the sustainable world of the future. Over the 500+ field trials, we have observed an overall 9-12% increase in yield on a variety of crops while reducing water input, providing more flexibility for farmers while supporting the concept of deficit irrigation.

natural ingredients triggered processes in plant and helped the plant perform its best. Our flagship product Megafol® was launched as one of our first foliar biostimulant and one of the first ever to address abiotic stress, esp. drought, in plants; this was soon followed by Viva®, a soil-applied product that improves overall plant health. Both products were way ahead of their times and have continued to grow and dominate the markets they serve and remain the best in class. In the last decade, with a concerted effort using their branded GeaPower™ platform & the Biosquad™ approach to market access, Valagro became a trusted name in agricultural markets including the row crop segments.

WATER MANAGEMENT – MOST CROP PER DROP

Most recently, we revealed a novel concept in the field of biostimulants with Talete® – a



fun FACT



Reading non-fiction, hiking, oenology (science dedicated to study and knowledge of wines), collection of wines and travel

bold attempt at addressing one of the most important challenges of agriculture – water management – and delivering the “most crop per drop”. It is one of the first products that opens new frontiers as a sprayable agri input for sustainable water management.

Composed of biomolecules of plant origin, Valagro's Talete is a new solution for sustainable water management. Talete acts directly on the plant physiology, helping the crops increase Crop Water Productivity (CWP = yield/unit of water) both when water is available in adequate quantities and when there is a water scarcity, be it permanent or temporary. Under water scarcity conditions, when water is the limiting factor, Talete increases CWP through a biochemical action on the plant

physiology maximizing yield, without changing the volume of water used for irrigation. More specifically, it induces the water-responsive genes, stomatal conductance while optimizing water use efficiency resulting in beneficial attributes in plants. The solution represents a sort of ‘safety net’ or water insurance every time growers face a problem with permanent or temporary water shortage.

Achieving higher yields and better quality with more efficient use of production inputs, especially water, is certainly a challenge that Indian farmers urgently need to address especially as we address the issues of climate change. Composed of biomolecules of plant origin, Valagro's Talete is a new solution for sustainable water management, working directly on plant physiology to help farmers manage water use more efficiently in both water-stressed and water-adequate conditions. This proprietary product was developed to specifically target some of the specific physiological processes in the plant and optimize the use of water by the plant. It increases crop water productivity or amount of water used.

Biologicals can transform agriculture while providing sustainability and added value for farmers and concretely support the global ecological transition. On one hand, they help increase productivity and optimize the use of resources, helping farmers protect their margins. On the other hand, the combined use of biologicals and traditional inputs can significantly help lower the environmental impact of the agricultural practices, under the same production levels. Biostimulants are the newest tool in the search of improved crop productivity and the future is bright for use of these natural products.

MAJOR TECHNOLOGICAL ADVANCES

BIOCONTROL,

BIO STIMULANTS



The Biocontrol market exceeded USD 3 billion in 2018. It is expected to witness 15% growth till 2025, resulting in 10% share of the global crop protection market. India is emerging as the potential market for biocontrol. It is projected to grow at a CAGR of 25%, contributing USD 778 million by 2025.

The bio stimulant markets market was valued at USD 3.2 billion in 2021 and is expected to grow at a CAGR of 12.1% to reach USD 5.6 billion by 2026. The India bio stimulants market is projected to grow at a CAGR of 14.04% during the forecast period to reach USD 142.435 million by 2026, from USD 56.783

million in 2019.

India with its rich diversity is emerging as the potential market for bio stimulants and biocontrol. This is attracting various global players to invest in the Indian market. Keeping in mind the popularisation of organic farming, the government has introduced various schemes to expand the market size of biocontrol and bio stimulants in India.

Diverse approaches in plant disease management have been very much influenced by the recent advances in the field of molecular biology. Many biotechnical tools have been developed by using different plant pathogens as experimental materials. The increased reflection on environmental concern over pesticide use has resulted in a large upsurge of use of biocontrol methods in India. According to the Directorate of Plant Protection, Quarantine and storage, a total of 361 biocontrol laboratories and units are working in India and there are 970 bio pesticides registered with the Central Insecticide Board and Registration Committee Data suggests that in India the use biocontrol has increased in the last few decades from 7190 MT in 2016-17 to 8645 MT in 2020-21.

About the AUTHOR

Mr Debabrata Sarkar is Vice President Asia Pacific, AlgaEnergy. He has successfully worked in leadership positions in Monsanto, Chemtura, Syngenta and a US-based biological company



The Curious Role Of Biostimulants

Biostimulants can include a wide variety of ingredients, which can be placed in the following four categories:

1. Microorganisms (e.g., fungi and bacteria)
2. Extracts from plants or Botanical extracts
3. Organic (i.e., carbon-containing) molecules including various components of soil organic matter
4. Inorganic (i.e., not carbon-containing) elements or molecules

Biostimulants can enhance plant health in multiple ways. In some cases, scientists don't yet know how a biostimulant enhances plant health, just that it does. Like biopesticides, a biostimulant may have more than one of the following modes of action:

1. Improve soil quality by impacting soil characteristics like water holding capacity, structure, or aeration
2. Improve plant access to nutrients already present in the soil
3. Stimulate plant defences or otherwise increase the plant's tolerance to stress (from biological or non-biological sources)
4. Improve root growth of the plant (so that the plant can take up nutrients better)
5. Improve the quality of something produced from or by the plant (e.g., improved flavour or nutrition of fruit)

While biostimulants focus on judicious and reduced use of fertilizers, biological control aims to reduce application of pesticide. Biological control is a method of restricting the effects of harmful animals, pathogens and plants using other useful organisms, e.g. microorganisms, insects and plants that inhibit the harmful organisms. Predation, parasitism, pathogenicity, and competition are all examples of basic ecological interactions between species that the approach makes use of. Biological control is now predominantly employed in agricultural agriculture to combat pests.

Leadership Position Of AlgaEnergy

AlgaEnergy, headquartered in Spain, is a biotech-based company exclusively focused on Microalgae. It has extensive experience in the field of microalgae and

**fun
FACT**



Mr Sarkar is a gifted painter. The accompanying image is the self-portrait painted brilliantly by him

other disruptive technology, consolidating more than four decades of R&D. Its technologies and culturing facilities are developed in-house which the most advanced in the world.

With its strong foothold in R&D, AlgaEnergy has been continuously developing innovative and quality products which are efficient, competitive and sustainable. The products manufactured by AlgaEnergy uses an innovated bioprocess in which molecules of interest are formulated without degradation, maintaining the naturalness of active ingredients. Microalgae exhibit a pool of traits with unique value for addressing this challenging agricultural scenario. Microalgae, impacts critical agricultural needs such as biological nitrogen fixation, soil phosphorus cycling, effects on soil microorganisms, plant growth promotion either by soil nutrient cycling and/ or

phytohormones or root associations, biocontrol, and soil stabilization.

Microalgae Play Vital Role

Recently, microalgae have gained prominence as bio-stimulant products due to their potential to increase germination, seedling growth, plant growth, productivity, nutrient use efficiency, as well as tolerance to a wide range of abiotic stresses (salinity, drought, sub- and supra-optimal temperatures, and heavy metals contamination). Microalgae improve soil fertility and contribute to plant growth and protection and offer an alternative to reduce our dependence on chemical fertilizers and pesticides. Microalgae also fix carbon dioxide through photosynthesis for carbon capture and some produce exopolysaccharides that improve soil structure.

AlgaEnergy is continuously working on developing advance technologies and bring a revolution is the field of biotechnology in the entire world. With its set up in India it is catering the needs of countless farmers to engage in the most advance and sustainable methods to do agriculture.

After success with Microalgae, Algaenergy is soon coming up with Biocontrol invention with the use of innovative technology. Committed to intense R&D, research & requirements, Algaenergy aims to assist millions of farmers across the globe with effective Biocontrol solutions that can significantly reduce pest organisms.

We aim to meet the growing demand with sound, bio-based integrated crop management solutions.



AGRICULTURE NEEDS AN INFORMATICS REVOLUTION

Gene editing will continue to play a major role in the future of agriculture

There is a big shortfall between the amount of food we produce today, and the amount needed to feed everyone in 2050. There will be nearly 10 billion people on Earth by 2050—about 3 billion more mouths to feed than there were in 2010. As incomes rise, people will increasingly consume more resource-intensive, animal-based foods. At the same time, we urgently need to cut greenhouse gas (GHG) emissions from agricultural production and stop conversion of remaining forests to agricultural land.

Agriculture is becoming more integrated in the agro-food chain and the global market. Environmental, food safety and quality, and animal welfare regulations are also increasingly impacting the sector.

There are ventures in agricultural business such as farm-to-table ventures and mega-ventures such as investing in technology. These enable more free-market opportunities for rural farmers. Today's agricultural entrepreneurs are developing innovative ways to revolutionize the entire food chain. They are at the forefront of reducing food loss and waste, increasing crop yields, improving market access, developing novel technologies, and increasing sustainable farming practices across the globe.

In addition to the traditional goals of making a profit and taking care of the natural resources so that business can continue, sustainable agriculture puts special emphasis on the social aspects of agriculture. Consumers are becoming more concerned about where their product comes from, who raised it, and what production methods are used. Farmers are recognizing the benefits of raising a local product for their communities and in reinstating the consumer's connection to the land that has been lost in many cities and suburbs.

How Farmers Can Be Agripreneurs

Writing a business plan can uncover roadblocks to profitability, including start-up costs and marketability. Farmers can explore opportunities and forge partnerships to contribute to the sustainable development goals of 'No Poverty, No Hunger' and climate action to develop climate-

Dr MS Reddy, Founder & Chairman, Asian PGPR Society for Sustainable Agriculture and Consultant & Entrepreneur, Auburn University, Auburn, AL, USA

New gene editing technologies such as CRISPR will help scientists develop crops that are resistant to pests and pathogens, more nutritious and adapted to the changing climate. CRISPR can also help address animal welfare issues and decrease the environmental footprint of meat production



smart villages, digital agriculture and the use of information technologies in agriculture.

A critical and crosscutting theme in humanitarian aid and resilience programs in collaboration with other organizations is the key for successful entrepreneurship. Focus on foundational production skills, business knowledge and personal development to establish the next generation of resilient farm enterprises for healthy and safe food.



tête-à-tête with Anjana

Need For Environment-Friendly Microbial Technologies

Research collaborators around the globe have conducted PGPR (Plant Growth-Promoting Rhizobacteria) research on various crops. The rationale is that there is a great need for environment friendly microbial technologies around the globe. Agriculture is plagued by two main constraints. The first is the depletion of nutrient supply in the agricultural soils, and consequently, the sizable gap between achievable and actual yields in various crops.

The second main constraint is crop protection. Devastating pathogens lead to 15-30% average crop losses annually. Despite the constraints, researchers have made great strides in agricultural production. Sustainable approaches are those that are not aimed solely at maximizing short-term production. They also consider long-term production gains,



the ecology of agricultural systems and profitability of farmers.

The Real Test Of Sustainable Solutions

Sustainable solutions result in empowerment of women, farm labourers

CHALLENGE AREAS

Feeding 10 billion people sustainably by 2050 requires closing three gaps:

- A 56 percent food gap between crop calories produced in 2010 and those needed in 2050 under “business as usual” growth
- A 593 million-hectare land gap (an area nearly twice the size of India) between global agricultural land area in 2010 and expected agricultural expansion by 2050
- An 11-gigaton GHG mitigation gap between expected agricultural emissions in 2050 and the target level needed to hold global warming below 2oC (3.6°F), the level necessary for preventing the worst climate impacts.

The solutions are organized into a five-course menu.

- *Reduce growth in demand for food and other agricultural products
- *Increase food production without expanding agricultural land
- *Protect and restore natural ecosystems
- *Increase fish supply
- * Reduce GHG emissions from agricultural production

and rural communities. They involve restructuring the crop rhizospheres for improving and sustaining the nutrient supply in the soils and enhancing the health and yield of crops through sustainable practices based on microbial technologies.

There are two main outcomes or effects from beneficial microorganisms: enhanced plant-growth and crop protection, both of which represent the two main constraints to agriculture. The network partnership around the globe has correctly identified the use of microbial inoculants to provide holistic health and sustainable crop yields. Each partner in the network has made substantial contributions to agriculture in research with plant-associated rhizobacteria.

These research leaders bring their expertise together in building a partnership in higher education. Several large development projects in agriculture failed after initiation because of new pest and soil health problems. There is urgent need to promote integrated pest/disease management at a faster rate. It is driven by emphasizing organically produced food, conservation of biodiversity, unpolluted environment, and sustainable agriculture.

The adoption of bio-pesticides by farmers is still in infancy. While already threatened by the unforeseen drought spells, crops suffer the frequent outbreaks of pests that lead to total crop failure. Because of such crop failures, poor farmers cannot afford expensive crop protection technologies and remain poor. Strengthening relationships among leaders in the field through development, training, education for propagation of low-cost technologies will help in the improvement of our farmers' economic situations and thereby eliminate the cycle of poverty.

Major Concerns

Science Breakthrough teams imagine a future where mobile apps connected to smart devices can alert farmers in real time to animals that are sick or particular



If we understand agricultural microbiomes, we can make changes that shift the system in favor of the good bug. That means plants and animals that are more resistant to pathogens and use nutrients more efficiently

areas in a field that need water. Agriculture needs an informatics revolution. In addition to attracting talented data scientists, new technologies such as artificial intelligence can be developed to help manage and learn from agricultural data.

Gene editing will continue to play a major role in the future of agriculture. It allows scientists to tap the genetic potential of wild species and tweak specific traits without muddying up the gene pool by breeding our best stock with less desirable relatives.

New gene editing technologies such

as CRISPR will help scientists develop crops that are resistant to pests and pathogens, more nutritious and adapted to the changing climate. CRISPR can also help address animal welfare issues and decrease the environmental footprint of meat production.

We are just beginning to understand the positive impact that our own microbiomes have on human health. Plant and animal microbiome research is way behind. If we understand agricultural microbiomes, we can make changes that shift the system in favor of the good bug. That means plants and animals that are more resistant to pathogens and use nutrients more efficiently.

A renewed emphasis on training the next generation of food and agricultural scientists is essential for replacing the aging workforce and filling jobs that already have high vacancies at every level of this sector. Most importantly, funding for agricultural research needs to match the magnitude of the challenges ahead.



PRATHISTA®
The pride of being

PRATHISTA INDUSTRIES LIMITED

An ISO 9001, 14001, 45001, ISO 22000 & GMP Certified Company
(An India Based MNC)



PRATHISTA "4G" ORGANIC PRODUCTS LAUNCHED BY Dr.S.AYYAPPAN (Ex. Director General ICAR - Govt. of India)
Team Prathista Hearty Congratulates Dr.S.AYYAPPAN for receiving Padma Shri Award

"4G" CROP NUTRITION ECO-FRIENDLY ORGANIC FERTILIZERS



ECO-FRIENDLY ORGANIC CROP PROTECTION PRODUCTS



- ▶ Prathista "4G" Organic Products are import substitutes for Inorganic Fertilizers.
- ▶ It improves soil fertility and soil microflora.

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Factory :

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EVERGREEN REVOLUTION THE SUSTAINABLE BIO AG MODEL

Green Revolution made a huge impact in the food security of Asia. The situation in two largest countries – China and India – is indicative of the challenges that we face. Green Revolution made India food surplus by 1970.

China Feeds 20% population of the global population with 6% arable land. Agriculture played the key role in China's revolution. But the following challenges remain.

1) Since the green revolution, land has witnessed an indiscriminate and prolonged use of chemicals. The strong need for moving away to more eco-friendly farming is felt.

2) We need to promote eco technologies which integrate the principles of ecology in technology development and dissemination. We also need to promote production and use of biological software for sustainable agriculture and food security. How we can achieve advances in productivity in perpetuity without ecological harm is

being demonstrated more and more.

The 20:20 Model and Digital Platform

The 20:20 model is emerging as perhaps the most practical and popular model with the farmers. It is realized that the environmental issues and the high costs of chemical farming cannot be wished away. Farmers who suddenly switched to organic farming faced disappointment, which did disservice to the cause. The 20:20 model has shown the practical and positive way for easy adoption. After the first year of 20:20, the bio-organic inputs use can easily be doubled and even tripled in the next two years by many progressive farmers. Such farmers are in different agro-climatic conditions and have grown different crops.

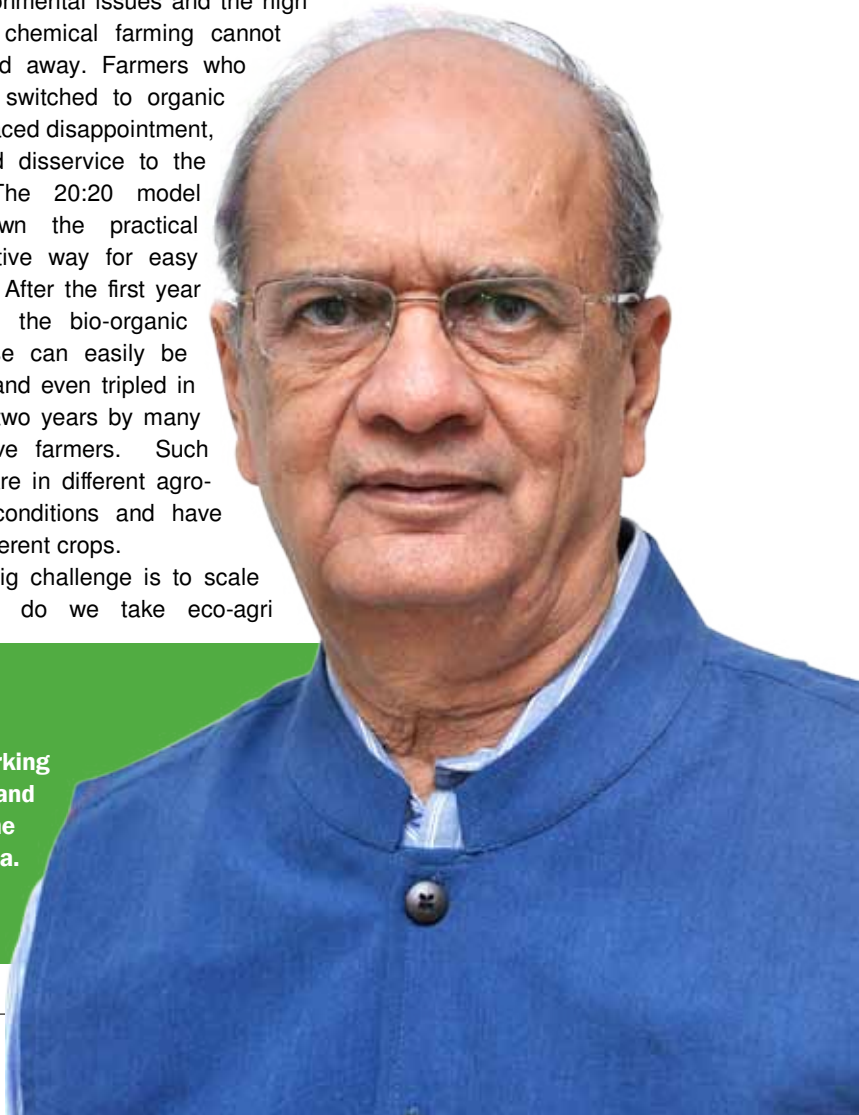
The big challenge is to scale up. How do we take eco-agri

practices to the smallest farmers? Digital technology can play a big role here.

Organic/Eco Farming Around Rivers and Water Bodies: Ganga

About the AUTHOR

Padma Shri Dr MH Mehta is the Chairman – Working Group Eco Agriculture, Indian Chamber of Food and Agriculture (ICFA) and President/Chairman of the Science Ashram/Gujarat Life Sciences, Vadodara. He heads the Mission on Eco Agriculture for Ever Green Revolution





And Vishwamitri Models

The over-use of chemical inputs in farms around rivers and water bodies is a major problem. This can be tackled with the right intentions and efforts.

Vaho Vishwamitri Abhiyan was a people's movement to rejuvenate the ancient and once beautiful river in Central Gujarat. The holistic plan prepared included Bio Shield (trees and shrubs) and organic farming up to 1 km on both the banks of this 134 km long river. This plan was shared with the Namami Gange team also.

For such a large and challenging project like Namami Gange, the holistic action plan includes (a) Organic / Eco Farming up to 5 km on both banks of this large river (2525 km) and (b) Forestation (Bio Shield).

In the budget speech of 2022, the Finance Minister announced special financial support for organic farming around Ganga. This is a great and



Dr Mehta is a keen sportsman with avid interest in cycling and swimming. His other interests are poetry and music. He plays a rare musical instrument namely Kasth Tarang

laudable initiative but very challenging. It can be a big step for eco agri revolution.

We must realize that terms like Organic/Natural/Agro Ecology/Dynamic Farming etc are not competitive or contradictory, but have to be viewed as complementary. The word Eco Agriculture encompasses all this.

During our meeting with the Global Expert committee, the Prime Minister had emphasized that the “real challenge is How – viz, how to scale up eco-friendly/organic farming in a big way”.

For preparing the road map for Ganga and other rivers, the role of forestation and organic farming on both the banks is well accepted at all levels.

The strategy for agricultural use of treated effluent water from Effluent Treatment Plants will have to be scientifically designed for integrated farming including animal husbandry, aqua agriculture, agro wastes to bio composts etc.

We need to ensure training and extension at all levels including farmers, registration, standardization and market link up with support and expertise from Working Group and AIOI (Association of Indian Organic Industries).

A practical and middle path of transformation from chemical farming to Eco Agriculture for Ever Green Revolution can be the 20:20 model of transition. This is most important. Attempts of sudden switch over to organic/natural farming are neither practical nor beneficial, and have often met with disasters.

The 20:20 Model is the ideal middle path. It is evolutionary in nature, is sustainable, economical and environment friendly. This is the way for moving from Green to Evergreen Revolution.

New Direction For Farmers

The exorbitant rise in input cost and uncertainty crop production the current farming has besieged with has put farmers in dire situation. The adverse changes in climate have further complicated it for farmers and crop production. For a long time farmers were looking for an alternative solution which they have finally got in the form of 20:20 Mehta Model. The app was developed by CSO, Solidaridad Regional Expertise Centre which is actively working in the Soy belt of Malwa region for about more than ten years. It aims to reduce cost of production by 20% and improve crop yield by 20%. The model provides the farmers an alternative to current input intensive farming by adopting ecological practices, use of ecological inputs, bio pesticide, bio fertilizer, growth promoters.

CAN TWO DAYS CHANGE THE TRAJECTORY OF BIOCONTROL?



The past two years have shown how quickly life can change. The pandemic, extreme climate events, and geopolitical challenges that are resonating throughout the world, have made us all realise the fragility of our lives, and that of even the strongest business.

Few companies were prepared for the changes that the past two years have wrought and, while strengthened supply chains, flexible working and



About the AUTHOR

Dr Minshad Ansari is Founder and CEO of Bionema, a leading UK bio-pesticides technology developer, specialising in organic chemical-free, biological crop protection for safe and sustainable agriculture



other pragmatisms have provided the resilience that AgriTech needs to continue thriving in the 'new normal', old challenges remain.

Primarily, the biocontrol sector continues to struggle with the challenge of converting brilliant ideas into commercial products that can be sold on the market. There appears to be no shortage of new ideas for biocontrol solutions, but the following challenges remain.

1. Innovation: there are not enough biocontrol products on the market to address growing demand – as more toxic chemicals are banned, the

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world urgently needs more biological solutions to fill those gaps.

2. Formulation: early biocontrol options failed due to sub-optimal formulation techniques that allow full efficacy to be achieved.

3. Regulation: despite 30 years of efforts by individual companies and other industry groups, little has been achieved in gaining the regulatory reforms required for new biopesticides.

4. Investment: the biocontrol sector is dominated by entrepreneurs, spin-offs and SMEs that need external investment to advance their innovations and get them to market.

Covering Biopesticides, Biostimulants, Biofertilizers, Biocides and Bioremediation, the Annual World BioProtection Summit and Awards (AWBSA) – the annual meeting of the World BioProtection Forum – addresses

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I like watching Bollywood movies with my wife in my free time, if I have any, and going for long walks

all three of these key challenges. Promising to be the most exciting biocontrol event of the decade, AWBSA offers:

- An excellent conference programme featuring top-billing speakers who will share latest developments and opinions in bioprotection.

- A session dedicated to regulatory challenges, with a meaningful panel discussion involving representatives from across the sector, including policymakers

- Excellent networking opportunities

- An opportunity to pitch new ideas in a vibrant and energetic InvestorReady session

- An Awards scheme celebrating the sector's brightest achievements.

We all know someone who's been incredibly 'lucky' in business – being in the right place, at the right time, is often cited as one of the core requirements for success. We think your future is too important to rely on luck – you should make sure you are in the right place to take advantage of any opportunities that might come your way.

You might have heard us say before, "It only takes one successful pitch to change your life." We also believe that it only takes two days to change the trajectory of biocontrol, and those two days could be 23–24 May 2022!

Join us in person or LIVE on-line on 23-24 May at this year's Annual World BioProtection Summit and Awards and make the connections that you need to reach success.



SUPERFOODS CAN IMPROVE FINANCIAL HEALTH OF FARMERS

The global wave of consuming 'superfoods' has taken Indians in its fold too. People are going back to old treasures like amla (Indian Gooseberry), pumpkin seeds, berries etc, which are rich in antioxidants, vitamins, minerals.

Indian contribution to the international superfoods are moringa, jamun (Indian blackberry) amla, ashwagandha (winter cherry), buckwheat, flax seeds, forest honey, millets like ragi among others. The list is growing as different superfoods are seen as the solution to address different deficiencies and health problems.

The global superfoods market size was USD 172 billion in 2020. It is expected to reach USD 287 billion by 2027. In India too, the market is growing and is expected to see a growth of 6 percent during 2021-26.

Superfoods have become a lucrative market due to their demand and profit margin, which is three to four times higher when compared to other foods. Global brands, supermarkets, cafes, fitness clubs etc are bringing innovations in use of superfoods in their products such as daily nutrition mixes, sports nutrition supplements, smoothie mixes, meal replacement drinks, nutraceuticals, daily protein. Turmeric Latte is one such example.

Internationally, famous superfoods like quinoa and chia are actually from Peru and Bolivia. They have found takers in urban areas in India. Farmers in Rajasthan, Telangana, Andhra Pradesh and Karnataka are earning big money by cultivating these superfoods. Quinoa has been adopted into Indian cuisine and is being used in various snacks such as idli, payasam, poha, and even in protein bars, cookies and beer.



Indian millets too are identified as superfoods and are set to get global recognition. Government of India is encouraging the cultivation of millets that can help secure dietary, nutritional

and economic security. Millets are rich sources of minerals like calcium, iron, zinc, phosphorus, magnesium, and potassium, besides containing appreciable amounts of dietary fibre and vitamins.

Millet production in India had declined over time due to changes in consumption pattern and replacement by wheat and rice. Farmers in India can easily switch back to millets. The Indian government has asked corporates to brand and promote Indian millets. These superfoods can ensure higher income to farmers through exports.

Similarly, another local superfood moringa has risen to fame for being rich in calcium and is in great demand worldwide. Moringa is traditionally used in the South Indian dish Sambhar. It has been adopted in Indian drinks.

The superfood market is still underrated in India, but there is going to be sharp growth due to the growing awareness about healthy food and new trends of switching to veganism and vegetarianism. Indian farmers can make farming a profitable business through superfoods cultivation, as most of them need low inputs, less water and withstand harsh weather conditions.



About the AUTHOR

Dr Shivendra Bajaj is Executive Director, Federation of Seed Industry of India and Alliance for Agri Innovation





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NOURISHING LIVES AND LANDSCAPES

TREE-BASED AGROECOLOGY

The environmental impact of unsustainable agricultural practices varies from producing food (with less nutrition) to how we process, consume (further loss of nutrition) and dispose of unconsciously (overall more waste) and high carbon, chemical and water footprint.

FOOD FOR CLIMATE ACTION: BELLY FULL, HUNGRY CELLS

When examining the global diet in the last three decades, one can see declining trends of vital food elements and how we have become dependent on a few staple crops (primarily cereals) and industrially farmed meats to meet the calories of growing demands but losing quantum of nutrition and diversity drastically, which results in a phenomenon called “belly full hungry cells”- consuming more food with fewer nutrition results in triggering the

habit of frequent eating and generating more waste.

Food grown in conventional monoculture with depleted soil has 8-25 times less nutrients than food grown in an integrated system with healthy living soil. This results in eating 8-12 times more food to meet the same nutrient requirement five decades ago. This has a significant negative impact on the climate and our ability to grow food now and in the future, water availability, global nutrition, and overall health of the people, landscapes and the planetary health.

There is a pressing need to shift to highly diversified agroecosystems to restore functional production and high nutrition to ensure the health of livelihoods and landscapes for present and future generations.

GRADUAL TRANSITION TO INTEGRATED TREE-BASED

AGROECOLOGY

The dynamics of agricultural production are driven by environmental factors such as drastic fluctuation in temperature, erratic precipitation trends, and water supply is often the most limiting factor making agriculture profitable and sustainable. They are characterized by persistent water scarcity, extreme climatic variability, high susceptibility to land degradation, desertification, and loss of natural resources, including biodiversity, at elevated rates.

We often fail to understand and hardly emphasize underlying factors and drivers responsible for building the resilience agroecosystems where ‘trees’ in production landscapes and soil organic matter are the primary shock absorbers to withstand the changes. Transforming conventional yield centric production into climate-resilient agroecosystems requires systematic combinations of crops, trees, animal species, and conservation practices to specific agroecological zones. Pursuing sustainable livelihood goals is based on several factors, including trees, crops, climate, soils, markets, capital, trade, and traditional knowledge. It demands an integrated approach with an ecologically sound functional production system to improve landscapes and livelihoods. Therefore, the international and national initiatives emphasize a gradual transition to ‘diversified tree-based agroecology at landscape level’ to reach at least 30% through strategic investment, innovative research, outreach, and enabling policies and the environment to achieve sustainable development goals.

About the AUTHOR

Dr. Dr. Chandrashekhar M. Biradar, is Country Director, CIFOR-ICRAF-India with Asia Continental Program; and Chief of Party (CoP, TOFI Program-Trees Outside Forests in India). He is a landscape ecologist with broad experience in executing agroecosystem research and outreach across the diverse landscapes in Asia, Africa, and the Americas.



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Dr Biradar is fond of ecosystem restoration, nature camping, gardening, and photography. He has grown more than 237 types of fruits and vegetables at home gardens.

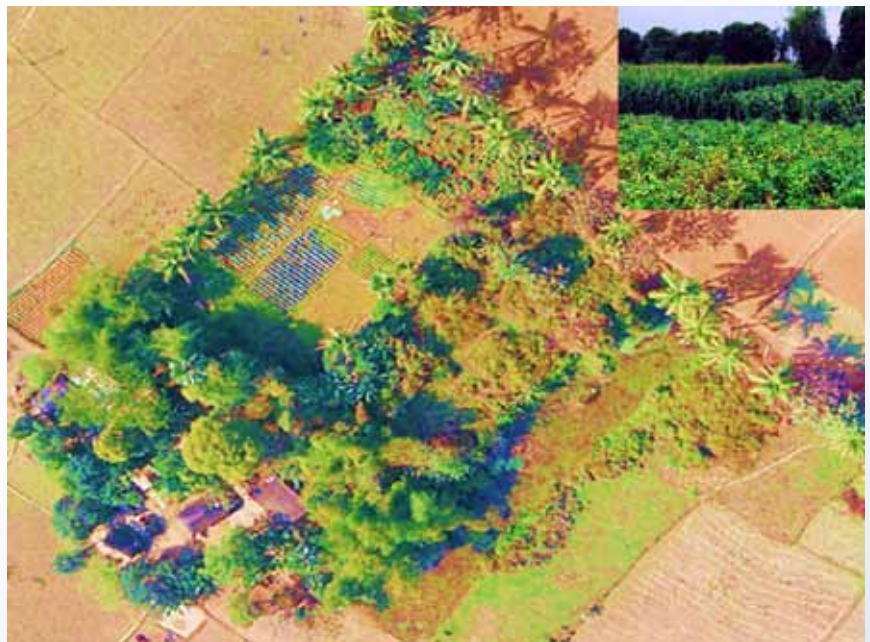
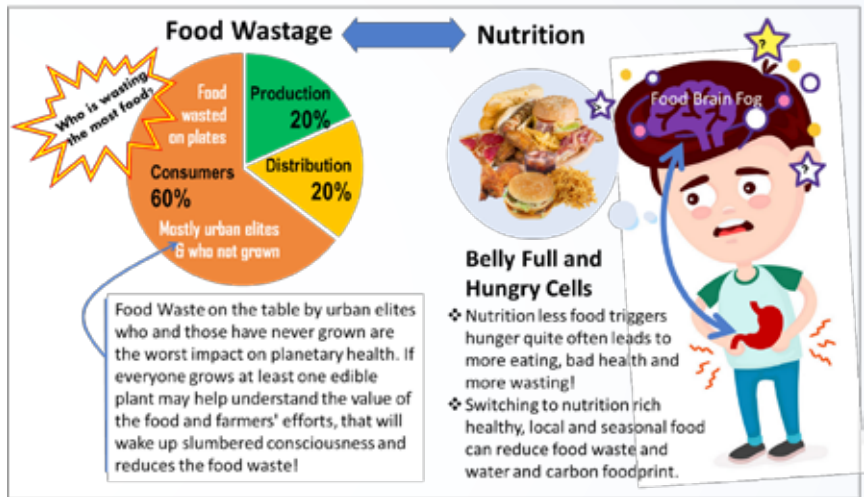
CABBAGE AND DONKEY!

Last spring, I visited a rural farmer's market in Egypt's Nile Delta and purchased a healthy-looking giant cabbage. As it was too big, I removed a few outer leaves to feed the nearby donkey next to vegetable sellers. The farmer immediately rushed to pull away leaves from the donkey's mouth. I asked him why. He innocently said the donkey will die as the cabbage is sprayed with chemicals.

I said What man! You are selling vegetables even not fit for your donkey? He asked me to sit down and explained to me patiently (with an Arabic translator); Sir, habbibi, please don't assume it is my fault. Buyers won't buy even if they see a single worm or hole in the cabbage leaves, and supermarkets reject the entire lot; we do not have any option other than spraying a heavy dose of chemicals. This is the tragedy of humans not limited to one country but across the world.

SHARED RESPONSIBILITY

The core value of the system-level innovation is their synergies to enhance the adoption rate of technologies and management practices through more significant interaction between researchers, policymakers and farming system stakeholders where the farmers are stewards of the reforms. While it also needs to emphasize reducing risks and vulnerability of smallholders by investing in mechanisms for measurable incentives such as soil-carbon and biodiversity. The conventional intensification of agriculture with a mere focus on yield alone is prone to high risk and exposure due to several associated factors such as climate, soils, lack of capital, poorly developed markets, demographic challenges, and ever-increasing pressure on the natural resources. In contrast, functional systems are characterized by intricate combinations of practices that combine production, consumption, conservation and restoration with significant co-benefits to the people, culture and nature. Because of their diversity in unity, it is necessary to characterize these systems at very high spatial and temporal resolutions to minimize and mitigate the risk and vulnerability in the transition. Therefore, context-specific interventions of tree-based agroecology present emerging trends to allow researchers and decision-makers to diagnose vulnerabilities by considering dynamics of land use, land tenure, patterns, supply chains, and demographics at the landscape level.



An example of a gradual transition (1/10 of the acre) to diversified tree-based agroecology shows various annual and perineal crops, fruits, vegetables, spices and condiments. Aerial and inset photos: C. Biradar

EMERGING SECTOR FOR IMPROVING FARM PROFIT

MEDICINAL PLANTS

CULTIVATION

Agricultural diversification through the medicinal plants can help in enhancing farms' productivity, profitability, and value addition besides leading a healthy lifestyle. Medicinal plants are a rich resource of ingredients which can be used in drug development in pharmacopoeia, non-pharmacopoeia or synthetic drugs.

According to WHO, 80% of the world population depends upon traditional medicine for their health needs. Cultivation and production of the medicinal plants will ensure the purity, quality and the sustainable conservation of these plants and the supply of herbs required for the herbal industry.

There is high demand of the medicinal plants owing to the increasing health concerns, resulting in high chance of economic feasibility. Hence, the medicinal plant's cultivation in agricultural diversification stands as

one of the best options for the farmers. Another benefit of the medicinal plants is that the various plant parts are used, hence the chances of wastage are less, reducing the environmental impact.

Cultivation of high-value medicinal plants like Ateesh, Kutki, and Shankupushpa are paving the way for opportunities for farmers to increase their income motivating them to diversify their crops. The medicinal plants sector gives high prices and market value than the traditional crops adding benefits to the farmers.

At QCS Herbs, we are working with farmers in nine states to cultivate medicinal plants, using quality planting material and good agricultural practices with assured buyback of the quality herbs as per predefined standards.

Wasteland Development

One of the major concerns of the agriculture department is the rapid growing numbers for the area of non-

arable wastelands. Skilled and research-based selection of medicinal plants for such lands. Therefore, the farmers with no assured productivity of conventional crops can get assured produce of medicinal plants through wasteland development also.

Opportunities in Cultivation

The overall export of nutraceuticals and herbal products is Rs 20,000 crore. This is expected to reach Rs 70,000 crore by 2023. This shows an immense opportunity for medicinal plants in domestic and international markets. There is high demand in the global market for these herbs. Organically grown herbs fetch more prices than the conventionally grown and wildly sourced herbs. Medicinal herbs are always in demand and most of their return can be seen within a year and the bark species are known to give yield in a span of 10 years which add value to his produce.

The case study undertaken by



Mohanji Saxena

About the AUTHORS

Pooja Uniyal and Balasree PP, Quality Certified & Standardized (QCSHPL); Gaura Verma, Business Head, QCSHPL;

Dr Anup Kalra, Director Ayurved and QCSHPL; Mr Mohanji Saxena, Managing Trustee ARF and Director, QCSHPL



Dr Anup Kalra

MAKING FARMERS PROSPEROUS

Adopting medicinal plant cultivation in agricultural lands will ensure additional profits and income-generating opportunities for the farmers which shall lead to a rise in national income. Cultivation of the medicinal plants is an emerging sector in agricultural diversification owing to the growing demands of the industry that would enhance employment opportunities in rural areas. Research and development will help in increasing the productivity and yield of the active ingredients in medicinal plants. Creating awareness and interest of the farmers with the help of government policies, market opportunities, and high remuneration, with appropriate agro-techniques will bring in more farmers to the agricultural diversification with the medicinal plants.



Ayurved Research Foundation (ARF) at Sonapat revealed that in comparison to the traditional crops the value offered by the medicinal plants were as high as 20%. Another study revealed that farmer nearly earns nearly Rs 2-3 lakhs/Ha by cultivating Ateesh in Himachal and Uttarakhand.

In his national address, the Prime Minister emphasized that the use of traditional knowledge of herbs for improving health should be validated scientifically to make such solutions available globally. NMPB provides several schemes in support of medicinal plant cultivation. They offer up to 75% subsidy to the farmers and also provides schemes and guidelines for financial assistance in medicinal plant cultivation. There are prioritized medicinal plant species for support of cultivation such as 75% subsidy for highly endangered medicinal plants like Kutki (*Picrorrhiza kurroa*), Ateech (*Aconitum heterophyllum*), Jatamansi (*Nardostachys jatamansi*), etc. The cultivation of critically declining

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Dr Kalra loves travelling and interacting with people

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FACT**



Mr Mohanji Saxena loves nature. He is fond of flora, fauna, likes to travel and listen to music

medicinal plants gets a 50% subsidy and 30% for the other therapeutic plant species which need support.

Way Forward

Currently, there is limited information available on the propagation and agrotechnology for the medicinal plants. Thus, developing agrotechnology with proper research and development will pave the way forward for the increase in the cultivation of medicinal plants. Furthermore, in order to meet the ever-increasing demand for medicinal plants, farming these plant species is imperative. Apart from meeting the present demand, farming of these medicinal plants will conserve the wild genetic diversity of medicinal plants which include the endangered species.

Cultivation of medicinal plants will allow the production of uniform material, giving standardized products, consistency throughout. Cultivation would also help in the better identification of the species, improved quality, and increased chances for genetic improvements.

The selection of quality planting materials for large-scale farming would be an important step to ensure the consistent quality of the raw materials with good quality active ingredients and possibly pest- and disease-resistant, and environmentally tolerant varieties. These herbs have played a significant role in improving the animal health.

Recently an MOU was signed between the NMPB, Ministry of Ayush, and Department of Animal Husbandry and Dairying for the research on a new formulation of quality drugs for improving livestock health and productivity.

One of the major challenges is the absence of the crop insurance for medicinal plants. Other challenges include adulteration, absence of labelling, uniform packing and non-standardization of herbs.

CHALLENGES, OPPORTUNITIES MAKING INDIAN AGROCHEMICAL INDUSTRY *Atma Nirbhar*



The fact that India is home to so many different kinds of plant biomass makes it possible for us to conduct research that can yield an important new plant-based molecule for the agrochemical industry. India can become world leader in biological based pest control technologies.

If we want to see robust growth in the Make in India or AtmaNirbhar Bharat initiatives, we must lessen our reliance on others for important advances in crop care. Top research institutions in India (government-aided or private) can assist in producing innovations locally and enable Indian enterprises to be better commercialized. This can bring Indian companies into a better position in global markets.



About the **AUTHOR**

Dr Nutan Kaushik is Director General, Amity Food & Agriculture Foundation, Amity University, Noida. She has been awarded several prestigious awards and fellowships



Technological advancement

Agricultural production is experiencing a time of fast change. Companies engaged in R&D are restructuring their operations to take a more holistic approach to provide manufacturers with integrated solutions. The techniques of synthetic chemistry, biotechnology, biologicals, and biopesticides are all heavily intertwined with significant advances in application technology, digital farming, and ample data use.

Use of Advanced Formulation Technologies

The formulation provides the active ingredient with its distinct physical form and specialised features, allowing it to fill a market niche in which it competes.

Agricultural companies are increasingly relying on formulation technology to differentiate their products and provide value. For brand refreshment, new product introduction and formulation technology can have a significant impact.

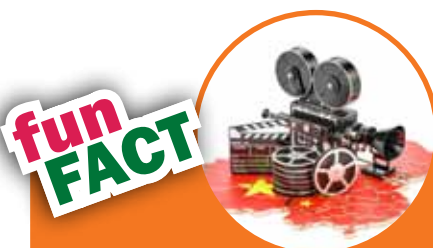
The use of traditional agrochemicals, which have broad-spectrum effects on the environment and organisms, is a big challenge for the agricultural business. Scientists are working on numerous pesticide formulations utilising different technologies to address this issue. Agricultural nano-emulsions and nano-delivery devices for agrochemicals have been the focus of intense research. For crop protection, pesticide nano-formulations with unique chemical and biologic features have been developed. There are agrochemical nano-emulsions in particular that can improve the solubility of active components, agrochemical bioavailability, and application qualities like stability and wettability. All of these, along with a variety of preparation methods, lead to a greener and more.

Development of new molecules and biologicals

India has rich traditional knowledge and biodiversity. Yet we lag in developing new green molecules. Scientific validation of traditional knowledge and bio-prospecting of plant and microbial diversity will put India on the global map of crop protection technology. Funding and policy support will facilitate fast-track development. Ease of regulation for registration on the pattern of USEPA is the need of the hour.

Application Technologies Related to Improved Pesticide Application and Drift Reduction

When it comes to crop production, plant protection actions are the most crucial techniques to employ. The use of a sprayer to administer the pesticide is one of the most recurring and significant activities in agriculture to apply fungicides, herbicides, and insecticides to crops. The contradiction between economic growth and environmental conservation in



Dr Kaushik likes to watch documentary films and engage in face reading

agricultural output has been exacerbated by conventional agricultural spraying tactics. Spraying techniques have been steadily improving over the last few decades. It is not only the sprayer that is important for pesticide application. All of the parameters, such as the type and area of the plant canopy, the area of a plant leaf, the height of the crop, and the volume of plants that are related to plant protection product applications, are critical for obtaining better results.

Recent developments in sprayer technology began in the last few decades. The percentage of applications for robotic and automatic spraying technology such as variable-rate sprayers, UAV sprayers, and electrostatic sprayers is increasing so that farmers can use more pesticides, reduce pesticide residues, and save money by spraying plants with real-time, cost-effective, compatible pesticides all in one operation. Drift Reduction Technologies (DRT) is the term used to

India has rich traditional knowledge and biodiversity. Yet we lag in developing new green molecules. Scientific validation of traditional knowledge and bio-prospecting of plant and microbial diversity will put India on the global map of crop protection technology

describe such technologies. Pesticide application can be addressed precisely using a mechanical spraying system, which is often implemented by extremely precise equipment or mobile robots or drones and can be done at the desired time and location.

Drift-reducing adjuvant compounds are also included in the technologies. In the case of pesticides, an adjuvant is any ingredient that can be added separately to a pesticide product, often as part of a spray tank combination, to improve the effectiveness of the pesticide product. These cutting-edge spraying technologies save operating costs. They are also highly beneficial in terms of environmental preservation. Indian researchers are conducting experimental investigations on the design, development, and testing of precision spraying technologies for crops and orchards, with the goal of improving agricultural and orchard productivity.

Agrochemicals or crop protection is an emerging sector. There is need to give more impetus to produce a large number of new molecules in the agrochemical market. Weed and disease resistance, as well as insect resistance, have made it clear that new active ingredients are needed.

After experiencing stagnation due to the pandemic, the industry again shows indications of resurgence, raising the prospect of a return to slower but consistent growth. We must give farmers the tools they need to reach their potential for steady, high-quality food production. In return, the government should support the agrochemical sector under AtmaNirbhar Bharat.

Industry and academia must work together to ensure that farmers utilize agricultural chemicals appropriately and promptly. It is up to the agrochemical industry to spearhead an initiative to help spread knowledge about the safe handling of agrochemicals among farmers. Local specialists and government assistance groups like KVKs should provide more information on formulations and application techniques. Spray technology should be known more widely.

REDUCING MAN-ANIMAL CONFLICT IN TERAI

CROP DIVERSIFICATION

TO SAVE LIVES



About the **AUTHOR**

Mr Pulkit Khare is District Magistrate, Pilibhit, Uttar Pradesh



Pilibhit, located in the Terai landscape of Uttar Pradesh, is home to Pilibhit Tiger Reserve which has rich flora and fauna. As part of the Upper Gangetic Plain, its characteristic Sal forests, tall grasslands and swamps host species like Indian leopard, swamp deer, hispid hare, floricans and an estimated 65 Royal Bengal Tigers.

With an area of around 730 sq km and a horse-shoe shape giving it a huge perimeter of over 800 km in the district, the Sal jungle periphery touches about 72 populated villages of Pilibhit district. Stories of man- animal conflict are commonplace in these habitations. Incidents of tiger straying into the village to either snatch away a livestock or have direct confrontation with villagers have an increasing trend.

Over last five years, 15 humans were injured and 21 innocent lives were lost in such conflicts. Fencing the entire perimeter of the reserve is a mammoth project which moves only a few notches each year as per the availability of budget with the department. Several efforts

by the Forest Department like asking villagers to resort to *haanka* (lighting the fire, beating drums and dhols) to scare away the animal, moving in groups to their fields for irrigation or manuring or identifying the signs of tiger's presence nearby are carried out intensively in these villages. It was imperative for the administration to intervene, analyze and take other corrective efforts to reduce such occurrences.

Most Deaths In Sugarcane Fields

Data analyses of the region of such occurrences showed high percentage of man-animal conflicts happening in the sugarcane fields adjoining the jungle in these villages. It was found that 12 out of 21 deaths in last 5 years were in sugarcane fields of farmers who went for irrigation or harvesting the crop.

Sugarcane tigers are those that stray out of the reserve and adopt sugarcane fields as their habitat. This includes the sub-adults pushed out of the forest by dominant male tigers and tigresses, and cubs who find it congenial to take refuge in cane farms when the crop is ripe. Cane fields also provide a semblance of forest ecosystem with long canes often providing hiding place for herbivores, which attract the tiger as prey to these fields.

Farmers Motivated To Grow Other Crops

An intensive campaign was launched by district administration Pilibhit last year to motivate the cane farmers of these villages to shift their crop to equally remunerative alternatives. Discussions were held with progressive farmers and agricultural



Amongst other options, a few medicinal crops and the aromatic crops even drove the herbivores away due to their pungent odour, further reducing the chances of a chasing tiger entering these fields

experts from KVK to identify such crops which are agro-climatically suited to the Terai environment. After several rounds of discussions, crops like *haldi*, *laahi*, *sarson*, *matar*, *chana*, *soyabean*, *mentha*, *lemon*, *kheera*, *parval*, *lemongrass*, *khus* and rose were identified as alternatives.

A roster to hold awareness meetings in these 72 adjoining villages was prepared along with the list of cane farmers in each village. Senior officers



were armed with the facts regarding the enormity of the problem to help them improve effectiveness of these village level meetings. Cane farmers of the village were particularly invited to share their fears and experiences.

Many farmers told sordid tales of spending fearful nights in their cane fields guarding their crops or moving in group with *mashaals* while harvesting the crop. They were then told about equally or even



more remunerative crops as alternatives to the conventional sugarcane plantation. Amongst other options, a few medicinal crops and the aromatic crops even drove the herbivores away due to their pungent odour, further reducing the chances of a chasing tiger entering these fields.

Trench Method Of Cane Plantation Introduced

Farmers reluctant to take the big leap of replacing their entire cane crop were also educated about the trench method of cane plantation whereby pulses, medicinal plants and several spices varieties were introduced alongside cane. Along with talks to motivate farmers to shift to safer alternatives, hand holding training sessions were also conducted by taking the farmers to the field demonstrations where the alternate crop was being successfully done by a farmer. Peer learning was used as a tool along with interaction about details with the expert agricultural scientists. Avenues for marketing of the new produce were specified to drive away hesitancy, reluctance and inertia of farmers in shifting from the conventional sugarcane crop.

Every year a GPS based survey is carried out by the cane department after the sowing season to decipher the cane coverage. While the cane coverage as per the GPS survey for the year 2020-21 was 104213 hectare, it was reduced to 102114 hectare when the same GPS survey was carried out for the year 2021-22. A reduction or rather diversification of around 2099 hectare (3.5%) of cane area was achieved in these villages as a result of this intensive campaign to motivate and train farmers for alternative safer crop which would reduce occurrences of man-animal conflict in times to come.

This mission of 'crop diversification with life saving purpose' continues unabated in this Terai district. Silently it will create an environment whereby peaceful co-existence of tigers and humans in their defined domains can be achieved along with improving the income and mental peace of the farmers of these villages around the jungle.

HEALTHY SOIL

EQUALS

HEALTHY NATION



About the **AUTHOR**

Dr Prafull Gadge is a well-known scientist-entrepreneur and industrial consultant in Agricultural Biotechnology. His expertise is in product innovation, process development and industrial problem solving. Dr Gadge has served more than 150 agrochemical companies and provided several commercially viable strategies for plant protection and high productivity through eco-friendly biological approach

The good news is that BioAg Asia 2022 has been highly successful in creating a new momentum towards ecological and sustainable agriculture in India. Currently, India ranks first in the number of organic farmers and ninth in terms of area under organic farming. In addition, agricultural products exports from India attained the highest level ever by crossing USD 50 billion for the financial year FY22. Thus, organic and residue-free farming will be in increasing demand of ecofriendly inputs like biostimulants, biofertilizers and biopesticides to mitigate the impact of climate change and pest control.

The bad news is depleting soil health! In today's date, the only sustainable option where we grow our food is the living soil underfoot, which is immensely exploited and highly ignored. About 20% of cropland over the globe is in continuous decline in productivity due to soil degradation (UNCCD, 2017).

India is no exception, and needs urgent attention to overcome the concerns of food security.

Soil health is the state of the soil being in sound physicochemical and biological condition, having the ability to sustain the growth and development of land plants. Soil health measurements may be quantitative or qualitative, or a combination of both. In this regard, the Union Government has taken an applaudable initiative of Soil Health Card. It provides qualitative assessment of nutrients present in the soil, which is helping farmers to use fertilizers judiciously.

However, despite more attention to nutrition management, the farmers' complaints of low productivity are rising. But focus on nutrients alone isn't sufficient for sustainable practices. It is soil's life that needs to be assessed. It is essential for better nutrient uptake, crop health and crop protection from biotic and abiotic stresses. Let's understand what is soil life and its current status.

A healthy soil is a living ecosystem that consists of microscopic and larger organisms. Largely, soil microorganisms perform many vital functions. They convert decaying matter as well as minerals to plant nutrients. These microbes serve as the 'stomach' of the plants by providing nitrogen, phosphorus and many other nutrients to plants (nutrient cycling). Furthermore, microbes protect plants from disease, insect and weed pests. Microbial activities improve soil structure, soil water and

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FACT**



Travelling, photography and amateur astronomy are my hobbies. They help me to understand, experience and evolve

nutrient holding capacity that helps in the mitigation of climate change, ultimately increasing crop yield. Hence, assessment and regeneration of soil microbial health i.e., soil's life is essential to increase agricultural productivity.

Current Status And Future Impacts

Agriculture alone uses about four times more antibiotics than human medicine. Bulk application of complex agrochemical compounds including chemical fertilizers, pesticides, fungicides, herbicides, antibiotics and failure to add sufficient organic matter (which serves as food to soil microorganisms) destroy the livelihood present in the soil. This makes crop plants lack of many essential symbionts to produce or make available nutrition, minerals, vitamins, antioxidants and many other metabolites necessary for health and own protection. According to several studies, many important species of microorganisms may have already gone extinct, some which might play a key role in plant as well as human

health. This could increase the risk of upsurge pests and pathogens that may threaten food security and food safety.

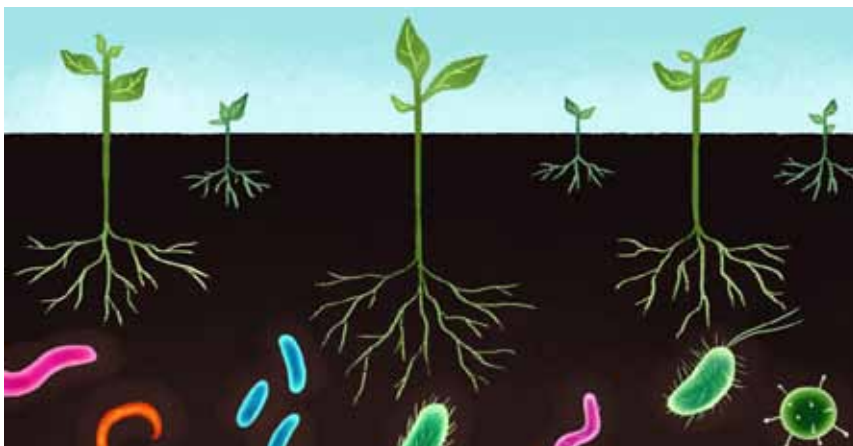
Challenges And Concerns

First of all, we must analyze the soil microbial health along with the soil nutrients in the soil health card scheme. These will give us better understanding of mitigation measures for the restoration of soil. Reintroduction of microflora is a key aspect of soil restoration that must be delivered with sufficient organic matter they feed upon. Although the government is promoting the use of organic fertilizers, biofertilizers and biopesticides, the implementers have very little knowledge and experience of agri biologicals.

They should be trained with scientific approach for new technologies, new products and appropriate application. Inefficacy of biofertilizers and biopesticides is mostly due to improper application in the field. For example, many biopesticides are of fungal origin. Due to illiteracy regarding agrochemicals, farmers use chemical fungicides together that kill biopesticide fungi, and no results are visible to farmers.

Farmers should also be trained for appropriate handling and application of chemical and biological inputs that will increase acceptability of bio-organic applications. Many state agricultural universities and research institutions do not tend to recommend biofertilizers in fertigation schedule and biopesticides in the pest control methods. The inclusion of bio-organic approach should be made mandatory in such crop schedules.

As soils are a crucial ally to food security and nutrition, greater attention is needed towards restoration of soil's life. The management of nutrition and balance of soil microbial health is a key to sustainable agriculture. The public private partnership with needful research, education and skill development can promote acceptability and application of agri biologicals and make eco-friendly, sustainable agriculture a reality.



FOR RESIDUE FREE FARMING PRACTICES

CHELATED NUTRIENTS

The Wonder of Chelation technology was introduced to the Indian market in the 1970s. The technology ensures food security without compromising soil and human health. It remains the most sustainable, residue free, cost effective and agronomically efficient method of supplementing micronutrients and other positively charged minerals to crops.

What is a Chelate?

In a practical sense, metal micronutrients such as Zinc, Manganese and Copper may be chemically changed and protected by forming a cage-like structure around the metal ions. This cage-like protected structure, if properly designed, will prevent unwanted and harmful reactions from taking place. The conversion of a positively charged metal ion into a negatively charged metal chelate is essential in obtaining the most efficient delivery of the micronutrient to the plant system.

When protected in this manner, the metal is considered to be chelated.

When in chelated form, the metal isn't precipitated by phosphates, carbonates and other soil and fertiliser components. In this free, chelated form, it remains mobile and unfixed. It is able to move freely through the soil for uptake by the plant root system. In other words, a chelated micronutrient has the metal ion surrounded by a carefully protective cage structure so that it can arrive unharmed at its destination- the crop.

What is a Chelating Agent?

Chelating agents are a man-made element that has an almost perfectly designed structure to form a protective cage around zinc, iron, copper, manganese, calcium and magnesium. This bond locks in the metal ion and is required for forming the right cage structure necessary to provide optimum agronomic use of the micronutrient.

Naturally Occurring Chelating Agents

Some naturally occurring chelating agents include products of organic matter decomposition like humic



About the AUTHOR

Dr Rahul Mirchandani has built 100+ brands in his 27 years at Aries Agro, now serving as Chairman. As a salesman, strategist, academic, author, speaker and global industry leader, he is passionate about bringing the world's best practices to India's farmers

Advantages Of Chelates Over Tradition Forms

- Lower quantities of chelates are required as they are easily assimilable
- Chelates are cost effective
- Chelates are more easily absorbed by plant roots or leaves
- Chelates are easily translocated within the plant.
- Under alkaline conditions, chelated iron, zinc, manganese and copper is a better way to provide micronutrients to a crop.
- Chelates are compatible with a wide variety of pesticides and liquid fertilizers, as chelates do not react with their components. Most chelates can be mixed with dry mixes and liquid fertilizers.
- Chelates are not readily leached from the soil as they adsorb on to the surface of soil particles

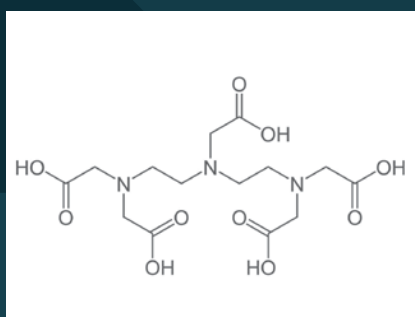


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FACT**

Taking a trip around the world, covering every continent in 1.5 months and doing everything from trekking to sky diving with my wife and son has been an adventure of a lifetime

acids, organic acids, amino acids, sugar acids and derivatives, phenols, polyflavonoids, siderophores and phyto siderophores. One of the greatest advantages in adding a biological chelate is that unlike the synthetic chelates, the organic chelates can be absorbed into the plant.

Fulvic acid is a biological chelating agent. Fulvic acids are lighter in weight



and more biologically active than their precursor, humic acids.

Another category of biological chelating agents includes amino acids. Amino acids can function very well in chelating, as they are similar to a magnet in that they have both negative and positive charge (like north and south poles). In chelation, amino acids form a five point bond with the mineral element. This allows amino acid chelates to function well due to their relative stability. When the amino acid chelates reach the cell membrane, they are recognised by the mechanisms of absorption as a source of organic N. As a result, entire amino acid chelate is taken into the cell very rapidly and efficiently. However, because of its efficient absorption, much lower doses of true amino acid chelates need to be applied to the crops. True amino acid chelates are available as Zn, Fe, Mn, Cu and B complexed forms

Also, several organic compounds (chelating agents) are also used to produce chelates. Examples of synthetic chelating agents include ethylene diamine-tetra-acetic acid (EDTA), diethylene-triamine penta-acetic acid (DTPA), ethylene-diamine-di-(o-hydroxyphenylacetic acid) (EDDHA). EDTA is the most common synthetic chelating agent and is used for both soil and foliar applied nutrients. EDTA has four points of connection to the elements it chelates. Different chelates have varying numbers of

points of connection. EDTA is better suited to slightly lower than neutral pH levels. Iron often becomes deficient at higher pH values such as those typically associated with rockwool or mineral soils.

Diethylenetriaminepentaacetate (DTPA) is a chelating agent better suited to high pH levels. As the chemical name suggests, it has five (penta, ie. Pentagram) points of connection to the element it chelates. It is more effective than EDTA but is usually more expensive.

Several studies suggest that ethylenediaminedihydroxyphenylacetic acid (EDDHA) is a superior synthetic chelating agent. Its relatively high cost prohibits it from being added to many synthetic fertilizer formulations.

Economic Benefits of Chelation

Due to the fact that Chelates are used at almost one-twentieth the dosage of comparable sulphate form of the same metal nutrient, the farmer is able to significantly save on the per acre cost of application. For example, 500 g of Chelated Zinc, sprayed twice has been found to substitute 20 to 25 kilos of Zinc sulphate. Cost of application, added to the consequent yield increase due to Chelated zinc application has been found to give farmers a very favourable benefit:cost ratio of an average 6:1, proven through a multitude of University trials conducted over the decades.

Prevention of micronutrient deficiencies in crops is far better than correcting them. Following the recommended practice, the micronutrient should be applied with fertilizer before or at planting chelated micronutrients will help correct deficiencies by allowing the essential metal to move to the root zone for rapid and efficient plant absorption.

With Chelates, the farmer is using a safe, environmentally sustainable, low dose source of the mineral that does not cause any harmful reactions or leave any harmful residues at the time of consumption.



EMBRACE AN ORGANIC LIFESTYLE WITH JANBHOOMI

In the words of Margaret Mead, “Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it’s the only thing that ever has.”

Enactus is an international student-run not-for-profit organisation working on the lines of social-entrepreneurship. Enactus Kirori Mal is one of its chapters established at Kirori Mal College, University of Delhi, which has three unique projects under its umbrella. One of them is Project JanBhoomi, which works to promote an organic lifestyle through a variety of means. What distinguishes this organization from the rest is the zeal of young changemakers to work not for themselves but for the society as a whole by envisioning a sustainable future.

About Enactus Kirori Mal

Enactus Kirori Mal consists of a team of over 70 passionate students who aim to uplift socio-economically marginalized communities by building sustainable business models around them. They currently have three projects running: Project Dor, which works to revive the dying art of tie-and-dye and uplifts a community of migrant women; Project Syahi, which replaces plastic pens with upcycled paper pens while uplifting underprivileged women; and Project JanBhoomi.

About JanBhoomi

Land degradation and waste management are two of the world’s most pressing environmental problems and the situation will keep worsening without rapid remedial action. Globally, about 25 per cent of the

total land area has been degraded.

Project JanBhoomi primarily aims to tackle this problem of land degradation and waste management, which as stated, is a source of major concern considering that the amount of fertile land is continuously decreasing in contrast to the rising world population.

The project was piloted on the college premises on 26th April 2018. After receiving technical expertise from the IARI (Indian Agricultural Research Institute), the team set up compost pits across Delhi.

Project JanBhoomi emphasizes the importance of living an organic lifestyle by not only caring for our health but also the environment. JanBhoomi believes that with the right garden tools by your side, you can set up a beautiful garden in your home and give back to nature in

the process. Hence, it sells a gardening toolkit consisting of five high-quality tools - Cultivator, Fork, Trowel, Weeder, and the Transplanter - all packed in an eco-friendly jute bag. Project JanBhoomi is also involved in the production of flower compost using the flower waste generated in Birla Mandir, Delhi, thus preventing the flower waste from being disposed of in and polluting water bodies. A flower composting machine was set up in Birla Mandir in association with Angelique Foundation for this purpose.

Project JanBhoomi also collaborated with the Government of Haryana to set up 159 compost pits in over 70 villages of Palwal, Haryana. Through this intervention in Palwal, Haryana, they encouraged farmers to substitute DAP for compost to boost the harvest and pull down the input prices.

Impact Created by JanBhoomi

As human population and overconsumption grow, the waste we produce becomes harder to get rid of. With adequate waste management, we tend to think that waste does not affect us. It does. JanBhoomi has provided a helping hand in waste management through its flower compost which, in turn, has helped reduce the burden on municipalities for waste disposal in overburdened landfills. The gardening toolkit has encouraged hundreds of people to adopt an organic lifestyle by indulging in home gardening. JanBhoomi turned 28 farmers of Palwal into entrepreneurs, who apart from using their compost for self-consumption, started selling the same to create an additional source of income.

JanBhoomi strives to propagate the thought ‘Look after the land and the land will look after you, destroy the land and it will destroy you.’ The students have been able to create an impact by setting up compost pits in Vasant Kunj and Pitampura in Delhi and Palwal in Haryana.

Through Project JanBhoomi, they also aim to address issues such as pollution, habitat loss and climate change which is on an alarming rise in India and create a positive impact by propagating a

Laurels & Recognitions

Project JanBhoomi has been recognized several times on social media pages including Greenish Affair and Platonic, e-commerce platforms like Bikayi Shop Khata and Quick Sellalso, for the incredible work it has been doing. The project has been awarded Letters Of Recommendation by several renowned institutions including Indian Agricultural Research Institute, Chandigarh University, Punjab Agricultural University and from dignitaries like the Deputy Excise Commissioner, Prayagraj, Uttar Pradesh, IAS- Health and Family Welfare Department. It also received a Letter of Appreciation from a scientist at Indian Space Research Organisation for the huge impact it has created.



sustainable means of living. It successfully prevented water pollution and land degradation in the villages, saved electric energy and provided immense contribution in the field of waste management. This noble initiative has saved over 630 acres of land from rapid degradation, reduced significant greenhouse emissions from the chemical fertilizers and lessened the usage of energy and water in agriculture.

Towards A Greener Future

By conducting surveys and using critical thinking skills, JanBhoomi is laying increased focus on intensive research and development to diversify its approach to address waste management in urban

areas. The vision of the project is to ensure that the fertility of the available land is maximized to make the most of this limited resource and further maximize productivity. The project strives to combat global warming, climate change and create more sustainable business models for a better tomorrow.

JanBhoomi has been enriching people and changing their mindsets from being a polluter to being a nature lover. YOU are just a step away. It is time for you to fulfil your responsibility to protect and preserve the environment to leave a healthier planet for posterity. Support Project JanBhoomi in its endeavours and be a part of the change.

Are We Ready?

INDIA'S 'WATERSHED' MOMENT IS HERE

Watershed Development as a programmatic intervention can become an effective strategy for enhancing resilience and building up the capacities of communities to adapt to climate variability



Several phenomenal stories of sustainable adaptations have emerged from rural hinterlands in India in the last few years. One such instance is from the villages of Pandhurna block in the Chhindwara district of Madhya Pradesh. While the world was struggling with the pandemic, villagers of this place were creating a precedent for others to follow. They were busy creating sustainable watershed models to create irrigation and livelihood opportu-

nities.

In a project implemented by WOTR with the active participation of the villagers in the challenging Covid period, 176 water and soil conservation

structures were built, and 1,619 households benefited. This resulted in 15% increase in agricultural productivity. The project resulted in an increase of 302 hectares in agricultural land and 373 hectares increase in double cropping land in these eight villages, which were part of the project. Coming out of the trying times of the health crisis, the 1600 families today are better off with livelihood opportunities within their village and enough water to irrigate their land.

For villagers of Chhindwara with small landholdings and tribal economically weaker sections, WOTR's five years of consistent efforts under the 'Natural Resource Management and Improving Sustainable Livelihood Opportunities' programme is more than just a development initiative.

These villagers are no longer fighting a losing war with infertile land and increased use of chemicals resulting in poisoning of their food. They are on course to improve their quality of life

About the AUTHOR

Mr Sandeep Jadhav is currently the Director at Watershed Organization Trust (WOTR), an NGO established in 1993. He has played a key role in Indo-German Watershed Development Programme (IGWDP) in Maharashtra, one of the most successful watershed development programmes in India



MAJOR GAINS

Watershed Development contributes positively to enhancing the resilience of ecosystems, and subsisting social and livelihood sub-systems. An empirical study by WOTR, together with others in the sector, confirms that community-led watershed development has the potential to make significant contribution towards achieving intended outcomes.

For effective and sustained watershed development and management, we need innovative technical, governance and institutional strategies to manage the ecosystem in adaptive ways. These include a newer look at and re-organising the way natural resources are managed. The Water Governance Standard developed by WOTR is an important step in this direction. It has evolved a Water Governance Standard and Certification toolkit that prescribes a set of criteria that puts forward good water governance practices, relevant for local governance in agrarian communities. The system incentivises good water management practices by providing better investment and more development opportunities for villages that score better in the certification system.



through secure sources of water, food, and livelihood. The initiative has helped enhance the adaptive capacities of the village community towards climate-induced shocks.

Higher Farm Productivity, Better Incomes

Across the country, improved watershed management practices to increase farmers' resilience to climate change are helping promote higher farm productivity and better incomes. Yet another remarkable story is from the Bamni cluster of villages situated in Murhu block of Khunti district, Jharkhand. It falls under the assured zone of the rain with normal rainfall of around 1100 mm. Lack of water saving irrigation techniques and applying of high dosage of chemical fertilizers and pesticides was affecting the health of the farmers and their land badly. Working with the WOTR team, they were able to fruitfully turn things around, rejuvenating 457.61 ha of degraded land.

WOTR takes up applied research and closely engages with institutional and governance actors so that insights and good practices derived from ground experience contribute to shaping enabling policies and effective programs.

The above-mentioned case studies are few of the many testimonies that have contributed towards it.

With climate change expected to have far reaching implications on ag-

riculture and rural livelihoods, there is an urgent need to undertake measures that reduce vulnerability, enhance resilience, and build eco-friendly livelihood farm practices in our rural areas. Watershed Development is directly connected to increasing resilience and livelihood security of the people.

Important Lessons From Global Initiatives

Globally, many watershed programmes have not been as successful as they should have been because they adopted a resource use and production system that, while enhancing resilience in the short run, was unsustainable. These turned out to be resource depleting, maladaptive and economically ruinous. This happens because of the ignoring of the system feedback, signals and links which are important for the success of any Watershed Management.

If watershed development is to live



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FACT**

Mr Jadhav loves listening to Indian classical and film music, reading books, and is an avid traveller

up to its promise, there is a need to bring about changes in the way 'the dominant package of practices'- technological, institutional, and operational processes are conceptualised, organised and implemented in policy and practice. Watershed Development as a programmatic intervention can become an effective strategy for enhancing resilience and building up the capacities of communities to adapt to climate variability by going beyond the project mode. It can be done by empowering communities to sustainably manage their regenerated ecosystems and its services and engage with relevant resource agencies across sectors and levels on a continued basis.

India Has Robust Institutional Architecture For Watershed Development

For the last three decades WOTR has engaged at the intersection of practice, knowledge, and policy across scales and in collaboration with stakeholders from across sectors. Its experience in carrying out developmental work in over 3500 villages across seven states of India has been an encouraging story to reckon with. Development programmes like those of WOTR is more about assisting rural communities to assess their vulnerabilities to climate and non-climatic risks.

India is distinct in having a robust institutional architecture for watershed development. Are we ready to onboard this larger opportunity?

ORGANIC FARMING AND OPPORTUNITIES

Businesses are flourishing by helping farmers and supporting the rural ecosystem

Cultivation of food crops has become a challenge when we think of global requirements to meet the increasing population, hungry poor and food security. Traditional knowledge of farmers and indigenous people and their contributions is key to biodiversity management and mass production of plants with low-cost inputs. Here, vermicompost, biofertilizers, panchakavya and Jeevamrutham are suggested with low inputs.

Vermicompost And Mass Production

We used this technology under NSS programme in PRIST university, mass multiplied, demonstrated to farmers, in their villages and encouraged them to prepare and apply to their lands for better crop production with low input costs. Women folk benefited and adapted it in four villages of Thanjavur district, Tamil Nādu. This service was recognized for UK government gold medal. One person became an entrepreneur and started using vegetable waste from the market and gave it to farmers in Nellore (AP). Now this product has become very common. It is available in all nurseries for home and kitchen gardening.

Biofertilizers

This deals with beneficial microbial inoculum associated with rhizosphere of plant community. This is also called as Plant Growth Promoting Rhizobacteria (PGPR). Symbiotic (for legumes) and non-symbiotic (for cereals) bacterial inoculum can be multiplied and given to the specific crops as fertilizers.



About the AUTHOR

Prof Lakshminarasimhan Cuntheepuram retired as Professor, Botany and Microbiology, Dean of Sciences, AVVM Sri Pushpam College (Autonomous); Advisor PRIST University, PGPR group, President Indigenous Frontier Technologies and Research (IFTR)



I am talking about my experience with bioinoculants for sugarcane crop. With the support of DST project (in AVVM Sri Pushpam College, Poondi), I isolated and identified a number of rhizosphere bacteria associated with sugarcane mass multiplied in 100 farmer fields of Thiru Arooran, Kothari and Aringner Anna sugar factories. The results indicated

10% growth increase of cane, 50% of chemical fertilizer N saving, improvement of soil texture for farmers, and 1% quality cane for factory. The fertilizer requirement is only 2kg per acre.

This encouraged Tamil Nādu Sugar Federation (TNSF) to implement the project in all cooperative sugar factories with a mandatory note to apply biofertilizer to 10000 acres in each sugar factory, under the leadership of AR Solayappan, entomologist, MBRL, a unit of TNSF. The product has become value added and benefited thousands of farmers.

By way of training to cane officers, the technology has spread to all districts and farmers. With this, ICAR has permitted to start a production unit for biofertilizers under the leadership of TR Srinivasan, SBI, Coimbatore for national development. Muthukumaraswamy, Revathi and Vadivelu isolated endobiotic *Acetobacter* spp. from rice fallows which even now serves as multifaceted isolate for production of inoculum. Seshadri (Secretary IFTR and mentor NITI Aayog) isolated Rock phosphate solubilizing bacteria and added its importance to the inoculum production. As on today many entrepreneurs are in the market. This awareness made the farmers take up organic farming in a large way.

Stellar Role of Prof MS Reddy

Taking Asian PGPR as a platform, Prof MS Reddy, international scientist and founder of PGPR group, encourages usage of rhizobacteria nationally and internationally by way of conducting seminars, webinar programs, publications and bridging the gap between scientists, farmers, enterprenuers and the

government. He is an ambassador to carry the message to the United Nations for clean and safe environment and clean technology.

Panchkavya, Jeevamrutham and biopesticides are indigenous products prepared locally and are used in organic farming. Many farmers are followers of Subhash Palekar from Maharashtra, Nnammalwar in Tamil Nādu. Jagadeesh Reddy from Chittoor district uses this technology over in his land measuring 35 acers growing sugarcane, mangoes and groundnut, and participates in research in agricultural development.

Indigenous Frontier Technologies and Research (IFTR)

IFTR is a growing NGO coming up with defined proposals with like-minded people and institutions to help the farmers in the field of agriculture, education, health and nutrition. It has established collaboration with Korea for participatory research in agricultural development. Mr Seshadri (Secretary IFTR and Mentor, NITI Aayog) trained many organic farmers with BERAS, Sweden, an international organization.

This platform promotes village development through organic agriculture, conducts farmers meet, helps the farmers in testing the soils for nutrients and gives suggestions for crop patterns. Usage of vermicompost and biofertilizers are suggested. In collaboration with MCRC solar energy applications, farmers are educated regarding sprinkler irrigation and marketing of agricultural products.

In Chitravadi village, 124 farmers from 11 nearby villages attended the training. A leading organic farmer Jayachandran was honoured with “Farmers Friendship Award” for his bio-dynamic farmer friendly activities.

In Acharakuppam Thiruvvelangadu, topics like global warming, soil nutrient status, clean food production and marketing were discussed with 750 small and marginal farmers from 40 villages, ten supporting organizations and three collaborators. We have adopted a village named Zambada. A farmer producer



Mr Jayachandran was honoured with “Farmers Friendship Award” for his bio-dynamic farmer friendly activities.



By taking measures to preserve the soil organic content, promoting healthy plants and nutritional products, we can add value, protect biodiversity, ensure food security and improve environment and economy while growing urban and rural businesses

organization meeting was conducted. The soils were tested for nutrients and farmers were advised regarding technologies under the leadership of Mr Krishnam Raju. Similar programs were arranged for farmers in Coimbatore and Trichy districts too.

Global Scenario

For protecting biodiversity, clean environment and healthy mass production, many firms are coming up with good digital platforms. They are associating with farmers and addressing the local needs to promote organic farming. In this way, they are growing their business working for farmers’ welfare.

Future of Organic Farming, Benefits

About 70 million hectares in the world is under organic farming. By taking measures to preserve the soil organic content, promoting healthy plants and nutritional products, we can add value, protect biodiversity, ensure food security and improve environment and economy while growing urban and rural businesses.

TECHNOLOGICAL ADVANCES

BIO-CONTROL AND STIMULANTS

Meeting the global food-, nutritional- and livelihoods security without compromising on the resource use efficiency and environmental safety for ecosystems, biodiversity, and health of humans and animals is a new order challenge. The hunger-death triggered commercial agriculture has distorted host-pathogen-natural enemies' equilibrium, ravaging narrow-based food crop diversity by pests. In absence of strong host resistance, chemical methods became inevitable. However, their

misuse or abuse has provoked serious concerns among stakeholders, thus broaching for eco-friendly alternatives.

Current Status of Biocontrol and Biostimulants

A successful BCA or biostimulant should be efficient, stable, easily multipliable and applicable, economical, less toxic than chemicals and easily storable. The BCAs are eco-friendly and their use minimize energy trade-off due to transient immunity expression as compared to genetic resistance and thus allowing plants to allocate more energy and resources towards yield. The BCAs can directly suppress pathogens and/or produce secondary metabolites that prime, or induce or strengthen host resistance. And, BCAs manipulate the ecosystem to promote natural pathogen suppression. The growing health consciousness and commitment for safe environment among consumers, policy makers and growers has triggered huge demand for these products in recent years.

Technological advancements

Modern molecular biology has contributed to better knowledge about plant-microbe interactions. Mobile technology with internet access has eased the technology dissemination. AI-, IoT- and ML-based precision diagnostics and farm

operations have changed the product development perspective. The discovery of phyto-microbiomes that regulate niche microbial configuration has added a new dimension and can help to realize full benefits of microbe-mediated crop health management. Opening of the global markets has helped to imbibite advanced technology from elsewhere and capture export markets with quality products.

Enabling policy environment

Biocontrol agents and biostimulants are integral to organic- and natural-farming. India launched the institutional framework 'National Program for Organic Production (2001)' followed by 'Par-amparagat Krishi Vikas Yojana (2015)' and 'Mission Organic Value Chain Development for North Eastern Region (2016)' that helped states like Sikkim to claim 100% area under organic farming. To strengthen at

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FACT**



Dr Desai loves to read books, play chess, volleyball, travel and interact with people

About the AUTHOR

Dr Suseelendra Desai, after serving ICAR for 34 years, is now the Dean of School of Agricultural Sciences and Technology, NMIMS University, Shirpur, Maharashtra

grassroots level, the PM said that Union Budget 2022-23 is focused on natural farming, following which ICAR is developing contextual curriculum as part of agricultural education.

CURRENT GAPS

Quality and inconsistent field performance

Many products fail to qualify which flags inadequate in-house compliance. The inconsistent field performance of a BCA may be either due to its variable performance per se or lacks other desirable traits for its survival and proliferation. Systematic agro-ecosystem-wise characterization and cataloguing of the microbial biodiversity can help to deploy appropriate microbes.

Consortium versus Mixtures

While mixture is just physical mixing of two or more organisms, a consortium is an outcome like precise microbial load for a given seed and out of which what should be the proportions of each of the organisms optimally harness their synergies while neutralizing their antagonism.

'Me too' products versus innovation

Many present day products are based on limited diversity of organisms or molecules. During early technology lifecycle of the BCAs and biostimulants, due to lack of a thorough understanding of



The growing health consciousness and commitment for safe environment among consumers, policy makers and growers has triggered huge demand for Biocontrol and Biostimulants in recent years

the technology and consumer needs, often companies neglected the rigour of 'product development processes'. However, continuous research backstopping on innovative product development process can sustain technology life cycle with enhanced efficiency, ensure market penetration and minimize probable odds of product failure.

Bulkiness – a concern

Most of the companies fail to meet the long distance commitments despite demand because the bulkiness attracts huge transportation costs. As in other

industries, if a policy for active ingredient transportation is developed, the final formulation could be made at/near the site of use, after due compliance of regulatory requirements.

The interplay of biotic and abiotic stresses vis-à-vis host system

The simultaneous occurrence of multiple stresses in a crop season is not completely understood. A critical analysis of this interplay will be helpful to design novel products. Many abiotic stresses influence pathogens and BCAs. In absence of such information, the products might fail to perform.

Regulatory set up

Biofertilizers, biocontrol agents, PGPRs and biostimulants are governed under different regulatory systems. But, it is not possible to restrict activity of a deployed organism and thereby defining its primary role as BCA or biostimulant. The systematics of microbes is dynamic, a popular being the case *T. harzianum* and *T. asperellum*.

Biocontrols and biostimulants could be game changers in 'Green agriculture' with ensured farm productivity and profitability, reduced adverse externalities, natural resource conservation and reduced pollution for healthy ecosystem services with peoples' participation in natural farming.

WAY FORWARD

- * To meet the aspirations of the stakeholders for quality BCAs and biostimulants, there is need for the following.
- * Nodal repository agency of harmonized SOPs for uniformity in product standards across industries
- * Formal functional public, private and NGO networks with dedicated outlays for R&D to promote disruptive innovation like multiple stress tolerance and unravelling microbiomes, climate change impacts etc
- * Private-private partnership consortia to create common knowledge pools that reduce innovation costs and diversify portfolio
- * Skill-building of agricultural graduates under CSR activity as a win-win model and achieve Atmanirbhar Bharat
- * Dedicated awareness building programs for stakeholders
- * Enhanced public investment for SPV/SPE for innovative product development
- * Consider a policy framework for automatic release of proven standardized technologies in analogous agro-ecologies of the world
- * Scheduled revision of regulations to remove grey areas such as consortia of BCAs etc. and make services faceless.



ESTABLISH MINI ORGANIC FOOD PARKS ALL OVER INDIA



Organic farming is a buzz word in the agriculture sector today. The pandemic has had a tremendous impact on the status of organic food and farming. Traders and business houses are in a great hurry to catch the 'Organic Train', even if it is at the cost of farmers' livelihood. It may also be at the cost of ignoring, bypassing or avoiding the basic Food Law Amendment 2011/2014. It ignores the organic produce protocols, national and international laws.

In the business which is 100% dependant on farmers and farming—due to the greed and scandalous manipulations of a few, the credibility of the concept is lost. Committees are formed to frame organic laws by people who don't know the basics of either organic business or organic farming.

The concept of organic farming primarily is practiced by farmers. It is a matter of national concern that no experienced farmers of organic farming have been included in vital committees. This is going to be a bigger nightmare for organic farmers and organic consumers alike.

There is not much time lost. Still there is chance to change it for good. Let us

not politicise the very concept of organic/natural farming at the cost of farmers and consumers.

SOLUTIONS

The solutions to the problem are very simple. I list them here.

- 1) Let experienced academicians, farmers and exporters be made members of the committee for making laws for organic farming.
- 2) Implement Food and Law Amendment 2011 in letter and spirit with immediate effect
- 3) Let organic/natural farming be under combined charge of Ayush and Agriculture Ministries only
- 4) Allocation of special budget should be there for research and related fields
- 5) Strictly, we must not mix agriculture input laws with organic/natural farming laws.
- 6) Government of India must frame the Organic Seed Law.
- 7) Government of India must allocate separate subsidies for organic/natural farming infrastructure that organic farmers and farming deserve for saving ecology, import bills, curbing environmental pollution etc.

8) Establish a virtual Organic Food Bank where all the organic produce gets registered. This produce should be available to customers all over the globe for facilitating the sales of produce from small and marginal farmers, and avoiding their exploitation like is happening now

9) Facilitate the establishment of Mini Organic Food Parks all over India

10) Establish an Indian system of carbon credits for organic farming.

11) Let Ayush Ministry educate farmers about herbs, their cultivation, pre harvest, post harvest methods and their storage

12) It is very important to give incentives to organic farmers and to organic farming in general



About the AUTHOR

Mr Harpal Singh Grewal is the owner of Heavenly Farms at Sirsa, and is the pioneer producer of certified organic foods in North India. Crops are grown by following traditional Vedic methods of farming, following the principles of sustainability of nature and preservation of natural soil goodness



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Attention Farmers & Conscious Indian Citizens !!

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