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For more details, please contact :

Mr. Tushar Sharma, Director-ICFA
+91 - 8812859008
tushar.sharma@icfa.org.in

Mr. Simarjot Singh, DGM Marketing
+91 - 8448482489
simarjot.singh@icfa.org.in

Mr. Ankit Kumar, Senior Manager
+91 - 7290088227
ankit.kumar@icfa.org.in

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SOW THE SEEDS OF CHANGE

Agriculture, the primary occupation on which millions of lives depend, begins with seed. A seed carries in it life in its most rudimentary form, which when tended to with utmost care unfolds the future of a nation. Having said that, there rests a huge responsibility on the seed and therefore on us, to make sure we produce quality seeds and ensure they reach the farmers intact and untampered.

The seed market in India is huge and diverse with an extensive and elaborate supply chain. There are organized and unorganized players adding volume and competition to the sector. The constantly growing Indian seed industry is worth Rs 18,000 crore and has room for all kinds of players. Fuelled by excessive demand, lack of proper checks and ignorance of farmers, there is a thriving business for spurious seeds which unfortunately has added chaos and a sense of distrust in the market.

Fortunately, there are digital interventions that can bring transparency and accountability to the entire value chain. Probably this has inspired the government to launch SATHI (Seed Traceability, Authentication and Holistic Inventory) Portal and Mobile App, a Centralized Online System for seed traceability, authentication and inventory designed to deal with the challenges of seed production, quality seed identification and seed certification and most importantly to deal with counterfeit seeds. But the biggest challenge is to bring the entire nation into its fold. Enrolling the states will take time and will stretch indefinitely until a limited time frame is announced.

Exciting advancements are happening in seed segment. Development of biofortified seeds, gene editing, biopriming, genetic engineering, block chain technology for seed traceability are inspiring changes and ushering in a revolution. But the pertinent question is where does India stand? How far have we been able to attract research and development in the segment?

India has the potential to emerge as a global hub in seeds. But for that we need to invest keenly in research and create an ecosystem that nurtures and supports new developments. India has to evolve and become the epicentre of innovation and sow the seeds of change.



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Sanjay Kumar

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Web Designer - Mr Rahul Singh

Graphics - Akash Bhargav

Subscription - Mohd Aijaz

Circulation - Rajkumar

Graphic Designer

A. Rehman

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Phone No. 011-23731129 Fax No.011- 23731130

E-mail: editor@agriculturetoday.in

info@agriculturetoday.in

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THE NEXT SEAWEED REVOLUTION



Red Seaweed



Brown Seaweed



Green Seaweed

KEY FEATURES

- Regulatory Compliant
- Batch to Batch Consistency
- Residue Free, Non Toxic
- Crystal Clear Formulation
- High Precision Extraction (HPE) Method

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UTTAM BEEJ – SAMRIDDH KISAN SATHI to Combat Spurious Seeds



The seeds are the future of a farmer, a nation and the world. Seeds hold the promise of a secure future and a hopeful present. Quality seeds alone can push up the yield 15 – 20% depending upon the crop and it can be further be raised up to 45% with efficient management of other inputs and hence quality becomes a paramount feature for seeds.

Spurious Seeds Wreak Havoc

Seeds of quality remain a major constraint in India. On one hand there is a tremendous shift towards market, bought seeds over farmer saved seeds, there also remains a considerable probability of the farmer being duped by spurious seeds. Spurious seeds reach the market without completing the elaborate machinery of seed licensing and hence have questionable credentials. They carry the name of a reputed brand with a performance inconsistent with the name or the variety and hence denying the farmers the provision for compensation in case of seed failure.

The sale of spurious seeds is rampant and has been reported in Andhra

Pradesh, Telangana, Maharashtra, Gujarat and Karnataka. Andhra Pradesh has reported losses to the tune of Rs 2.08

lakh during 2018-22 due to sowing spurious seeds. During 2015-2022, about 1.17 lakh tonnes seeds were seized

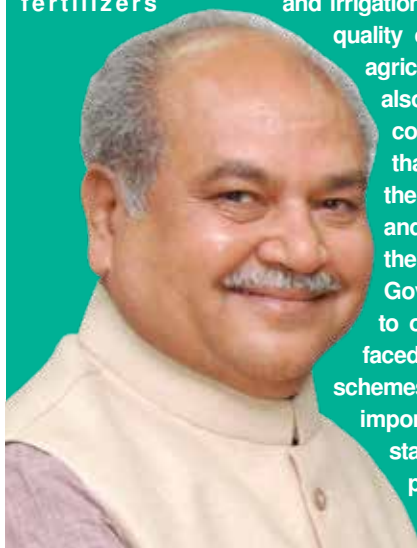
Shri Narendra Singh Tomar, Union Agriculture and Farmers Welfare Minister

“Agriculture is of great importance to India. This importance has increased in the changing scenario. Earlier, we had only the aim of fulfilling our needs in agriculture, but at present the expectations of the world are also increasing from India. In such a situation, it is our responsibility to help feed the world while dealing with all the challenges of agriculture, climate change etc. Seeds, pesticides, fertilizers

and irrigation play a major role in agriculture. Inferior quality or spurious seeds affect the growth of

agriculture. This causes loss to the farmers, it also affects the agricultural production of the country. It has been said from time to time that we should devise such a system so that the market of spurious seeds is checked and quality seeds reach the farmers, for this the SATHI portal has been launched.

Government of India is constantly trying to overcome the challenges and difficulties faced by Agriculture sector through various schemes and programmes. SATHI portal is an important step in this direction. When its use starts right to the grassroot level, it will prove to be a revolutionary step in the field of agriculture.”



SATHI Features

- GIS reports based on Bharat Map Interface
- Provision of wallet service
- Offline-friendly and device-agnostic mobile application
- Quality inspection module for the quality check of the inspection process
- System-generated sample slip on processed verification data
- Online forwarding of the samples to the seed testing laboratory
- Issuing of tag certificate based on digital tag register

in Telangana, 21,724 tonne in Andhra Pradesh, 10,343 tonne in Karnataka, 7,095 tonne in Maharashtra, and 252 tonne in Gujarat.

The threat of spurious seeds is severe and considerably reduces the productivity. In cotton alone, they have the potential to bring down the productivity to 3 quintals from 12- 13 q per acre. Telangana has recorded a total of 991 cases related to the manufacturing and supply of spurious seeds between 2014-2022. Chilli farmers of Bachodu in Tirumalayapalem mandal lost Rs 50 lakh in the form of farming investment after they raised chilli seeds on 150 acres.

With a huge number of stakeholders in the seed supply chain and the possibility of duplicate labelling spurious seeds enters the seed supply chain effortlessly. a complete digital platform for the seed life cycle becomes therefore necessary for transparency and traceability.

SATHI - Seed Traceability, Authentication and Holistic Inventory

Union Agriculture and Farmers Welfare Minister, Shri Narendra Singh Tomar on April 19 2023 launched the SATHI (Seed



SATHI enhances and ensures the quality and purity of seed through the complete digital platform for the seed life cycle and it also increases accountability with the help of seed traceability through multiple modules

Traceability, Authentication and Holistic Inventory) Portal and Mobile App, a Centralized Online System for seed traceability, authentication and inventory designed to deal with the challenges of seed production, quality seed identification and seed certification. Developed by the NIC in collaboration with the Union Ministry of Agriculture and Farmers Welfare on the theme of 'Uttam Beej – Samridh Kisan', SATHI provides a holistic approach to encompass the complete seed life cycle over multiple seed generations. This measure is achieved through automation of the entire seed supply chain, starting from seed production to certification, licensing, seed Inventory, and seed sale by certified dealers to seed growers and includes traceability of seeds.

So far 766 Districts, 7,230 Blocks and 597,483 Villages have on boarded with this system.

SATHI enhances and ensures the quality and purity of seed through the complete digital platform for the seed life cycle and it also increases accountability with the help of seed traceability through multiple modules. It also intends

to improve the on-field efficiency of SCI by reducing human error and integrating technology into the system. There is also provision for generating GIS-based MIS reports powered by Bharat Map Interface and it can also reduce transactional time for registration, approval, access to field inspection reports, lab testing reports, and certification. This will be an eco-friendlier alternative to carry out operations.

Inventory with SATHI

SATHI, with its intensive, accurate, and up-to-date record makes tracking and dispatching of inventory secure and easier. It provides an effective way to record and maintain seed inventory accurately and efficiently with the help of stock management. Seed inventory can be easily adjusted when seed lots are damaged by auto-blocking defective lots. The availability of livestock reports helps to provide better supervision and management of the seed lots. Also there is management of inventory alongside accounting in one integrated system

SATHI aims to make the seed supply chain more efficient, accessible, save time and resources, improve traceability, while guaranteeing the uncompromised seed quality and purity. It makes the working of seed production chain uncomplicated for everyone involved in the process.

SATHI, with its intensive, accurate, and up-to-date record makes tracking and dispatching of inventory secure and easier.

GLOBAL SEED SECTOR DEVELOPMENTS FOR ZERO HUNGER AND FOOD SECURITY

The global seed industry has transformed significantly over the past two decades, with farmers adopting high-value seeds to replace farm-saved seeds, contributing to an overall increase in crop productivity and seed business.

Global Seed Market

Global seed market is projected to reach around USD 81.0 billion by 2027, recording a CAGR of 6.6%. The shift in farming practices worldwide has necessitated the adoption of commercially produced enhanced seed varieties by farmers instead of using seeds from the last harvest. By regions, the North-America is the largest market, followed by Europe, Asia-Pacific, South America, Africa etc. North America is the largest commercial seeds

market, accounting for more than 35% of the market share. Though North America dominates the overall global seed industry with 35 percent of the total share, the major growth is seen in Asia-pacific and African regions. The seed market in the Asia Pacific region is the fastest growing market as it hosts the two major agricultural countries, India and China. Further, the supportive regulations, government incentives, and an increase in food and feed demand in the region are driving seed market growth in the region.

Global Seed Regulatory Frameworks

Seed trade at the global level is heavily dependent on seed regulatory frameworks at the national and international levels, and it involves a number of stakeholders and global organisations. The OECD and AOSCA provide seed certification schemes based on varietal iden-

tity and varietal purity; ISTA and AOSA provide standardised methods for seed testing, where ISTA rules have been referred to worldwide and AOSA in North and Latin America; the IPPC, WTO-SPS, and NPPO provide phytosanitary measures; the ITPGR is responsible for PGR laws; and UPOV guidelines are for plant variety protection and IPR laws (Joseph Cortes, 2009). Synergy and harmonisation among stakeholders and regulatory bodies are critical for the smooth movement of seeds across borders and the development of the seed sector globally.

In addition, the deep knowledge of seed science and technology and its wide dissemination is also very important to ensure the development of a strong and competitive seed industry. Several affiliated organisations across the continents, like ISTA, OECD, AOSA, AOSCA, FAO, ISF, IPPC, UPOV, ITPGR, and so on, are coming together to discuss and resolve important aspects of the global seed industry, including regulations, IPRs, phytosanitary measures, seed health testing, quality assurance, new technologies, capacity and capability building, etc. and coming up with collaborations or joint projects on these aspects to promote seed sector growth and the development of agriculture globally.



About the AUTHOR
Dr. K. Keshavulu
President, International
Seed Testing Association,
Switzerland and
Managing Director,
Telangana State Seed
Organisations, Hyderabad,
Telangana State, India.



Major Challenges

- Varied levels of seed systems development across the regions
- Inconsistency in seed policies, IPR laws and regulations
- Trade related barriers
- Country-specific varietal registration and testing protocols
- Non-uniformity in phytosanitary requirements, country by country
- Problems with the movement of early generation seeds, treated seeds and small seed lots
- Increasing dependency on advanced seed testing methods
- Non-uniformity in seed testing and certification protocols.
- Lack of capacities and capabilities in organization, processes, and seed import/export activities among the small and medium seed companies

Need for Harmonization of Seed Regulatory Frameworks

In the recent past, considerable efforts have been made at international/regional level in the adoption of harmonised regulations and standards. There are plenty of global examples of successful harmonisation of seed standards and certification processes, such as the EU unified system of seed certification, FAO's efforts towards harmonisation of seed systems especially in developing countries, regional systems in Africa like Southern African Development Community (SADC) etc. These would not only encourage the growth in the seed trade but also improves the farmers' access to quality seeds through uniform procedures and rules, reduced trade barriers, increased transparency, lower transaction costs etc.

Indian Seed Market

Indian seed market has emerged as the fastest-growing seed market in the world expected to reach 12.0 billion USD by 2028. The seed industry in the country is expected to develop at a significant rate due to growing demand

Seed trade is a global business, and the free movement of seeds across international boundaries is essential for the expansion and development of agriculture worldwide as well as meeting the food and nutritional demands of an ever-growing population.



for food and feed, and as farmers begin to purchase commercially produced seeds because of all year-round availability and more consistent quality, in addition to using farmer-saved seed.

Though Indian seed industry is being placed within the top 5 positions, its representation in global seed trade and cooperation is very less. Need to improve seed exports, global cooperation, and networking to expand the niche for Indian seeds in the global market.

India, with its vibrant and strong seed industry, varied agro-climatic conditions, national and multinational knowledge bases, vast seed production expertise, reasonably good seed quality assurance systems, and necessary infrastructure, has great potential and opportunities to become a leader in the global seed trade.

Way Forward

Many countries, particularly in Europe, demand European-equivalent quality

standards. There is a need to expedite the process of obtaining EU seed equivalence for India. India has adopted OECD seed schemes, which are supposed to boost India's export potential, but due to some policy issues, it could not harness this opportunity, and the staff conducting certification, including seed testing, lacks the necessary expertise in many states and needs to improve competency in this domain.

We need to focus on seed health to strengthen the phytosanitary certification system in India in accordance with international standards to boost seed exports. Strengthening seed quality assurance systems in line with global standards is another priority. Under the ambit of "Seeds Without Borders," a regional seed policy agreement that aims to speed up the distribution of seeds of modern rice varieties across the countries in South and Southeast Asia under the facilitation of IRRI has a huge potential for India to reach out to these neighbouring countries and also to SAARC countries for expanding the market and reaching out to farming communities.

The policy framework of governments around the world needs to define the role of all stakeholders across the seed value chain with legal and institutional support. The aforementioned recent developments at the global level, such as efforts to harmonise regulatory frameworks, the introduction of new technologies, products, and approaches, joint collaborations and projects of international organisations, and so on, are moving in the direction of the development of dynamic, responsive, and effective seed systems for achieving the target of SDG #2 of achieving zero hunger and food security for all.



INDIAN AGRICULTURE IN 2030

AGRICULTURE DEVELOPMENT COUNCIL FOR CENTRE-STATE COORDINATION

Future is not an extension of the past. We should neither be exuberant nor despondent over the future just because of how our past and present have panned out. We have to create our own future.

If we have to imagine Indian agriculture in 2030 we have to reimagine certain elements of it in the way that they are progressive and sustainable.

Agriculture is a state subject which

Farmers' international competitiveness index is to be developed in key crops and benchmarked.

makes it very difficult to have many national level policies. Hence, it is extremely important that a national level Agriculture Development Council is formed with representations from all states, centre, ICAR and other stakeholders. Agricultural strategy for the country must be developed that is accepted by the ADC and is uniformly implemented across the states. This is the foundation for a good future of our farmers across the country.

Creating an Enabling Policy Regime

Farming is to be made more profitable. For this to happen yields must go up, markets should reward farmers, value addition is to be done and costs should be reduced. But how?

Increasing Farm Incomes

Farmers should have access to modern science and technology based inputs on par

with any other farmer in the world. Farmers' international competitiveness index is to be developed in key crops and benchmarked. Farmers should be connected to markets to improve his price discovery. Farm bills which were withdrawn have to be redrafted and implemented with active collaboration of the states and farmers organizations.

Apart from boosting non-farm income, carbon credits markets are to be made accessible to farmers on a digital platform. This will incentivise farmers to follow sustainable agricultural practices and in turn get rewarded with additional income.

Incentives and Financial Services

Positive incentives are to be given to farmers for crop diversification in different states. Oilseed crops, pulses, maize and vegetables cultivation to be promoted with a target acreage in mind and through positive incentives to farmers.

Modify procurement pattern of rice and wheat and shift to an equitable distribution across states – making cultivation of these crops less attractive for agro-climatically unsuitable areas – this will make farmers cultivate crops in suitable areas and only those demanded by markets. This will improve their incomes.

All financial services (credit, insurance) should be made available to farmers at the click of a button through large scale development and adoption of Open Access Digital Public Goods that will transform this

About the AUTHOR

Ram Kaundinya,
Director General, Federation of
Seed Industry of India





service to farmers by leveraging multiple databases available in different government departments and among private players. An Open Data Exchange Platform, an Electronic Farm Record System will be essential in creating this facility which will have a huge impact on cost of credit for farmers, reduce his dependence on private money lenders and mitigate his risks through insurance.

Mechanization and Value Chain Development

Large scale mechanization of agriculture can reduce the labour costs which are now above 45% of total cost of production in all important crops. This scale up is not possible unless government funds directly or through banks. A huge rural entrepreneurship program can be set up for custom service centers in villages that provide multiple agronomic services including spraying of pesticides using drones and tractor mounted boom sprayers.

Value chain development for identified crops in general and for nutrition fortified crop varieties in particular through a cluster approach can help them access both domestic and export markets. Each state may specialize in selected value chain development. This needs contract cultivation and an identity preserved supply chain – seamless access and delivery of the output across states. Large scale private investment is to be incentivized by states in creating processing and supply chain systems.

Millet and fortified food grains to be made a part of the food subsidy program,

Major research investments should be enabled through PPP in using gene editing technology and developing nutrition fortified food grains.

mid day meal program of schools.

Towards Climate Resilient Agriculture and Efficient Use of Natural Resources

We cannot afford to waste water and soil in the way we have been doing. A transformational change has to happen. Climate change is real. We have to equip farmers to fight high temperatures, floods, droughts, etc., which have become common now.

- Large scale incentivisation of cultivating rice with direct sowing. Target at least 30% of rice acreage to be converted to DSR method of cultivation by 2030.
- Large scale funding of micro irrigation systems like drip and hose reel.
- Reduce flood irrigation acreages by 30% by 2030.
- Approval of seed technologies that bring Water Use Efficiency (WUE) and Fertilizer Use Efficiency (FUE) traits into crops that currently consume too much of water and fertilizers.
- Restoration of soil structures

- Bring measurable climate resilience into our agriculture with a reward and punishment system.
- Withdraw subsidies on water and power in all states.
- Fund major research projects in ICAR and in PPP mode to develop crop varieties that are resilient to climate change
- Promotion of solar energy based farm power through a major subsidy program
- Use modern agri tech and digital tech based enterprises to monitor each field for adoption of sustainable agricultural practices and incentivize the farmers who adopt such practices.

It is very important that States and Centre work together for a profitable and sustainable crop production system. Clear targets on yields, crop portfolio, technology deployment, sustainable agriculture and natural resource conservation should be supported with a suitable policy environment. Innovation, research and investments have to be given due importance. The need is to think end to end policy support for each crop and make our farmers internationally competitive in target crops. Carbon Credits might play a key and catalytic role in achieving these objectives. The role of agri-tech start innovators and digital technology entrepreneurs in this transformation should be clearly understood and supported through policy interventions. Centre-State coordination is very important and a National Agriculture Development Council might play a crucial role in pushing this transformation forward.

QUALITY BRANDING OF POTATO SEEDS IN INDIA

A NOVEL INITIATIVE

Potato is the third most important food crop in India behind rice and wheat in terms of human consumption and gets the tag of staple, vegetable and cash crop. Although India has witnessed significant growth in production and consumption in the past five decades, i.e., more than fivefold increase in production from 8.3 million tonnes in 1980 to 50 million tonnes in 2020 and holds the rank of second largest producer and consumer of potato, the sector continues to be plagued by several constraints including non-affordability and non-availability of quality planting materials, particularly by smallholder potato farmers.



Potato Seed Production System in India

The majority of potato seeds in India are produced using aeroponic technology by private companies. These seed



About the **AUTHORS**

Dr. Samarendu Mohanty,
Asia Regional Director,
International Potato Center



Dr. P.C. Sindhu,
Joint Director, Department
of Horticulture,
Government of Haryana



Dr. Sampriti Baruah
Project Coordinator for
Asia,
International Potato
Center



Ms. Deepa Toni,
Senior Research Associate,
International Potato Center



Seed potato with certification tags and QR code along with Haryana Seed Potato Logo.

Photo Credit : Deepa Toni, CIP

companies purchase mother cultures from the Central Potato Research Institute (CPRI) and multiply in tissue culture laboratories. The tissue culture plantlets are planted in aeroponic facilities in high tech temperature-controlled facility where nutrient solutions are sprayed to the roots and minitubers are harvested at regular intervals. Minitubers are in turn planted in open field by seed companies or farmers to produce G1 seeds. Once G1 seeds are produced, further multiplication upto G5 seeds take place in farmers' field through contract farming. Many times, seed companies directly purchase seeds from seed farmers who purchase minitubers and multiply in their own field. At present, there is no central monitoring mechanism in place for quality control of seed multiplications by farmers. Each company has its own monitoring mechanism for quality control. These seeds are sold as truthfully labelled seeds with tag of early generation seeds.

We have dealt with major seed companies in the last few years as part of our Small Farmers Large Field (SFLF) group farming we piloted in several states. On behalf of our SFLF farmers, we facilitated purchase of thousands of tonnes of seeds from reputed seed companies. The truthfully labelled seeds which didn't give us any confidence on the quality of seeds and as feared, we had bad experience on several occasions and in some cases, farmers lost most of its crop be-

Since potato seed costs are high and account for nearly half of the total cost of production, potato farmers are reluctant to invest in such a large sum in seed purchase without any quality guarantee and end up using cheap local seeds or discarded table potatoes from the local market.

Application	Interested growers request seed from Potato Technology Center
Verification of Seed Grower	<ul style="list-style-type: none"> Includes meeting with seed growers and history of seed multiplication by grower
Association formation	<ul style="list-style-type: none"> Group seed producers to form association to reduce paper work. Each association registers with District Horticulture Office for seed sale licence with INR 1,000 fee valid for five years. Seed Certification License of firm from Haryana State Seed Certification Agency (HSSCA). Training of seed producers on recommended production practices.
Seed Certification	<ul style="list-style-type: none"> Crop inspections at specified intervals by HSS Group seed producers to form association to reduce paper work First Inspection 30-35 days after planting or 15 days after germination to verify isolation, off-types, the extent of disease inspection with special reference to mild and severe mosaics and leaf roll Second inspection: 60-65 day after planting to verify above criterias and black scruff infected plants Third inspection: Just before haulm cutting to verify off types and virus infected plants Final inspection: 10 days after haulm cutting to verify that no regrowth of haulm has taken place Testing of the produce for grow out test



cause of seed borne diseases. Since potato seed costs are high and account for nearly half of the total cost of production, potato farmers are reluctant to invest in such a large sum in seed purchase without any quality guarantee and end up using cheap local seeds or discarded table potatoes from the local market.

To develop a system where farmers can have some confidence on potato seeds they are purchasing, we worked with Potato Technology Center, Department of Horticulture, Govt. of Haryana to develop a potato seed quality mark to assure quality and authenticity. The quality mark signifies that the potato seed is originated from Haryana and its quality meets the relevant standards defined by the Government of Haryana. This is first of its kind in potato and potato seeds and was developed along the line of green logo of Thai Hom Mali rice, a stamp of authenticity mark of Thailand's Department of Foreign Trade Thailand's Department of Foreign Trade, Ministry of Commerce. Like Thai rice producers who go through an elaborate process to get the right to use the logo of Thai Hom Mali Rice certification, a stringent process is in place to get the



Green Logo of Thai Homa Mali Rice

This is first of its kind in potato and potato seeds and was developed along the line of green logo of Thai Hom Mali rice.

right to use the “Har Aloo” quality certification by Haryana potato seed producers.

After extensive deliberations with different stakeholders including government officials, state certification agency and seed producers, the Govt. of Haryana with support from CIP team launched “Har Aloo” potato seed quality certification system. The “Har Aloo” logo was finalized after extensive consultations.

The Making of “Har Aloo”

The seed certification process begins with the identification of seed producers with adequate experience. In the next



step, seed producer individually or as a group register with the Haryana State Seed Certification Agency (HSSA) by paying license fee. The seed producers are given hands on training on production practices, isolation and other preventive measures to protect crops from pests and diseases. The HSSA visits their field at specified intervals. Parallel to the seed certification exercise, as a part of traceability a digital database is being updated where in all the basic crop information from planting, irrigation to dehauling and then harvest is being recorded. Once the crop passes the HSSCA quality checks and is awarded certification tags, a QR code generated from this portal will also be awarded to the seed grower. Finally, the agency approves the use of “Har Aloo” quality mark on their seed bags and QR code to be put on the bags for traceability.

Progress so far and way forward

In 2021 (first year of roll out of the program), 12 seed growers registered with the “Har Aloo” certification program. The number has increased to 55 in 2022. We expect the number of registered seed producers to grow to 200 in 2023. This work is jointly supported by the Government of Haryana and the Seed Equal research initiative of CGIAR.

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Seeds Online!

National Seed Corporation (NSC) is onboarding the Open Network for Digital Commerce (ONDC) as a seed seller and Agriculture Today is the first to bring out this exciting development

Seeds are a basic input for agriculture. The seed market is also one of the most diverse, not only because of the multitude of crops, their varieties, and seasons in the country, but also due to varying technology interventions. It is estimated that 70% of the seeds used in the country are farmer's own saved seeds. 30% of the seeds from the market come from different sources- from cutting edge researched varieties to completely unorganized sector. There are also considerable variations amongst crops, for instance cotton alone constitutes 41% of the hybrids sold. There would be other crops like kodo or kutki with no hybrids at all. Irrespective of which sector of the seed market, the universal demand is for disease resistant and productive seeds.

While the saved seed of traditional varieties have a critical role in preserving



While seeds have been available on commercial e-platforms, the difference with the ONDC's onboarding on mystore.in site is that there are no charges on account of the e platform

biodiversity and keeping input cost low for the farmer, access to certified high yield seeds remains a challenge. An equitable playing field for the small and marginal farmers entails that they can procure certified seed at reasonable prices. The importance of certified seed is on account of a certain quality assurance that the seed is of an improved variety and meets a certain level of quality in production and processing. Also, in case of failure to germinate or bear fruit or grain, there is a legal recourse available for the farmer under the Seed Act.

ONDC as a Seed Seller

One of the farmer's main compulsions is sourcing inputs from the limited options locally available. This was articulated by a farmer member from a Farmer Producer Organization (FPO), that not only



About the **AUTHOR**

Dr. Maninder Kaur Dwivedi IAS
Chairman & Managing Director,
National Seeds Corporation

is the local dealer the deciding factor for what seed he can choose from, but dealer also prescribes a minimum quantity for the same. A dealer's choice for marketing understandably is based on the best margins for himself, as dictated by his business interest. This led to the National Seed Corporation (NSC) onboarding the Open Network for Digital Commerce (ONDC) as a seed seller. Since selling seeds online was a new initiative for NSC, it took time to work out logistics from different Central Seed farms (CSFs).

While seeds have been available on commercial e-platforms, the difference with the ONDC's onboarding on **mystore.in** site is that there are no charges on account of the e-platform. So, what the farmer or gardener pays is the cost of the seed plus logistics and shipping. All charges are on account of the product and its logistics, not a profit for the e-platform. In addition, the category of seed (certified, truthful label etc.) is clearly mentioned. The seed certification is tagged to the packets and is a recourse or remedy available in case of any germination or other failure.

There is no minimum quantity a farmer is bound to order when placing orders online, except in case of saplings (tissue culture banana plants), where a vehicle will have to be deployed for the delivery and is hence economical only in larger quantities. The most popular seeds have been vegetable seeds, where buyers want to trial different varieties, followed by fodder seeds, millets and flowers. NSC is probably the only seller with 9 certified millet seeds, besides truthful labelled other millet hybrids. Paddy and pulses are relatively slow moving online, presumably due to local saved seed with farmers or larger volume of the requirements.

Digital Marketing is Cost Effective

Setting up physical dealer networks is expensive and time taking when the Corporation is also attempting to keep the seed prices affordable. Digital marketing in such scenario is cost effective for introducing high value seeds tar-

geted at import substitution, where the imported seeds are well known, but the equivalent local seed varieties are yet to gain traction. For instance, an expensive imported papaya variety has local varieties at less than half the cost, with similar fruit characteristics. These are used by nursery units that raise saplings and sell them, as well as by large farmers with

NSC is probably the only seller with 9 certified millet seeds, besides truthful labelled other millet hybrids



papaya plantations. Without the digital market, it is difficult to reach out to diversely spread-out home consumers, unless an extensive network is in place. Also, the home delivery of any quantity of seeds is an added convenience for the farmers.

While CSF's primary objective is seed production, Raichur CSF also has a fodder block unit, that uses all the straw on the farm as an input. The larger 20 kg fodder blocks are for consumption by the large sized cattle while the smaller pellets by goats etc. The fodder blocks were also offered online on **mystore.in** and the first order came from some 500 kms away. Basically, it showed that there is a demand for products even in urban areas which was not anticipated.

Future Course of Action

After seeds, the focus is on onboarding planting materials like bulbs, tubers, corms, and cuttings.



While these are also categorized, for each variety, into truthful labelled and certified, there are many varieties that are sought after. In each of the vegetatively propagated crops, there are numerous varieties that have been safeguarded by scientists, farmers or FPOs. For instance, in one center alone, 18 varieties of sweet potato are available. One FPO, with a grower contract with NSC, had 21 varieties of turmeric planting material, varying from the pale ambi haldi to black turmeric. The access to digital platform makes it easier to reach out to a larger segment with the unique products on offer, as individual marketing of these would be difficult.

Selling seeds online is reengineering the business processes for the agriculture input sector. It however provides an equitable playing field for a high-quality product with 'no-marketing' budget. The serendipitous orders from new places also serve as an indicator for which geographies to focus on and strengthen on ground through the dealer network.

BIOAG INDIA 2023

APRIL 27 AT HOLIDAY INN, AEROCITY



BioAg India 2023, the second in the series was organized by Agriculture Today Group at Holiday Inn, Aerocity, New Delhi on April 27, for bringing all bio input companies from across the nation and other key stakeholders on one platform to explore market opportunities and forge business linkages. It also became a venue to discuss the policy, trade, technology, business and investments environment in the sector.

BioAg India brought a galaxy of important speakers through its one day meet who discussed and deliberated around several important issues in bioAg sector. Some of the speakers were Dr. Ashok Dalwai, CEO, NRAA; Dr Tarun Shridhar, Former Secretary, Ministry of Fisheries, Animal Husbandry and Dairying, Govt of India; Dr. MH Mehta Chairman - ICFA Working Group on Eco Agriculture and Gujarat Life Sciences; Dr. SK Malhotra Former Agriculture Commissioner Government of In-

dia; Mr Rick Riegner, Executive Vice President, Verdesian Life Sciences, USA; Mr GP Upadhyay, Chief Investment Commissioner, Government of Sikkim among many others.

Apart from discussions and deliberations, the event also hosted BioAg India Expo 2023 which extended a platform for BioAg industry display their products, technologies and techniques.

Inaugural Ceremony

Union Agriculture Minister Shri Narendra Singh Tomar unveiled the special issue of Agriculture Today on Bio Agriculture and felicitated the winners of BioAg India Awards 2023.

Speaking on the occasion, Hon'ble Minister highlighted the importance of the sector in the growth and development of the country. He further asserted, agriculture is the only sector which has the ability to survive and serve even in the difficult situa-



tions. Government is constantly trying to make the profession profitable through its various initiatives and schemes, he added. Shri Tomar observed that chemical farming has depleted the health of soils. He informed that Natural Farming was a good alternative and the government has allocated an amount of Rs 1500 crore for the promotion of natural farming and intends to train 1 crore people every year. In the meantime, he suggested that farmers use only recommended dose of chemical fertilisers .

Dr Tarun Shridhar, Former Sec AHD & F, GOI, observed that agriculture cannot be completely natural. However, he suggested that we can blend our traditional practices with new technologies and innovations to get better and sustainable results. Market linkages needs to be strengthened to facilitate the concept and importance among farmers, he added.

Dr MJ Khan, Chairman, Indian Chamber of Food & Agriculture, spoke about challenges existing in Indian agriculture sector despite India being one of the largest agriculture economies. He highlighted four major challenges – Malnourishment, Climate Change, Pest Build-up and depletion of natural resources. He said that addressing these issues was a must to achieve adequate food and feed production, safe and nutritious food and sustainable production. He urged Hon'ble Minister to increase and

encourage R&D in the sector to achieve the goals. He further added, we have successfully achieved food security and now we should train our focus to achieve nutrition security.

Session 1: Policy Initiatives for natural farming

Dr Tarun Shridhar, Former Secretary – Fisheries, Animal Husbandry and Dairying, Government of India moderated the session and emphasized on the need for innovative solutions in food production. He highlighted that organic agriculture enhances eco health and focuses on the use of off-farming goods. He stressed upon the importance of mov-

ing towards value and quality. **Dr PVSM Gouri, Executive Director & CEO, Association of Indian Organic Industry (AIOI)** discussed the condition of farming before the Green Revolution and how excessive use of chemicals led to problems. She suggested that adopting different techniques of eco agriculture that suit climate and environmental conditions is crucial now. **Dr Chandrashekhhar Biradar, Country Director – India, CIFOR** spoke about how floods and droughts have wreaked havoc in agriculture. He discussed how farmers are adopting new technologies and getting value from it. He highlighted that crop diversification and agroforestry can play a crucial role in im-





proving the productivity, income, and bio agriculture practices.

Ms Komal Shah, Director R&D, SML LTD talked about the impact of fertilizers on the agriculture sector during the Green Revolution. She emphasized on the need to address production and soil health through bioagriculture and biosolutions. She stated that both quality and quantity should be targeted simultaneously.

Mr Vipin Saini, CEO, BASAI highlighted the government's efforts to promote organic farming and how they have identified different locations where natural farming can be encouraged. He suggested that one package of practices cannot be a bible for the whole country because different areas have different agro-climatic zones. He emphasized that existing policies should be studied holistically to frame new ones.

Session 2: Policy and regulatory ecosystem for biologicals

Dr SK Malhotra, Project Director DK-MA-ICAR & Former Agriculture Commissioner, Govt of India moderated the session. He emphasized that there is a need to assure safe production through innovative techniques like bioagriculture, organic farming, and biodynamics. Further evaluating the scope of the sector, he asserted, the bioagriculture market

in India is currently valued at 62 million thousand rupees and is expected to reach 97 million thousand rupees by 2038.

Mr Raju Kapoor, Director, FMC Corporation highlighted the need to increase production to meet the growing population's demand. He suggested that government regulators and companies should partner to change the ecosystem and adopt advanced technologies like other countries to make agriculture a profitable business.

Dr Gagnesh Sharma, Director, National Centre for Organic Farming shared that statistics that showed an increasing trend in organic farming and that the production of liquid biofertilizers has touched new heights last year. However, farmers need to move towards biofertilizers, and the government needs to push the use of these fertilizers.

Mr GP Upadhyay, Chief Investment Commissioner, Govt of Sikkim shared his experience of converting 17000 hectares of land into organic in 15-16 years. He shared that it takes time to adopt new policies, but with the support of the government, financial institutes, and government committees, they achieved their target. He suggested that everyone's support is required to achieve the set policy targets.

Mr Sahil Malik, Secretary, National

Bio stimulants Industry Forum suggested that the government should play an active role in facilitating the farm ecosystem where research can be done in a proper direction to utilize the ecosystem.

Dr. P.K. Gupta, Director, NHRDF emphasized that bioagriculture constitutes many things, and organic and natural farming inputs depend on many factors. He suggested that the government should consider factors like dosage to be given, height for the spray, etc., while introducing drones for pesticides.

Dr R Sudhakaran, Head Regulatory Affairs (Agri Inputs), INERA Cropscience Pvt Ltd suggested that there should be simplified guidelines for biostimulants. He emphasized that the government should enhance data protection and use APR for that. He also suggested that biostimulants are the future of bioagriculture, and we should not believe in the myths surrounding it.

Session 3: Technological advances in biocontrol and biostimulants

While moderating the session **Dr. Nutan Kaushik, DG, Amity Food & Agriculture Foundation** highlighted that food safety is a major concern and policies are being developed to address this issue. Biologicals are emerging as a useful tool to cover food safety and nutritional security in the world.



Dr. Vimala Prakash, Head, Technology and Innovation Centre, IPL Biologicals emphasized the need for innovation and technology in biocontrol and biostimulants. She pointed out that the shelf life of produce is important and what farmers produce and what is claimed for it is often different. The use of a consortium of microbes to act against pests is more effective than the use of single-stranded microbes. She also emphasized the need to make farmers comfortable with new innovations in the microbe's sector.

Mr. Mukesh Patel, MD & Co-founder, Agriland Biotech Ltd discussed the technologies developed at Agri land Biotech, mainly for biopesticides and biofertilizers. The use of surface technology for fungal bioagents and special rooms for mass production of fungus

like *Trichoderma* and *Metarhizium* were highlighted. However, he expressed concerns over the economic viability, transportation, and time required for the registration of new products.

Dr. Prashant Khare, Director, Xenesis, Absolute highlighted the challenges faced by the biopesticide sector such as shelf life, stability, pollution, and cost-effectiveness. He discussed the two platforms established at Xenesis - the Nature Intelligence Platform and the BCIT Platform. The Nature Intelligence Platform focuses on how pests and crops can communicate with each other and be controlled.

Mr. Debarata Sarkar, VP, Alga Energy discussed how biocontrol has been used since ages, and technological advancements are taking place. He empha-

sized that Europe is the continent where biocontrol and biostimulants are being used to develop a framework for this sector. Investment and technology will play a significant role in this sector, and a roadmap and framework are required to ensure its growth.

Session 4: CEO's Session on Roadmap for Sustainable Bioagri model for Evergreen Revolution

Dr. M.H. Mehta, Chairman - ICFA Working Group on Eco Agriculture and Gujarat Life Sciences the moderator of the panel, emphasized on the importance of eco agriculture and natural farming and suggested scaling up.

Mr. Pratul Gadge, CEO, Biome Technologies Pvt Ltd stressed the significance of innovations and regulations in the agricultural sector. He pointed out that the Green Revolution taught farmers to use fertilizers but did not educate them about the right quantity to be used according to soil health and condition. In biologicals, application at the right time is crucial.

Ms. Renuka Diwan, CEO, Bioprime highlighted the need for a holistic approach and integration of pesticides with biologicals. She also stressed that technological innovations are required in packaging and delivery. There should be a system where farmers can make a better choice and use limited chemical pesticides.



Dr. Dinesh Chauhan, Director, Tropical Agrosystem pointed out that farmers rely on the knowledge of distributors and retailers for bioproducts. Therefore, there is a need to work on the bioproduct sectors and develop research centres.

Dr. Raja Ram Tripathi, Chairman at CHAMF INDIA "Central Herbal Agro Marketing Federation of India expressed concern over the budget allocated to the chemical sector as compared to the organic sector. He suggested that proper funding is required, and the government should focus on policy framework, subsidies, and achieving proper results to make organic farming a success.

Mr Rick Riegner, Executive Vice

President, Verdesian Life Sciences, USA shared that only 2% of bioproducts are used in India, and 66% more fertilizers are used in India as compared to the USA. He suggested that awareness and education in biostimulants can be solved by the efforts of the stakeholders.

Mr. Rajan, MD, Privi Lifesciences emphasized the importance of reviving old practices. He also highlighted the impact of climate change and suggested that technology is a great healer for the problems we face. If the intent is genuine and the world comes together, then no hurdle is insurmountable.

BioAg India Awards 2023

The development in Bioag sector has

been possible by active support of policies, research system, commercial initiatives and farmers themselves. The experts, institutions and corporates, who have played seminal role in making bio-agriculture a success, need to be recognized for their tremendous contributions. The institution of the **BioAg India Awards 2023** a significant step in this direction to recognize the contributions of various stakeholders 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.



AWARDEES

- Emerging Leader Award - INERA Crop Science Ltd
- BestbioAg Startup – Bioprime Agrisolutions Pvt Ltd
- Best Bio Pesticide Product - Agriland Biotech Ltd
- Best biostimulant Product – UPL Ltd
- Best Company in R&D - IPL Biologicals Ltd
- Best State in BioAg - Haryana
- Best Farmer Award- Dr Rajaram Tripathi
- Lifetime Achievement Award - Dr MH Mehta
- Best Company- Tropical Agrosystem India (P) Ltd
- Global Leadership Award - Verdesian Life Sciences LLC
- BioAg CEO - Debabrata Sarkar
- Innovation- Privi Life Science Private Limited
- Policy Leadership - Dr SK Malhotra
- Market Impact - Biostadt India Ltd

Roadmap for Overall Development of the Bioag Sector

The experts through the debates and discussions in BioAg India 2023 brought to the fore many important issues persisting in the bioagriculture sector. The suggestions collated from the discussions provide a roadmap for ensuring overall development of the Bioag sector and is presented here.

Research Level Suggestions

- Study of region specific Package of Practices and identification of Zonal level resources centres
- Innovative products by the combination of microbials and biostimulants
- Innovation required for increasing shelf life
- Development of consortium of biopesticides
- Inclusion of secondary metabolites in the formulations for knockdown effect
- Regulatory framework for commercialization of novel microbes
- Protection for the applicant on third party use of these microbes once they are deposited in a repository
- Framework for upcoming technologies like RNAi, aptamers etc
- Framework for development of biostimulant product specification and attributes for ultra low volume formulations for drone based spraying

Policy Level Suggestions

- Ensuring availability of bio agricultural harvest in a cost effective way
- Instituting buy back guarantee for produce cultivated through organic methods, subsidies for organic inputs and incentives for farmers cultivating organically
- Equal emphasis on quality and quantity of produce
- Combining agriculture forestry along with commercial farming with the involvement of FPOs for sustainable agriculture transition for green growth
- Incentivising producers of biological inputs
- Transparent traceability of produce
- Strict policy to eradicate spurious pesticides
- Awareness among farmers
- Budget for organic agriculture R&D

Regulatory Level Suggestion

- Regulations should move hand in hand or ahead of commercialisation
- Easing of regulations for technology imports to expand R&D base of India
- Guidelines for sprayable pheromones
- Simplification of guidelines in the registration of biomolecules. Reduce the time, energy and cost involved in commercialisation of bioinputs registration
- Protection of data of primary legislators

MANAGEMENT OF 'SHREE ANNA' DIVERSITY

ROLE OF NBPGR IN STRENGTHENING MILLET SEED SYSTEM

Millets comprising of sorghum, pearl millet, finger millet, foxtail millet, little millet, kodo millet, barnyard millet and proso millet have been the traditional food grown in India especially in the marginal environments of the drylands. Because of their better adaptation to the extreme climate of hot and dry environments, millets have the potential to provide food, nutrition and fodder security, especially under climate change scenario. The millet germplasm conserved in National Genebank and which is available for crop improvement programme includes 307 genetic stocks and 142 trait specific registered germplasm which are directly used in the breeding programmes.

Facilitating Release and Notification of Varieties

Before the variety is released and notified by Central Sub-Committee on Crop Standards, Notification & Release of Varieties for Agricultural Crops and Horticultural Crops, it is mandatory to deposit the seeds of the varieties, hybrids and their parental lines



About the AUTHOR

Dr. Gyanendra Pratap Singh, Director, ICAR-National Bureau of Plant Genetic Resources, New Delhi

in the National Genebank, which are allocated national identity number. A total of 8272 varieties released by centre and states have been conserved in the National Genebank out of which 547 belong to millets. This material is available to revive a variety whose seeds are completely lost due to any calamity.

Enhancing the Utilization of Millets

Currently, there is renewed interests in millets due to their in-built tolerance to water stress and supra-optimal temperatures, and capacity to grow well and produce good yields on soils with low fertility. Moreover, millets being highly nutritious, have an important role in achieving nutrition security. Therefore, Government of India declared millet crops as 'NutriCereals'. The year 2023 has also been declared as the 'International Year of Millets' on India's call, which is supported by 70 countries in the world to promote cultivation and consumption of millets.

NBPGR has been working to facilitate better utilization of the conserved germ-



Organization of Sorghum Germplasm Field Day

As part of celebration of International Year of Millets 2023, ICAR-NBPGR has taken up the country's biggest characterization programme of sorghum germplasm at Agricultural Research Station, Washim



A total of 8272 varieties released by the Center and States have been conserved in the National Genebank out of which 547 belong to millets.



Research, Hyderabad and Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

This programme will help in development of core set, representing the diversity in sorghum germplasm conserved in the National Genebank and thus enhance the utilization of Sorghum Genetic Resources in crop improvement programme. This characterization programme has also given us the opportunity to showcase the Global Sorghum Diversity to the researchers across the country during the 'Sorghum Germplasm Field Day' which was organized on 13th March 2023. More than 600 researchers from national and international research institutes, personnel from private seed sector and farmers and students participated in the field day. Researchers from public and private sectors have made selections of the promising germplasm, and have placed indents which are being compiled for supply.

Since the germplasm conserved in the National Genebank is an important source of variability, which is pre-requisite in the variety development programme, ICAR-NBPGR envisages to take up large scale characterization and evaluation programme in all major crops important for food and nutritional security which will trigger the development of improved varieties and thus strengthen the seed sector.

plasm for crop improvement programme. To ensure widespread utilization of Plant Genetic Resources, NBPGR is implementing an ICAR project on 'Consortium Research Platform on Agrobiodiversity' since 2013 and considering the importance of millets in nutritional security, Management of Millet Genetic Resources has been included as important component of CRP-AB.

As part of celebration of International

Year of Millets 2023, ICAR-NBPGR has taken up the country's biggest characterization programme of sorghum germplasm at Agricultural Research Station, Washim. Around 25,000 accessions of sorghum germplasm conserved in the National Genebank of ICAR-NBPGR were characterized using a set of 26 descriptors. The programme was implemented in collaboration with ICAR-Indian Institute of Millet

Conservation of millets in National Genebank at ICAR-NBPGR, New Delhi

Sl. No.	Crop	Germplasm	Genetic stock	Released Variety	Registered Germplasm
1	Sorghum	25624	189	201	83
2	Pearl millet	8757	62	170	21
3	Finger millet	11612	41	104	23
4	Foxtail millet	4658	5	23	6
5	Kodo millet	2401	1	15	2
6	Little millet	2215	3	18	2
7	Barnyard millet	1993	6	9	5
8	Proso millet	1037	-	7	-
TOTAL		58297	307	547	142

tête-à-tête with *Anjana*

BUILDING SUSTAINABLE FOOD VALUE CHAINS

Bayer, a global enterprise with core competencies in the life science fields of agriculture and healthcare organized a National seminar, "India Horticulture Future Forum 2023" on 26th April 2023 at The Leela Palace, Chanakyapuri, New Delhi, to deliberate upon the future of Indian Horticulture and nutrition security concerns that can be alleviated through the Fruits and Vegetables segment. The spotlight was kept on the challenges, opportunities, and advancements of the segment from the lens of empowering the smallholders for better economic prospects. Along the sidelines Mr. Simon Wiebusch, Chief Operating Officer for the Crop Science Division of Bayer in India, Bangladesh & Sri Lanka discussed with Ms. Anjana Nair, Group Editor, Agriculture Today about the relevance of horticulture and how important the sector will be for the country.

How has horticulture been integrated into the sustainability initiatives of Bayer?

I think the sustainability initiatives of Bayer are not necessarily just focused on horticulture. Sustainability also includes the aspect of income of farmers, resource needs, and horticulture offers a lot of advantages to diversify agriculture in India. When you take the simple fact that there is 44 million hectares of rice in India and if you were to change the rice cropping system to ideally a direct seeded system, you would have a lot more space available for horticulture, which from a sustainability perspective, especially if you look at methane emissions and other inputs, would improve the footprint of agriculture in India significantly. Now, in horticulture itself, there are a lot of opportunities as well. Today there are opportunities for a farmer to more diverse crops. When you look at the need for horticultural products in the country, this is a huge opportunity to get new acres into horticulture agriculture.

How significant is India as a market for Bayer in the horticulture segment or otherwise?

India is currently the second biggest producer of horticulture goods in terms of volume. According to me, India will be the biggest consumer of horticulture goods in the world by 2030 as India still has a reasonably low per capita usage and for a company like Bayer, which says horticulture is one of our major pillars, this is a huge market. Presently, we are the fifth largest business in the world, and I assume India will catch up to become the third largest after the big protein producers, US, and Brazil, within a foreseeable timeframe.

Over the years, Bayer has had a strong leadership in seed segment. What are the new trends that you observe in the seed segment?

tête-à-tête with Anjana



In the seed segment, there is a move towards more certified seeds if you look at the open-pollinated seeds, but there is clearly also a drive towards hybridization, when you look at horticulture.

In the seed segment, there is a move towards more certified seeds if you look at the open-pollinated seeds, but there is clearly also a drive towards hybridization, when you look at horticulture. As soon as you look for more processing varieties and really trying to build that value chain, the move towards hybrid vegetable seeds and specific hybrid vegetable seeds, which are for specific usages, as whatever it is processed tomatoes, for example, will definitely grow as a segment itself. Additionally, what you see is a lot of thoughts around gene editing that will allow you in horticulture to hopefully manage pests and diseases primarily with the strength of the plant and less need for chemical interventions.

More hybrids mean more inputs as well?

Not necessarily. If you have hybrids which are intrinsically resistant to certain diseases or either avoids insect damage, being somewhat propellant to insects, that gives an opportunity to reduce and the thing is, insects usually go for where it's most juicy and that's a little bit where you do see a correlation between potentially pest pressure and hybridization. But if you look at it on a per plant or per output basis, actually, you're going to be finding that usually hybrids are more efficient than non-hybrids.

How have seeds influenced the expansion of horticulture?

It is the basis for everything, and when you look at the horticultural seed or the vegetable seed variety, India is almost the center of the world. Everybody will





tell you it's Holland, but that is really when you look at a very limited number of commercial crops. When you look at India, the number of vegetable seed companies we have here, the number of varieties, the specific crops like okra, lady finger, etc., where India is almost the only source and the exports to the Middle East to the Indian fraternity but increasingly the palette also in the West moves a little bit towards Indian foods, this all comes from India. India for us is the biggest production and research side for vegetable seeds in the world at this point, at least when you look at variety. We might have more tomato research in Holland or so, but again, if you look at the breadth of the portfolio, India is actually the motherland of horticulture.

So, how is Bayer, through partnerships contributing to the horticulture ecosystem?

For me, the ecosystem is the most important. Bayer, while being an input provider which is on the seeds and pesticide side, is very much interested in saying how can we build sustainable food value chains, because one thing is to produce more, the other is to also to ensure that what is produced fits the requirements. We're back at processing, but we're also looking at quality. We are 1.4 billion people, and we will have, within a short period of time, potentially become the larg-

When you look at the horticultural seed or the vegetable seed variety, India is almost the center of the world.

est middle class in the world. And you see already, I would say sometimes a little bit also catalyzed by COVID-19 how the requirements of the Indian consumer, especially the urban one, has increased. People are much pickier as to what their produce looks like. They don't like the squishy tomatoes and that is important to cater to, that is where Bayer is trying to build, if you want to call it an ecosystem where you say, where is the best place to produce, which is the best hybrid, how do you manage the pests, how do you ensure that what comes out is actually also procured. The colleague from Grant Thornton was telling me yesterday, he's dealing with Indian vegetable traders, which are in the Middle East, and they actually import their vegetables from everywhere but India, because the Indian production system today does not have the output quality that even an Indian trader would buy for the Middle East. So, that gives you a sense that while for India itself, we still need to produce a lot more, the aspect of quality is becoming

equally important, and when you want to deal in an international export value chain, a lot of topics come around, be it simple quality aspects, be it simple look and feel aspects, but also topics around residues, around how things have been managed, around traceability and even water usage.

Which are the most important interventions that have happened in the horticulture world that have changed the course of the sector?

I mean, I'm not the absolute specialist here, but if I were to say, it's definitely hybridization, it's definitely water management, so specifically on drip irrigation, and it is increasingly also covered crops and a managed environment to really grow the crops.

What are future plans of Bayer in the horticulture segment in the world and for India?

Yeah. I am fundamentally of the opinion that India has a shot at being the supplier for fruits and vegetables for the world. Now, that doesn't mean 100% trade domination, definitely not. But from where we are today at 1% of the global fruit and vegetable food chain, India has a huge opportunity to become a significant player.



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NOURISHING INDIA'S FUTURE

The Power of Biofortified Seeds

Seeds—the humble, yet mighty, bearers of life—are at the forefront of a revolution that promises to reshape India's nutrition landscape and agricultural sustainability. As the fifth-largest seed industry globally, India holds immense potential to harness the power of biofortified seeds and address the pressing challenges of malnutrition and food security. With the Indian seed market projected to reach a staggering \$12.7 billion by 2028, the time is ripe to unlock the transformative impact of biofortification.

Revolutionizing Nutrition through Biofortification

A staggering 59% of Indian women suffer from anemia and 35% of children under five suffer from stunting, while deficiencies in vital micronutrients like iron, zinc, and Vitamin A persist. Research has also shown that higher concentrations of carbon dioxide in the atmosphere will deplete the protein and nutrient content (especially iron and zinc) by 3-17 percent in most staples. By 2050, an additional

The biofortification market is projected to grow at a CAGR of 9.42% during the forecast period to reach US\$243.852 million by 2027, from US\$129.852 million in 2020.

50 million people in India could become zinc deficient, while an additional 502 million women and children under five could face anemia as a result of climate change.

Biofortification offers a glimmer of hope in this battle against hidden hunger and climate crisis. The ICAR has pioneered the development of biofortified varieties and over 70 biofortified varieties have been released across India. Encouragingly, these biofortified crops have demonstrated the potential to address nutrient deficiencies and improve the health outcomes of millions across the country. In New Delhi, over 3,000 pre-school children (4-6 years old) and their mothers consumed either conventional wheat or biofortified wheat daily for six months. Biofortified wheat reduced time spent ill: children spent 17 percent fewer days sick with pneumonia and 40 percent fewer days vomiting than children who

ate foods prepared with conventional wheat. Their mothers (nonpregnant, non-lactating) reported spending significantly fewer days (9 percent) with fever.

A Catalyst for Positive Change

The seed sector stands as a steadfast ally in the quest for nutritional excellence. India's remarkable agricultural universities and plant breeders are tirelessly working to enhance the nutrient traits of crops, aligning them with the needs of specific regions and populations. With a projected compound annual growth rate (CAGR) of 12.43% between 2022 and 2028, the seed sector is primed to play a pivotal role in the production and distribution of biofortified seeds. Seed companies and organizations are championing the cause, driving awareness through comprehensive campaigns, empowering farmers through training programs, and forging strategic partnerships to ensure biofortified seeds reach even the most remote corners of the nation.

Unleashing Economic Opportunities

Biofortification not only nourishes bodies but also fuels economic growth. The biofortification market is projected to grow at a CAGR of 9.42% during the forecast period to reach US\$243.852 million by 2027, from US\$129.852 million in 2020. It promises exponential growth as demand for nutrient-rich crops surges. Market linkages established by the seed sector foster vibrant connections between farmers, consumers, processors, and key stakeholders. By collaborating closely with policymakers, the sector ensures adherence to quality standards and effective regulation. This synergy lays the foundation for a thriving biofortified crop



About the AUTHOR

Ravinder Grover,
Regional Coordinator-Asia,
Harvest Plus

ecosystem that unlocks new economic opportunities for farmers, empowers local communities, and drives India's agricultural sector towards a sustainable and prosperous future.

Sustainable Agriculture

Sustainability lies at the heart of India's agricultural transformation. By reducing reliance on chemical inputs, biofortified varieties pave the way for environmentally friendly farming practices. These crops exhibit inherent pest and disease resistance and climate resilience. Moreover, biofortification equips farmers with climate-resilient crop varieties, enabling them to thrive amidst escalating challenges posed by drought, salinity, and changing weather patterns. Through the cultivation of locally adapted biofortified crops, India can nurture biodiversity, preserve indigenous seeds, and foster a harmonious relationship between agriculture and the environment.

A good example for these is the adaptation of biofortified high-iron pearl millet varieties by farmers. A farmer feedback study conducted among iron pearl millet seed purchasers in rural Maharashtra in 2013, showed that 83 percent of pearl millet growers had replaced their traditional variety with a biofortified one, owing to their high yield, mildew resistance and drought tolerance apart from nutritional qualities.

Embracing a Brighter Tomorrow

The power of seeds extends beyond the boundaries of agriculture. It is a power that can uplift communities, safeguard health, and shape the destiny of a nation. As India's awareness of nutrition and well-being continues to soar, the demand for biofortified crops is set to skyrocket. This presents a golden opportunity for the seed sector to drive innovation, enhance production, and ensure equitable access to biofortified seeds across diverse regions and socio-economic groups.

To realize this vision, a multi-pronged approach is crucial.

First, research institutions and agricultural universities must receive sus-

Through the cultivation of locally adapted biofortified crops, India can nurture biodiversity, preserve indigenous seeds, and foster a harmonious relationship between agriculture and the environment.



tained support and investment to accelerate the development of biofortified varieties tailored to the specific nutritional needs of India's population. Collaborations between academia, government agencies, and international organizations can facilitate knowledge sharing, technology transfer, and the exchange of best practices.

Second, robust seed production and distribution systems need to be established. This involves strengthening the capacity of organizations to scale up production, maintain quality standards, and meet the rising demand for biofortified seeds. National Rural Livelihood Mission (NRLM), with its 8.3 million self-help groups (SHGs), has the potential to establish seed production centers in collaboration with research institutions, seed companies, and farmer producer organizations (FPOs), ensuring availability and affordability of biofortified seeds to farmers.

Third, comprehensive awareness and training programs are vital to empower farmers with the knowledge and skills necessary to cultivate and market biofortified crops effectively. Farmer field schools, demonstration plots, and mobile-based extension services can disseminate information on agronomic practices, post-harvest handling, and mar-

keting strategies. Engaging with women farmers and SHG members who play a pivotal role in agricultural production and nutrition within households, is particularly important to ensure inclusivity and gender equality.

Fourth, the government can play a catalytic role by formulating supportive policies, providing incentives, and integrating biofortification into existing agricultural and nutrition programs. Public-private partnerships can leverage the strengths of both sectors to drive innovation, improve access to markets, and maximize the impact of biofortification on the ground.

Finally, robust monitoring and evaluation mechanisms must be put in place to assess the impact of biofortification on nutrition outcomes and ensure accountability. Regular data collection, analysis, and knowledge dissemination can guide evidence-based decision-making, facilitate course corrections, and drive continuous improvement.

The journey towards a healthier, more resilient India begins with the power of biofortified seeds. By embracing these innovative crops, we can combat malnutrition, promote sustainable agriculture, and foster economic growth. It is a collective responsibility to ensure that biofortification becomes a cornerstone of our agricultural and nutrition strategies. By investing in research, strengthening seed production systems, empowering farmers, and fostering partnerships, we can unlock the transformative potential of biofortified seeds and pave the way for a nourished and prosperous future. Let us seize this opportunity to sow the seeds of change and cultivate a nation where every individual thrives with access to nutritious food and a brighter tomorrow.

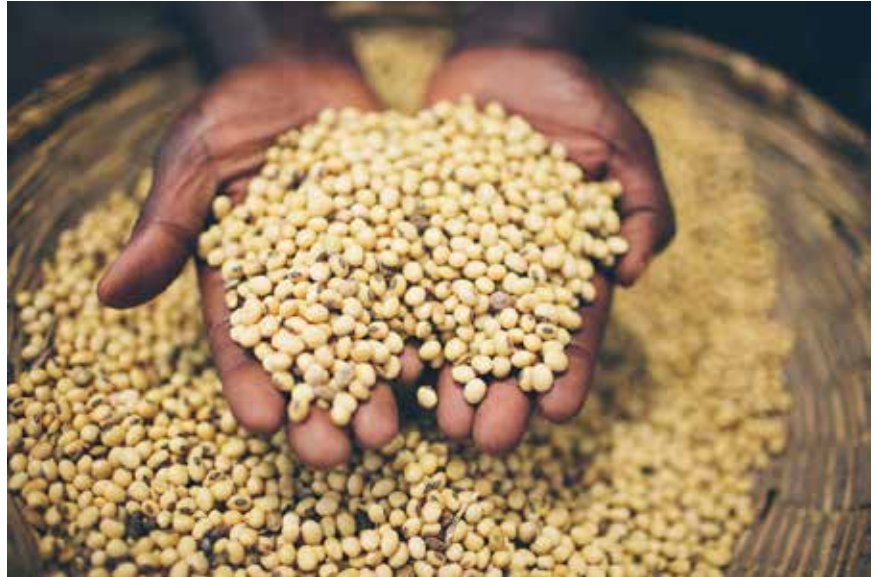
BLOCKCHAIN SOLUTION FOR SPURIOUS SEEDS

Seed quality is the backbone of the food supply chain. Seeds are produced by creating a nucleus with the potential to generate breeder seeds, which are then duplicated in vast numbers to form a seed crop. Seed quality must be maintained throughout the journey to achieve the target output under ideal conditions. Illegal seed practices like false labelling, counterfeits, misrepresentation and under-performing seeds have compromised seed quality. 50% of the seeds available in the markets are fake.

Seed Quality Central to Food Security

Good seed quality determines physical and genetic qualities like purity, viability, vigour, and health. Without the proper regulation and management of the seed value chain, there is considerable threat to food security, sustainable agriculture and farmers' incomes.

Quality seeds are vital input in crop production. Crop status and outcome depend on the quality of the seed. Good



seed is said to develop and increase yields by 20-25%. Besides, they ensure uniform plant stand and uniform maturity providing high productivity with higher market value. Good seed will pre-empt any seed borne diseases and insects. Fewer resource inputs of water, fertilizer, and compost are required, following a decrease in cost and enhanced productivity.

Spurious Seeds in the Markets have a Threefold Effect

The farmer's livelihood, the seed market in the economy, and the sustainable agriculture factor. Seed markets are jeopardized majorly through counterfeits

and illegal seeds.

The seed market was valued at \$58.5 billion in 2020; it is a fast-growing market, which has never-ending needs. To cope with such volumes, productions are being scaled up while maintaining quality. Safety and sustainability have become major tasks. Within the seed market, counterfeits, illegal seeds, mislabelling, tampering, adulterations, and regulatory offenses are the major issues.

Global challenges like climate change, food security, and pest resistance also add on to this. Supply chain disruptions have made the seed industry very vulnerable and prone to uncertainties, with the farmers facing the brunt of these problems. Innovative approaches are required to feed the growing population and assure the farmers of a quality yield and consumers of healthy food. This would also combat the challenges that exist in the demand for growing sustainable food.



About the AUTHOR

Manu Bharadwaj,
Vice President - Growth & Strategy
TraceX Technologies



Technological intervention!

Traceability solutions provide end-to-end transparency through its digitalized data recording systems at each seed development process. The vast market and its variety of seeds have made it difficult to find and remove fake seeds. Farmers are facing difficulties in determining the quality of seeds because of false labelling, lack of regulation, and no proper standards. With the intervention of technology, stakeholders are being more aware of their seeds through backtracking and transparency throughout the seed manufacturing process.

Capturing the seed to shelf forward journey will bring transparency and visibility into the seed supply chain and assure the farmers of a quality seed for agriculture

- Geo-tagging of farmer’s land and verifying the breeder seed origin.
- Recording harvest details, processes followed, chemical and fertilizers details, batch labelling, transfer details, etc.
- Seed processing and grading details are entered along with quality control steps and related certificates.
- Tamper-proof packing with proper labelling, certification stamps, and QR Codes decoding the seed’s journey is printed.
- Proper storage and logistics maintain adequate temperature and moisture control throughout its journey until it reaches the farmer.

Technology has seamlessly integrated the seed value chain and provided a configured system for smooth functioning by providing solutions across the supply chain. Blockchain technology has

emerged as a game-changer in the implementation of end-to-end traceability. The entry of transactions from the source to consumption in digital ledgers enables authenticity and reliable tracking measures. The decentralized, shared platform onboards all the stakeholders in the seed supply chain and help in building mutual trust and transparency. The immutable ledgers avoid tampering with records and can prove as a single source of truth for validating the origin claims.

Benefits of Seed Traceability with Blockchain solutions

- It helps farmers check the genuineness of seed production, seed quality and verify the same.
- Misbranding of seed bags and misuse of seed tags can be eliminated.
- QR coded seed bags assure the farmers of the transparent journey of the seed, thereby ensuring quality.
- Improves credibility of seed manufacturers
- Ensures Regulatory Compliance

Putting Traceability to Test

Professor Jayashankar Telangana State Agricultural University (PJ TSAU) uses TraceX’s Blockchain-powered traceability solutions to trace the origin of seeds and their movement to distributors and retailers.

India one of the prominent seed exporters has been dealing with hoarding, price fluctuations, tampering and a disordered system. The Telangana state was no different; hence TraceX’s Blockchain solutions targeted these issues,

- Distribution & Traceability of Foundation Seeds
- Track and Trace the production

of certified seeds

- Post-harvest buy-back from SSC for Quality testing.
- Packing and Labelling with QR code

How did we solve it?

■ Collaborating with PJ TSAU we started by enrolling farmers from different levels and classes into a single integrated system.

■ Geo-locations of farmlands along with field inspection and soil quality were done.

■ PJ TSAU shared the package of practice through the TraceX app which was later used in recording and sharing data, such as progress, analysis, date, time and harvest conditions.

■ Seeds were subjected to germination testing and results were digitally shared thereafter. After the standards were met, it was certified through PJ TSAU.

■ TraceX ensured that every 25kgs bag was sampled and certified, after which it was sealed tamper-proof along with a non-tearable certified tag, which contained a unique QR code.

■ With the QR Code in place, it was ready for marketing, equipped with traceability and authenticity relating to the seed source, date of harvest, quality, and certification.

Technologies like Blockchain are a breakthrough in the food value chain, providing benefits to all stakeholders across the supply chain, assuring authenticity and trust, and building a safe and sustainable future. The decentralized nature of blockchain ensures that information cannot be tampered with, providing an immutable record of seed transactions. As technology continues to evolve and gain adoption, we can envision a future where spurious seeds become a thing of the past and farmers confidently access high-quality seeds for their agriculture practices.

Together let us embrace blockchain solutions and foster a more reliable and sustainable seed ecosystem for the benefit of all stakeholders involved.

“ENORMOUS OPPORTUNITIES FOR COLLABORATION BETWEEN INDIA AND NEW ZEALAND”



Approximately 140 New Zealand companies are currently doing business with India. The key sectors of engagement with India for New Zealand companies comprise specialised manufacturing, including aviation, services, information technology (IT), healthcare IT; food and beverage (F&B), dairy, agri-tech and hort-tech, wood and lumber. Agriculture forms a very important sector in this engagement. Alongside the exports of New Zealand fruits such as apples, kiwifruit and avocados, seed quality and certification is a sector that has great potential for collaboration between New Zealand and India.

Ms. Mel Poulton, New Zealand's Special Agricultural Trade Envoy (SATE), appointed by the Minister for Trade and Export Growth and Minister of Agriculture, during her visit to India interacted with Ms. Vinita Singh and Ms. Zaman Almas, Agriculture Today. She shared her experience in India and drew parallels between the Indian and New Zealand agriculture. Ms. Poulton's role supports key Government objectives, including raising the value of New Zealand's agricultural goods and services.

Ms Poulton, a farmer and a scholar, is well positioned to speak about New Zealand's domestic agricultural industry, including new innovations in sustainable farming and New Zealand's journey from being a heavily subsidised economy with largely one international market to becoming one of the world's most successful exporting nations. Excerpts from the interview

What are the opportunities that you see in India?

There are enormous opportunities for both India and New Zealand to collaborate. I am here to understand how we can do that. There is lots of potential in Indian and New Zealand agriculture. There are strong agriculture sectors in our countries, which provide opportunities.

The average farm size in India is less than 2.5 acres and that of New Zealand is 200 hectares. How can we draw a parallel between the two countries?

It does not matter how big or small a farmer is, they are proud to do the same things (practise their profession) and produce food and nutrition for people.

We all face challenges; it does not matter in which part of world we practise farming. Challenges like climate change and market opportunity remain the same for farmers around the world. Farmers the world over face challenges in getting products to the market, or meeting market expectations, at the same time as managing the rising cost of inputs.

How was your experience in India?

I am here to learn. I have had a glimpse of the immense knowledge, experience and expertise of people right across the Indian agriculture sector, be they a farmer, a scientist or a government official. I have learnt a little of India's 5000-year-old history with agriculture. There is a lot to learn and explore in India and I am leaving this land with a lot of respect for what India has achieved and is doing to develop their agriculture sector to be more productive and efficient.

What are the areas in which India and New Zealand can partner?

There are a lot of opportunities to partner. We need to build our relationship on what we have already been doing. We need to identify together the things that we can partner on, in a way where we can learn and grow together.



India is the world's largest producer of milk and New Zealand is the largest exporter of dairy. What tips can you give us?

I am not here to tell India what is to be done. I am here to learn and share New Zealand's story. We've learnt that to grow any of our agriculture sectors, it requires an enormous amount of energy across the whole of the ecosystem, including Government, the processing sector, industry groups, cooperatives, the farm-service sector (banking, vets, seeds, fertiliser, farm retail), the farmers, education, science and R&D. Change and growth require strategy and smart implementation of the strategy. It requires governments to work together and create an enabling environment for the private sector and farmers to solve the challenges and grow in a way that is sustainable – socially, environmentally and economically.

We've learnt that for New Zealand to grow and expand or do something different, it requires the whole of the ecosystem to come together to make that possible.

How can there be collaboration between India and New Zealand?

First, we need to understand each other; we need to keep building people to people, business to business and Government to Government relationships. This is happening already through organisations like the India New

Zealand Business Council, our science and research centres, our universities and industry. Then together, we work through the opportunities in which we can both collaborate, learn and grow.

What are your observations on the subsidy guaranteed agriculture being practised in India? Is this hurting or rewarding the farmers?

In the New Zealand context, subsidies were removed from farming in the 1980s. It was hard at the time and it meant a lot of change. Now, our farmers don't want to go back to subsidised agriculture. We have seen the benefits of subsidy removal to increased efficiencies in production, which helps with climate-change mitigation and means less harm for the environment. They are running as profitable businesses, and socially those farms are now able to do a lot to support their families and local communities. We as farmers control our business and our destiny.

How can New Zealand assist India's seed industry in seed quality and certification?

I can't say I know the situation of the Indian seed industry to be able to comment on how we can help. But I can say that New Zealand has done a lot of work in seed certification. We have robust regulatory standards to be maintained and we have a system that our farmers, industry and customers have confidence in.



A Potential Tool for the Sustainable Agriculture in India

Seed is the basic & most critical input for sustainable agriculture and played vital role for overall growth of Indian Agriculture. The Indian domestic seed sector ranks fifth in the world with a turnover of US \$ 2000 million, next only to the USA, China, France and Brazil. The private and public, both sectors contributed significantly for the development of agriculture in India. However public sector dominated the seed market in initial phase and thereafter private sector have been contributing since last more than 3 decades. The seed industry has made substantial investment in seed research and development, processing, quality testing and seed value addition.

A Historical Perspective

The establishment of National Seeds Corporation (NSC) in 1963 marked the beginning of formal seed sector in India and contributed significantly for the growth of seed industry in early years. There are 15 state seed corporations working on seed production and marketing. In addition to the NSC and state seed corporation, ICAR institutes, SAUs and Cooperatives are also playing key role in research and development of new hybrids and varieties of various crops.

These organizations basically meets the seed demand through generation system of seeds multiplication.

The seed industry was dominated by the public sector till 1988 and the growth drivers during this period were, ushering of green revolution and special government schemes to increase seed replacement rate with National Seed Project initiative. The liberalisation of seed industry in the form of New Policy on Seed De-

The timely supply of high quality seeds at the farmer's field is another factor and very critical for enhancing the crop productivity and harvesting the potential yield of particular variety.

velopment (NPSD) during 1988 opened the doors for private seed companies including domestic and multinational seed companies. This has resulted in import of seeds and technologies as well as investment in research and development in India.

Present Scenario

In India, currently, there are around 500 seed enterprises involved in seed production and or seed commerce business. In general private seed companies have concentrated their efforts on development and marketing of high-value, low-volume seeds crops such as maize, sunflower, and cotton and vegetable crops. The public sector is contributing seed business for high-volume, low-margin crops like wheat, paddy, other cereals, oilseeds,

About the AUTHORS



Dr Dev Raj Arya, Vice president, Farm solutions & Dr Vipin Joshi, lead farm solutions (seed quality assurance and R&D) Agrostar, Pune



and pulses and will continue to be dominant in these crops for many more years.

All the seed companies that operate in the country, only few of them have their own R&D programmes and are involved in development of new hybrids and varieties. The rest of the seed companies produce and market the seed of public sector varieties and are not involved in breeder seed production or having their R&D activities. However most of the private seed companies are involved in the production of foundation and certified/ truthfully labelled seed. These companies are also exchanging the germplasm with each other's and selling in their own brand with proper marketing agreement with parent companies. Most of the varieties multiplied and marketed by the private sector companies are from the public sector. In the case of wheat, rice, maize and mustard, more than 300 companies have licensed the varieties developed by ICAR and the quality seed of newly released varieties is being made available to farmers. Some of the companies especially multinationals are also importing seed from Europe or other geography leveraging their foot print.

Maintaining Seed Quality

The seed quality is very important factor for ensuring better productivity. The Government of India had established minimum seed certification standards during 2013, which works as benchmark of quality control for seed by public or private seed sector and plays a vital role for ensuring quality of seed. Many of the companies are having well equipped labs in their facility, however some of the companies are still in developing phase and need to ensure seed quality labs in their premises. The monitoring of the seed quality is essential at various stages of seed production, processing, storage and transportation of seed.

The timely supply of high quality seeds at the farmer's field is another factor and very critical for enhancing the crop productivity and harvesting the potential yield of particular variety. The seed supply clubbed with scientific crop agronomic



With a less than 2% share in global seed export, we have not yet explored the export potential of seed to neighbouring countries

advisory and providing other solutions of their field problems also plays critical role for getting better yields.

With a less than 2% share in global seed export, we have not yet explored the export potential of seed to neighbouring countries. India has also exhibited its potential to grow many kinds of seeds produced in different parts of the world creating greater interest for not only Indian seeds but also identifying India as a hub for undertaking custom seed production for a good number of interested countries because of its trained and skilled manpower and low cost of production.

Suggestions to Empower Indian Seed Industry

- Policy framework to promote collaborative research between public and private seed industry at national and international level including germplasm exchange
- Making Indian seed industry globally competitive with the required policy reforms in the seed regulation in the country for export
- Government intervention in Global

seed demand generation and supporting seed producers by providing incentives for meeting the demand and generating foreign exchange

- Focus on infrastructure development particularly quality assurance lab and seed storage capabilities
- Government policies to promote investment in seed R&D and infrastructure and help industry in providing access to international markets.
- Ensuring favourable regulatory environment for Genetically Modified crops and introduction of various novel technologies such as herbicide tolerance, nutritionally enhancement, drought tolerance etc.
- The public sector seed industry has to be revitalised to address the present day challenges of competitiveness in R&D, development and protection of new varieties and efficient technology transfer systems.
- Smooth flow or germplasm exchange between public and private sector and or within private sector entities must be encouraged
- Strengthen and leverage weather forecast & pest prediction system for planting and harvesting of seed production fields.
- E-commerce platform need to be promoted for effective seed supply chain and educating growers about best agricultural practices.

UMMEHAANI KHORAKIWALA

MANNING THE SEED BUSINESS

An experienced retail consultant and the person behind the resurrection of the famed Akbarallys chain of Mumbai, Ms. Ummehaani Khorakiwala is the talk of the seed sector for all the right reasons.

Hailing from the reputed business family, Ms Khorakiwala's entry into the family's agro chemical business, Biostadt wasn't surprising. But plunging into a completely different sector was pure bravado, that too when there aren't any other women in seed business.

Stepping into Seeds Sector

"My father had a joint venture in the seed space. But it had dissolved. He bought a small seeds company in Ahmedabad called Nandi seeds which mainly sold Bajra. The idea was that we are in the chemical stage and the engagement with the farmers begins at the seed stage. He asked me to come over and help him get through the merger, considering my experience in the retail space."

Ummehaani, at that point was basking in the glory of the success of AKbarally's revival and managing the multitude of convenient stores in the HP outlets. "I was brought in for a special project. While our parent company was selling agrochemicals and our flagship product, 'Biozyme', it was our first step into a seemingly new vertical, seeds. When Nandi seeds was bought, I was called into smoothen the process of merger. Quite honestly I was happy. It is a very fascinating and a difficult business. That is why I never left."

Biostadt acquired Ahmedabad based Nandi seeds in 2012. They mainly sold Bajra and Castor in Rajasthan and Gujarat. With Umme-



haani on board, the company grew more than 10 fold in ten years. Their product range has expanded and they sell wide range of quality seeds of Bajra, Paddy, Castor, Mustard, Cumin, Corn etc. Today Nandi seeds is the fastest Bajra growing company with the brand Nandi Bajra. They are also expanding their territory into Southern India.

“We bought a brand called, Biogene. That gave us entry into the southern states of Andhra, Telangana and Karnataka. It will further open the doors to Tamil Nadu as well. Our seed business is going well and last year we were growing at 38% and this year I am sure it will be around 50%.”

Good R&D for Better Yields

A Bachelor of Science in Managerial Economics from The Carnegie Mellon University (2002) and a Masters in Textile Marketing & Engineering from The Fashion Institute of Technology, New York (2003), Ummehanni is also well informed about the seed sector and its challenges. “I see the seed sector in India as a snake, where the head represents the organised sector and the long tail the unorganised segment. Seed sector is a highly unorganised space and this is a big challenge. Our yields are some of the lowest. A good R&D can only ensure higher yields. Organised sector is spending a good amount of money on R&D. Apart from yield there are several other challenges that we need to brace especially that of climate change. R&D can play a major role in that as well.”

Seed Dearth in Millets

Ummehanni considers millets as a great crop from nutritionally and agronomically. “From consumption point of view it is still a poor man’s food and not widely consumed. In India, Bajra is the largest cultivated millet. There are no organised players handling with the seeds of these millets. Acreages haven’t changed as long as I have been in business. I think if the consumption pattern change, millet is a fantastic food. If there is a demand for the millets among the consumers, farm-



Many years back I had stopped thinking me as a woman in business. I consider myself as a person having a job which I have to do to the best of my ability.

ers will cultivate and there will be demand for seeds.”

Government Intervention required in Cotton and Oil Seeds

Oil seeds and Cotton are two areas where we are awaiting government intervention. India is not self-sufficient in oils and our oil imports run into billions. In some crops especially, cotton, there is a technology stagnation. We are stuck at Bt II. Cotton is facing a lot of biotic stress as the Package of practises have remained the same for years. We need government intervention or guidance.

Into the Future

Nandi seeds is associated with ICRI-SAT, ICMR and ICAR, especially in

rice, corn. Their own research station in Ahmedabad, Alwar, Hyderabad and Himachal Pradesh are intensely invested in research. Their access to huge germplasm base has given them an upper edge.

“We will be working on Mustard, Corn and Rice. India needs to be self reliant on oils. So I am going to be bullish on Mustard and we will be taking mustard in a big way”.

As the only woman in Seed Sector Business

Many years back I had stopped thinking me as a woman in business. I consider myself as a person having a job which I have to do to the best of my ability. I travel to tiniest and farthest of the villages. Only difficulty that I had faced in that situation would be the availability of restroom for women. In this business being a woman has not endowed me with any special privileges. I have only worked with men. But I would love to work with women and want to see more of them in this space. This is the job for the most capable.

Mother of two boys, Haider and Hasan, Ummehanni loves to dive and trek. She loves to travel.

ADOPTION OF NEW TECHNOLOGIES IN AGRICULTURE

THE NEED IS GREATER THAN EVER

Bt technology has reportedly been responsible for the biggest impact on agriculture anywhere in the world, enhancing farmer incomes significantly.

The formidable challenges faced by Indian agriculture in the 1960s and 1970s are well documented, and thanks to inspired vision and policy-making, and decisiveness, the country transformed itself into the agricultural powerhouse it is today. We are champions in volumes of commodities produced, yet we still face several limitations including lagging productivity in major crops, and competitiveness in world markets. While great strides have been made on many fronts including crop ge-

netics and seed quality, the challenges that farmers face remain much the same as in the time of the Green Revolution – soil health, pests, diseases, and water availability at the right time.

New Technologies and Conducive Policy Environment

Significant advances have been made when the policy environment has allowed innovation and game-changing technologies to emerge. The Green Revolution has been alluded to, but a more recent example is when biotech (GM) insect-resistant Bt cotton was released in India in 2002, followed by its second generation version in 2006. This technology has reportedly been responsible for the biggest impact on agriculture anywhere in



About the **AUTHOR**
Bharat Char
Chief Science Officer, Mahyco
Private Limited, Jalna

the world, enhancing farmer incomes significantly. Farm income gains during 2002-2018 are estimated to be around USD 24 billion. Unfortunately we have not followed on this success with new biotech advances in cotton itself, let alone in other crops, which present equally significant opportunities.

Edible oil imports and how to address them are currently a focus of attention. Increasing productivity in soybean is one example, where biotech interventions such as herbicide-tolerance and insect-resistance can lead to significantly greater farmer income and adoption, as seen in other parts of the world.

Advances in agronomy can also deliver major gains. High density planting systems (HDPS) in cotton combined with mechanical harvesting can increase yields by 25-40% over current practices. This entails breeding for plant types that are suitable for close planting and mechanised picking of the bolls. A number of major cotton producing countries have successfully adopted these methods. HDPS combined with the introduction of improved genetics and new traits would bring in a second revolution in cotton in the country.

Genome Editing - A Clear Way Forward

Genome editing is a set of new breeding techniques (NBTs) that offer scientists and breeders a slew of opportunities to improve productivity, pest and disease resistance, nutritional profiles and the architecture of crop species. The positive regulatory decision on this technology taken by the Govt of India will enable innovation in breeding and is a significant encouragement to the agri-biotechnology space, both in the public and private sectors.

An example to consider is improving the shelf-life of tomatoes after harvest, allowing better transportability and reduced post-harvest losses. Similarly, gene editing can enhance lycopene content in the tomato fruit, important both from health and processing industry standpoints. Large-acre crops such as rice and



High density planting systems (HDPS) in cotton combined with mechanical harvesting can increase yields by 25-40% over current practices.

wheat can be enhanced with these new breeding techniques to be sturdier, having higher yields, and drought and salinity tolerant. Further, NBTs offer potential solutions to long-standing disease problems such as sheath blight in rice which are difficult to address conventionally as well as a whole host of viral diseases in vegetables.

Farm Digital Tools on the Rise

On the digital agriculture front, there is a great deal of activity and excitement, with a burgeoning startup ecosystem in this area in the country. We are witnessing an increased use of IoT on farms, digital tools in improving farmer reach to sell produce, enabling accurate data capture and seamlessly delivering it to the end-user enabling them to make the right decisions on the farm. As of today, there is much promise but the hard work of delivering on the promise remains. Here again, an enabling policy regime related to UAV use, for example, would widen the use and commercial impact on small farms rather than restrict efforts to research-level type activities.

Climate Change – The New Normal

Finally, no discussion on technology in agriculture would be complete without talking about the biggest challenge we face as a planet. The effects of climate change are a reality we see on the news every day. Extreme weather events, changing rainfall patterns and temperatures are the new normal. Agriculture faces knock-on effects of this in the form of changing pest and disease incidences, droughts and floods, and hostile temperatures. While climate-resilient crops have been in discussions in scientific circles for years, the rapidity in the advance in the change in environments is extremely concerning. These developments make it even more imperative that new technologies are tested and implemented on the farm in the most efficient way possible.

Each of the technology approaches cited in this article can play a role in crop-loss mitigation or productivity enhancement. One can visualise these as tools in toolbox, which can be put to best use when and where needed. Looking at the current scenario, delays in implementing innovations on the farm will only put us at a disadvantage.

The ability to evaluate available new technologies (agronomy/biotech/digital) in agriculture and have an enabling policy environment would help us achieve our goals of food and nutritional security in the face of the challenge of climate change. This will help meet our internal needs as well as make our agricultural products competitive in global markets.

DEARTH OF QUALITY PLANTING MATERIALS

“There is dearth of quality planting materials in floriculture. The planting materials are expensive. So bulk order would cost a huge amount. So what we generally do is that we take our preferred varieties to tissue culture labs to get it multiplied. Unfortunately we do not have standardised facilities here to get pure planting materials,” says Madhu, a floriculture farmer from Kerala.

Madhu Shankar, a native of Trivandrum, in his farm of 5 acres at Navaikulam, Kollam has a brilliant collection of orchids, Heliconia and cut foliage. Varieties of Aranthra orchids such as, Annie black and James Storie, Arachnis orchids such as red ribbon and yellow ribbon and Terete Vanda flourish in his farm. His journey with flowers started in 2000, when his trip to Middle East in search of a job was uncertainly cancelled in the aftermath of Kargil war. He started a small shop upon the advice of his mentor, Ajay Sudhakaran, who himself was an established floriculturist. “I started with the seconds from Ajay’s farm which he gave me free of cost. It brought me a good clientele. He later on encouraged me to cultivate flowers in my

Floriculture is capital intensive. Getting credits for beginners can be difficult



Unfortunately we do not have standardised facilities here to get pure planting materials



to scale up the production and therefore area.”

“Getting farmers to cultivate in large areas means owning them. That may not be feasible for everyone. So, most of the farmers end up leasing the land. Floriculture has a long gestation period. You do not get to harvest the flowers within a few months. You need to develop the land, erect the nets and make many other infrastructural changes. By the time the farmers start getting profit, the lease time will be over. The landowner can ask him to vacate. So the investments and the time devoted in it by the farmer will be lost. The owner may be diverting the land for some other purposes. What a waste of resources!”

Madhu proposes government intervention. “The government can demarcate an area and lease it out to farmers. That area should only be reserved for floriculture. So even if one farmer leaves another one can take over. The land that he has prepared, the land that he has developed need not go waste. If efforts like these are done, I am sure that India can emerge as a leader in floriculture.”

Floriculture is a capital intensive. Getting credits for beginners can be difficult. Also there is a requirement for skilled labour. These things have to be looked into if we want more farmers to venture into floriculture, according to Madhu.

Otherwise it is a lucrative business. Madhu has a turn over of Rs.4,00,000 per month. He is able to give employment to around 11 people and sometimes more depending on the farm operations.

“The basic thing you need is your passion. That is the only one that can sustain you in this sector. If you are looking for a fast income you are in the wrong place”.

own farm. “

Buying a land at that time was not an economical proposition for him. He did the best next thing. He leased a land of 50 cents in Trivandrum and began the journey of a floriculturist. The experience from this venture gave him confidence. He decided to buy land for cultivation.

Thorns in the Path

A commerce graduate, Madhu identifies some inherent problems of the sector. The sector is no place for small scale cultivation. “There is also huge demand for flowers and most often the quantity required. For profits to be realised we need



ZARAAT - MINIMISING POST HARVEST LOSSES MAXIMISING RETURNS

TEAM ENACTUS



Beneath the apparent tranquility in parts of rural India, the farming communities are suffering in silence.

Farmers form the backbone of the Indian economy, making up 60% of the workforce. They are tasked with feeding over a billion people, making their contribution to the growth and development of the nation invaluable.

Dismal Scene of Post-Harvest Losses

However, statistics paint a rather dismal

picture. Despite being the second largest producer of fruits and vegetables, India imports produce worth Rs. 1.47 lakh crores. Post-harvest losses amount to agricultural losses of Rs. 93,000 crores per year, a figure close to 40% of the country's produce. In terms of volume, the amount of fresh fruits and vegetables that India loses every year is the same as the amount consumed by the people of the United Kingdom in one whole year. In other words, what they consume, we waste. This is reflected by India's low rank of 97th in Oxfam's food availability

index while 101st in the Global Hunger Index.

Project Zaraat - Genesis

In Chilla village, a community of 3000 small and marginal farmers, we met Jag-anlal who barely made up for his cost of production by selling in mandis. Making profits seemed like a far-fetched dream for him and fellow farmers.

To better understand the plight of this community, we assessed the current alternatives available to the farmers, and found that India oversees a gap of 84-

99% in achieving the target of improving its storage facilities. Out of the ones that do exist, 75% store only potatoes. We observed that the current storage solutions were expensive, inaccessible and not environment friendly.

Identifying a gap in the market for an eco-friendly and affordable storage solution, we initiated Project Zaraat.

Zaraat aims to minimize post-harvest losses by providing a portable storage solution, and enhancing forward linkages, through a self-sustaining social enterprise. In association with our storage partner, Saptkrishi, we innovated a 250 kg capacity portable storage which extends the shelf life of the produce by up to seven days.

Working on the principle of evaporative cooling, it creates a micro climate and inhibits the decaying factor of the vegetables. It maintains a lower temperature inside the storage and ensures the right amount of humidity to preserve the freshness of produce. It contains ethylene gas converter which slows down the ripening process.

In collaboration with Indian Agricultural Research Institute, we were able to refine our storage according to the needs of the community. Impressed by our ef-



Zaraat aims to minimize post-harvest losses by providing a portable storage solution, and enhancing forward linkages, through a self-sustaining social enterprise.

orts, they have agreed to serve as our knowledge partners and helped us get in touch with the agricultural department of Michigan State University who are mentoring and helping us delve deeper into the problem of post harvest losses.

Our 5-Step Model

Zaraat has now evolved into a 5-step model.

- We start with Community Identification wherein we conduct ground surveys in farming communities who deal with fruits and green vegetables.
- Farmer Mobilization drives are then carried out to explain the working and benefits of our storage.
- Our affordable eco friendly storage solution is then set up in the farming community.
- Our entrepreneurial model functions on, 'by the community, for the community model'. Our storages are maintained by our farmer entrepreneur who is also responsible for book-keeping of the produce stored.
- They participate in a one week long articulate training module where they are taught skills like book-keeping, stock management and financial literacy.





Zaraat portal, a one stop solution for the farmers to easily access our very own curated database of resources allowing them to purchase agricultural inputs at a cheaper rate. To ensure ease of access, we trained our farmers on the use of this portal. For farmers like Jaganlal, it is now as simple as connect, browse and order.

To venture into the B2C model, we organized Zaraat Mart to sell the farmer's produce directly to the consumers. This 2 day event proved extremely successful having sold more than 350 kgs of produce, generating a revenue of Rs 10000, and a profit of Rs.3000 for the farmers.

Wide Acclaim

Seeing our zeal and passion for social entrepreneurship, Adani Foundation has agreed to serve as our financial partner. This will help Zaraat reach greater heights. To ensure the project's sustainability, our farmer entrepreneur will evolve as the overseer of the project. Allowing them to take matters into their own hands, we will transfer the ownership of our storage to our entrepreneur after recouping our investment.

Staying true to our aim, we have reduced post-harvest losses by a whopping 60%, and minimized energy consumption by 20%. Generating a revenue of more than Rs. 3.7 lakhs and directly impacting the lives of more than 250 farmers, Zaraat has now become a harbinger of hope for farming communities across 3 states.

Enactus DCAC has also represented India at the Enactus World Cup 2022 held in San Juan, Puerto Rico with our flagship Project Zaraat.

Project Zaraat was one of the finalists in two of the Enactus Global Races, i.e., Race to Feed The Planet and Race to Climate Action out of a pool of 90+ teams from 16 countries. And we Feel ecstatic to announce that it later emerged as the Runners up in the Race to Feed the Planet Competition and also bagged a price money of \$10,000. The Competition saw a Participation of 91+ entries worldwide and witnessed judging by a diverse and esteemed Panel of judges.

Opportunity-Cost Analysis

We have held successful meetings with B2B companies such as Crofarm, Zomato Hyperpure and restaurant chains like Pind Baluchi. We have already collaborated with Bijak wherein we have integrated our farmers into an Online Agri Commodity Trade platform.

This 5-step model has become the hallmark of Project Zaraat. We charge our farmers on a "pay as you store basis" for the storage solution with a minimal charge of Rs.1 per kg of produce stored everyday. This allows the farmers to utilize the storage without having to bear the burden of the entire cost. Out of the revenue generated, 70% goes to the entrepreneur allowing him to earn a sustainable income of Rs. 6,300 while the rest is equally divided between recouping our storage cost (15%) and for reinvestment purposes (15%).

Scaling Up

Starting from Chilla Village in 2021, Zaraat has now expanded to four other farming communities including two states – Haryana and Uttar Pradesh.

Working with such a diverse number of farmers required us to find a mechanism to monitor the data of all our beneficiaries. We have streamlined this process by conducting digital profiling in as-

Generating a revenue of more than Rs. 3.7 lakhs and directly impacting the lives of more than 250 farmers, Zaraat has now become a harbinger of hope for farming communities across 3 states.

sociation with Samunnati, India's largest agri tech enterprise.

We surveyed the farmers for relevant information on various parameters such as land size, equipment available, livestock possessed etc. after which the platform provides us with predictive analysis. This gives us useful insights regarding crop cycles, harvesting time and resources available which can help prevent further losses.

Realizing that crop productivity is inadvertently based on soil health, we leveraged on the invaluable experience of our channel partner – Kisaan Helpline by conducting soil testing in its accredited laboratory.

Zaraat Portal

Witnessing the global shift towards digital agriculture gave rise to the idea of



About CACL

Concept Agrotech Consultants is a professionally managed private limited company, providing a wide range of consulting services in agriculture sector. Launched as a private limited company in 1994, CACL has come a long way in providing knowledge-based services to the agri-business sector. A dedicated team of qualified professionals with requisite experience, field network and extensive database of people associated with agriculture at various functional levels, the company is capable of accomplishing any assignment successfully. Over thirty agribusiness clients today acknowledge the company's quality and reliability of services.

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To know more, please Contact :

Mr. Anupam Rai

Division Head – Business Services

Mob : +91 9311983204

Email : anupam.rai@cacl.in

Mr. Rahul Singh

Division Head – Farm Services

Mob : +91 7827947370

Email : rahul.singh@cacl.in

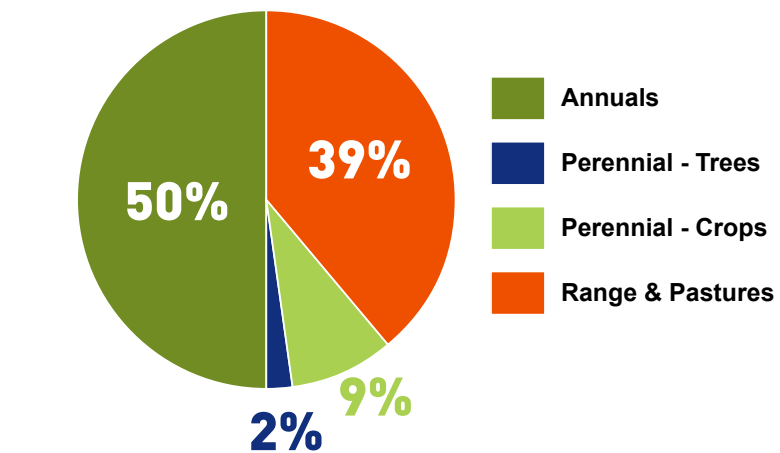
QUALITY FODDER SEED PRODUCTION AND CONSERVATION

In India, grazing-based livestock husbandry plays an important role in the rural economy as around 50% of livestock depend on grazing. Cultivated forage and range grasses and legumes are crucial for the nutritional security for mankind. Furthermore, the crops and horticulture sector will not be able to meet the nutritional demand of nearly 1.30 billion human populations. Thus forages constitute the base of a complete food chain and are a source of protein, fat and nutrition to human being through intermediaries like cattle, buffaloes, sheep, goat, pigs, poultry etc.

The total area under cultivated fodders is around 9.0 million ha or approx. 4.8-5% of the total area. Area under permanent pasture and other grazing land is around 15 million ha. At present the country faces shortage of green fodder, dry fodder and concentrates. Estimates vary from agencies to agencies and method of estimation. Some agencies put it at a net deficit of 35 per cent green fodder, 11 per cent dry forages, and 44 per cent concentrates.

Dairy sector in India is growing faster as compared to other agricultural sectors. Milk has become the largest agricultural commodity and value of only milk is estimated to be More than Rs.8 lakh Crore.

In a dairy farm maintenance it is estimated that feed and fodder cost is around 65%, labour cost around 10%



and rest is on animal maintenance, vaccination, medicine, insurance etc. Thus green nutritious balanced fodder can reduce the costs of production thereby increasing the profitability.

Trend of Fodder Production in India



With increasing urbanisation, purchasing power and health awareness, the demand for food from animal sources in the form of milk, meat, egg. etc. is projected to rise rapidly, thus offering opportunities for enhancing agricultural income and reduction in rural poverty through dairy based farming.

There is a vast scope of private investment and development of small business models to generate employment and make available the various ingredients for running successful dairy and other livestock-based enterprises. Fodder based cheaper feeding strategies are required to reduce the cost of quality livestock product as the feed alone constitutes 70% of the milk production cost. There is tremendous pressure of livestock on available total feed and fodder, as land available for fodder production has been decreasing.

To meet the current level of livestock production and its annual growth in population, the deficit in all components of fodder, dry crop residues and feed has to be met either from increasing productivity, utilizing untapped feed resources, increasing land area (not possible due to human pressure for food

About the AUTHOR

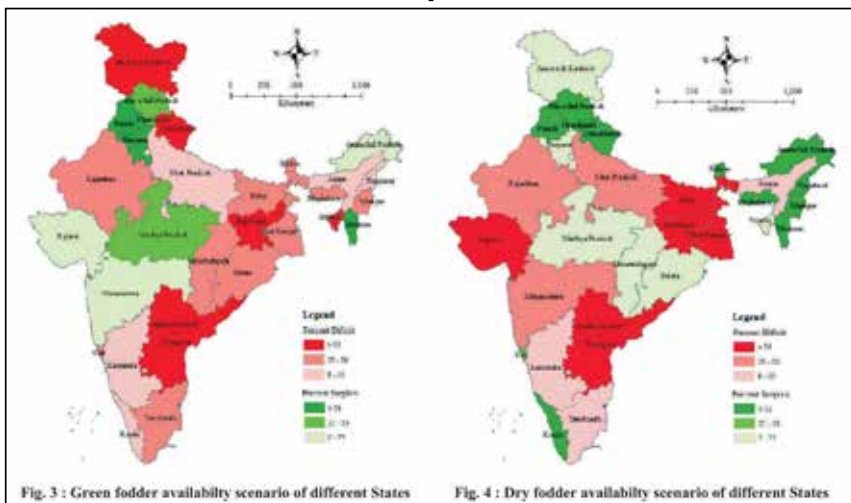
Prabhakar Babu. G.,
CEO, Foragen Seeds Pvt. Ltd,
Hyderabad

Fodder Deficit Statistics

Attributes	Forage Resources (million tonnes)			
	Present		Year 2050	
	Dry	Green	Dry	Green
Demand	508	816	631	1012
Supply	453	525	547	826
Deficit	55	291	83	186
Deficit %	11%	35%	13%	18%

IGFRI – Vison Doc-2050

State wise heat map of fodder scenario



crops) or through imports. In animal feed supply, coarse cereals have a major role and four major cereals viz., maize, barley, sorghum and pearl millet account for about 44% of the total cereals. Production of these cereals is stagnating at around 30 million tonnes. To meet the feed requirements there is a need to improve productivity of these cereals.

Policies – Impact in Research and Production:

There are multiple departments involved in fodder seed research, production and



Private companies needs to have a “Collaboration” with public institutes to develop new genotypes, acquisition, conservation and effective utilization of fodder biodiversity.

distribution. In India almost 55 crops are fed as fodder to animals and many institutes are involved in research of those crops. Even though IGFRI is the premium institute for fodder crops research and development, many important crops are still under different research institutes. Fodder crop research and development is under agriculture department whereas the utilisation and supportive scheme are under Animal Husbandry department.

A better coordination and single window system is needed to counter the fodder seed problems in India. In 2022 industry produced 1,50,000 Mt of fodder seed and distributed in all required states. As per the statistics still the demand and supply gap persists. To mitigate the deficit a nodal agency should be formed and bring all demand and supply stakeholders should be brought under one place.

The contribution from public research institutes are very well acknowledged by farmers, and still highest selling fodder varieties are bred by public institutes. But in recent times, many private companies are investing in R&D of fodder crops and releasing high yielding hybrids in many fodder crops.

Role of Public and Private Sector

Since fodder crops are more of volume and less of value, many private companies do not focus on germplasm collection and breeding. On the contrary, public institutes have very rich and diversified germplasm in fodder crops. Private companies needs to have a “Collaboration” with public institutes to develop new genotypes, acquisition, conservation and effective utilization of fodder biodiversity. ICAR released more than 250 forage crops varieties in berseem, lucerne, cowpea, guar, field bean, oats, pearl millet, Cenchrus, Dinanath grass, guinea grass, Sehima, Chrysopogon, Heteropogon etc. As Joint venture PPP projects can be worked out through advanced biotechnological approaches to develop new varieties in Lucerne, Berseem, Napier and BNH hybrids to get seed material.

TURNING VISION INTO BUSINESS

Agriculture has always been an essential sector in many economies, and it is no secret that it plays a significant role in ensuring food security. The industry has seen a significant transformation over the years, with entrepreneurs coming up with innovative ideas to improve the sector's efficiency. One such entrepreneur is Vivek Mishra, a young man who has made a name for himself in the agri-business industry.

Vivek comes from a middle-class background and had a passion for agriculture from a young age. However, he did not pursue his passion immediately and instead opted to go to college for higher studies and pursue a degree in

Vivek's success can be attributed to his determination and willingness to take risks

Management. After MBA, he landed a job in a reputed multinational corporation in healthcare industry where he worked for around 14 years. Despite his success in the corporate world, his passion for agriculture never dwindled. While traveling for his company to different corners of India, Vivek always kept in his mind that he wanted to do something different in life. During the conversation with his colleague doctors, Vivek realized that if there is good and pesticide-free agricultural production, then the number of dialysis patients can be reduced to a great extent.

After fourteen years, Vivek decided to leave the high paying corporate world and pursue his passion in the agri-business sector and to do something that aligned with his interests. He had always wanted to do something for the small farmers and thus make a difference in the industry. He knew that it was time to take the leap of faith. Vivek started a FPO and bought some farming equipment. He began helping the farmers on a small scale. After the initial opposition from the family members, Vivek gained everyone's faith.

A Steep Learning Curve

Vivek's first few years in the agri-business industry were not without challenges. The learning curve was steep, and he had to work hard to understand the dynamics of the industry. However, his passion and determination kept him going, and he gradually started making progress.

Vivek learned the basics of organic farming, for which he met progressive farmers, agriculture scientists and district and state agriculture officials, and their



guidance paved his path. Vivek quickly realized that to be successful in the agri-business industry, he had to be innovative and find ways to increase efficiency. He began experimenting with different farming techniques and technology, which helped him increase his yields and reduce costs. He also started networking with other farmers and industry experts which helped him gain more knowledge and access to new markets.

Genesis of Tamkuhiraj Progressive Farmer Producer Company Limited

Meanwhile, he came to know about FPO, the most ambitious scheme of the central government to double the income of the farmers and Tamkuhiraj Progressive Farmer Producer Company Limited was born under the guidance of SSC.

Vivek believes that the biggest problem of today's farmers is lack of awareness and not getting fair market price of agricultural products. Over the years, Vivek's business grew, and he expanded his farming operations to other regions. He diversified his operations and ventured into other areas such as agro-processing and value addition. Today more than 500 farmers are involved in his FPO which has helped them to reduce the cost of agricultural production and get more value for their produce. For this, Vivek has opened a seed and fertilizer shop through FPO, where seeds and fertilizers are provided to the members at a subsidized rate, which will reduce their production cost.

In the sugarcane dominated area, Kushinagar he also started production of organic jaggery with the name "Kushinagar Kolhu Jaggery", which includes ingredients like turmeric, cardamom, basil, jamun, etc. In the last 2 years, business of up to Rs 4000000 has been done through this group. There is availability of vermicompost and fresh milk of sugar mill at FPO's retail counter. The FPO has a bank of state-of-the-art farm machinery which is available on rent at concessional rate to the members of the FPO.



Today more than 500 farmers are involved in his FPO which has helped them to reduce the cost of agricultural production and get more value for their produce

An Inspiration to Youth

Today, under the guidance of Vivek, many youngsters are working as entrepreneurs in the field of fish farming. Today 8 employees have got direct employment and about 50 are indirectly employed through FPO.

Vivek's success story is an inspiration to many youngsters who come from middle-class backgrounds and aspire to be entrepreneurs. His story is a testament

that with hard work, determination, and a bit of innovation, anyone can achieve success in any industry they choose. Vivek's journey also highlights the potential that lies in the agri-business industry and the need for more young people to venture into this sector.

Future Ready

Vivek plans to invest in modern equipment to help him manage his growing business. He is also planning to use modern technology such as drones and soil sensors to monitor crop health and yield.

Vivek's success can be attributed to his determination and willingness to take risks. He did not let his lack of experience in the field hold him back and instead used his management skills to his advantage. He also recognized the importance of adopting modern technology and natural farming techniques to produce healthier and sustainable produce.

FOSTERING INNOVATION IN INDIAN AGRICULTURE AND SOCIAL IMPACT STARTUPS

Insights from an IIMB NSRCEL Interaction

NSRCEL is an entrepreneurship center and start-up incubation hub that aims to provide a safe platform for aspiring innovators across the country.

Established 20 years ago with the support of a grant from Mr. N.S. Ra-



ghavan, one of the founders of Infosys, the centre's primary vision was to encourage entrepreneurship as a legitimate career choice and to bridge the gaps in the entrepreneurial ecosystem, especially in underserved clusters. "NSRCEL aims to create a safe space for innovators to iterate on their business models, become entrepreneurs, and ultimately build scalable ventures. As of today, NSRCEL has created impact and extended their presence to 25 States and 4 Union Territories in the country," says Mr. Anand Sri Ganesh, the COO of NS Raghavan Center for Entrepreneurial Learning (NSRCEL) at IIM Bangalore.

Promoting Innovation in Different Forms

According to Mr Ganesh, innovation in the startup ecosystem can be categorized into two main types in the changing Indian context. The first type involves innovation emerging from research and development (R&D) activities, often in academic institutions and science labs. These innovations result in patented technologies and intellectual property that entrepreneurs seek to commercialize and bring to the market.

The second type of innovation focuses on business model innovation, particularly in the agricultural and rural entrepreneurship domain. These innovations leverage technology to create affordable and accessible business models that cater to remote corners of



the country. They aim to increase awareness, adoption, and the overall quality of life for consumers.

Supporting Start-ups through Incubation

NSRCEL's core work lies in the early years of start-ups, typically from inception to around 4 to 5 years. During this phase, start-ups are still refining their technologies, business models, markets, and teams. The incubation process consists of two primary stages: idea-stage incubation and revenue-stage incubation.

In the idea-stage incubation, NSRCEL helps founders crystallize their ideas into viable business models. The focus is on validating the innovation, creating minimum viable products (MVPs), and gaining initial customer acceptance. The revenue-stage incubation, which constitutes the majority of NSRCEL's work, assists start-ups in fine-tuning their products, achieving product-market fit, and building the necessary organizational infrastructure for growth.

Example: Neoper, an Agri-Tech Start-up Revolutionizing Soil Testing

To illustrate NSRCEL's incubation process, N Ganesh draws attention to example of a start-up called Neoper. Neoper, founded by students from IIT Patna, developed a chipset based on Texas Instruments' architecture. The chipset enables farmers to analyse soil nutrients, such as nitrogen, phosphorus, and potassium (NPK), and trace minerals before the crop cycle begins within 15-20 minutes. NSRCEL supported Neoper in validating their innovation, refining their product, and navigating the journey towards product-market fit.

The Role of Social Impact Ventures

N Ganesh emphasizes the significance of social impact ventures in addressing social, economic, and environmental challenges. He highlighted the diverse range of innovations seen in sectors such as education, finance, healthcare, artisan communities, and quality of life improvement. "The proliferation of ideas and innovations in the social impact space is driving positive change in society".

Grassroots and Crossover Talent

Ganesh points out that both grassroots innovators and crossover talent play a crucial role in driving the impact space. "Grassroots innovators are individuals who come from rural areas or marginalized communities and return to their roots to address the challenges faced by their communities. On the other hand, crossover talent refers to individuals from urban areas who possess the resources and skills to create scalable impact ventures in rural or underserved regions."

Voyage EduCare Foundation started by three engineers who, instead of joining prestigious companies, started this venture to enhance the quality of education in low-income schools in Kargil, Leh and subsequently expanded to other regions.

Challenges in the Social Impact Space

While the social impact space in India is thriving, it faces several challenges that hinder its growth. One major challenge highlighted by Ganesh was the infrastructure gap in the policy environment. "For social impact entrepreneurs to succeed, they often need to work with the government. However, the lack of clear mechanisms for collaboration between

entrepreneurs and government institutions creates obstacles in leveraging the government's reach and resources. This leads to inefficiencies and impedes the scalability of social impact ventures, which initiatives like NSRCEL and its collaborations are trying to solve".

Scaling barriers faced by many social impact startups is also another challenge. "While some ventures may achieve success at a certain level, scaling up to reach a broader impact becomes complex. Different business models, organizational capabilities, funding models, and distribution channels are required to expand the reach of these ventures. Many founders struggle to overcome this scaling barrier, which may necessitate reinventing their organizations and strategies".

Opportunities and the Way Forward

There exist immense potential and opportunities for social impact entrepreneurship in India. The engagement of social impact ventures with the government can drive systemic change and create a more favourable policy environment. Establishing institutional frameworks that facilitate collaboration and streamline processes would enable entrepreneurs to work efficiently with government machinery. This, in turn, would help leverage the government's scale and impact.

Incubators and support organizations like NSRCEL also have a crucial role to play in nurturing and guiding social impact startups. They can provide the necessary resources, mentorship, and network connections to enable ventures to overcome scaling challenges. Additionally, building a robust funding network specific to the social impact sector would further empower entrepreneurs to achieve significant scale.



Celebrating

THE POTENTIAL OF NUTRI CEREALS

The United Nations has declared 2023 as the International Year of Millets, recognizing the vital role this ancient grain plays in providing nutrition, food security and livelihoods to millions of people around the world.

Millets are a group of small-seeded grasses that have been grown and consumed by humans and which can grow in a variety of adverse environmental conditions, making them an ideal crop for small-scale farmers in developing countries. The International Year of Millets aims to raise awareness of the nutritional and health benefits of millets and their potential to contribute to sustainable agriculture, climate change adaptation and poverty reduction. It also aims to promote research and development of new millet varieties, value addition and market linkages to increase the production, processing and consumption of millets globally.

The International Year of Millets presents an opportunity to revive the cultivation and consumption of millets particularly in regions where they have been neglected or underutilized. By promoting the diversity

The International Year of Millets presents an opportunity to revive the cultivation and consumption of millets particularly in regions where they have been neglected or underutilized.

of food crops, the year aims to contribute to the achievement of the Sustainable Development Goals (SDGs), particularly SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being). The year will also provide a platform for dialogue and collaboration among governments, international organizations, civil society, academia and the private sector to address the challenges facing millet farmers and to support their sustainable livelihoods. It will also highlight the role of women and indigenous communities in the conservation and promotion of millets, as well as the need for policies and investments that enable their participation and empowerment.

Millet Benefits

Millets are rich in fiber, protein, vitamins, and minerals, making them a highly nutritious food

About the AUTHORS

Gurinder Singh, Department of Agronomy, Punjab Agricultural University, Ludhiana,
Rakshit Bhagat and Deepali Bakshi
Department of Entomology, Dr YS Parmar University
of Horticulture and Forestry, Nauni, Solan,



source. They contain essential amino acids that the body needs for growth and development. They are naturally gluten-free, making them a great alternative for people who have celiac disease or gluten intolerance. Millets have a low glycemic index, which means they release glucose into the bloodstream slowly, preventing spikes in blood sugar levels. This makes them a great option for people with diabetes.

Millets require less water and fertilizer than other crops such as rice and wheat making them a more environmentally sustainable crop to grow. They can grow in a variety of adverse environmental conditions such as drought, low soil fertility and high temperatures making them an ideal crop for small-scale farmers in developing countries.

Millets can be used to make a variety of dishes including porridges, bread, cakes, and alcoholic beverages. They are often less expensive than other grains such as rice and wheat making them an affordable food option for people on a tight budget.

Millet farming provides livelihoods for millions of small-scale farmers in developing countries. By promoting the consumption of millets, we can support the livelihoods of these farmers and contribute to poverty reduction.

CELEBRATING THE POTENTIAL OF NUTRI CEREALS

The celebration of the potential of nutri cereals is important because it can lead to a more sustainable and nutritious food system. Here are some ways we can celebrate the potential of nutri cereals

- **Promote awareness:** Raising awareness of the nutritional and sustainability benefits of nutri cereals is crucial in promoting their consumption. This can be done through public campaigns, educational programs and social media platforms.

- **Encourage production:** Encouraging production of nutri cereals through government policies, subsidies, research and development can increase their availability and affordability for consum-

Millet Basket

There are several types of millets, each with its own unique nutritional and culinary properties

Pearl Millet (*Pennisetum glaucum*): Popularly known as Bajra, this millet is a staple in India, Africa and parts of the Middle East. It is rich in iron, protein and fiber and is used to make a variety of dishes such as roti, khichdi and porridges.

Finger Millet (*Eleusine coracana*): Known as Ragi, this millet is a staple in southern India and parts of Africa. It is rich in calcium, iron and protein and is used to make a variety of dishes such as dosas, idlis and porridges.

Foxtail Millet/Italian millet (*Setaria italica*): This millet is popular in China, India and parts of Africa. It is rich in protein and is used to make a variety of dishes such as upma, pongal and porridges.

Sorghum/Jowar/Great millet (*Sorghum bicolor*): This millet is grown in many parts of the world including Africa, Asia, and the Americas. It is rich in fiber, protein and antioxidants and is used to make a variety of dishes such as porridges, bread and alcoholic beverages. It is also known as “king of millets”.

Little Millet (*Panicum sumatrense*): Also known as Kutki, this millet is grown in India and is rich in fiber, protein and iron. It is used to make a variety of dishes such as upma, khichdi and porridges.

Kodo Millet (*Paspalum scrobiculatum*): Also known as Kodra, this millet is grown in India and is rich in fiber, protein and antioxidants. It is used to make a variety of dishes such as upma, pulao and porridges.



Millets require less water and fertilizer than other crops such as rice and wheat making them a more environmentally sustainable crop to grow

ers.

- **Promote innovation:** Promoting innovation in the processing and marketing of nutri cereals can increase their appeal to consumers. For example, value-added products such as millet flour, qui-

noa chips and sorghum-based snacks can create new markets for these grains.

- **Foster collaborations:** Collaboration between farmers, processors and consumers can create a more sustainable and resilient food system. Encouraging partnerships between different stakeholders can help to increase production, reduce waste and promote the consumption of nutri cereals.

- **Showcase culinary diversity:** Nutri cereals have been used for centuries in traditional cuisines around the world. Celebrating the culinary diversity of nutri cereals can increase their appeal to consumers and promote cultural heritage.

International Year of Millets is a timely and important initiative that recognizes the potential of this ancient grain to contribute to food security nutrition and sustainable agriculture. By raising awareness and mobilizing action, the year can help to ensure that millets regain their rightful place in the global food system and that the people who depend on them for their livelihoods and well-being can thrive.

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Maddu Raviteja

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