

August 2020 Volume 1, Issue 6 AgTech Special Issue

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### **Industry Speaks**

#### News

value chain today that include:

• Phenotypic assessment for advancing the pipeline: Advanced machine vision technology and customized deep learning algorithms are being developed to revolutionize seed breeding and production cycles. Today such modern and breakthrough AI based tools are available that allow genotype analysis without doing molecular genetics tests and is more importantly non-destructive to seeds. These cloud based AI powered tools combines AI, algorithms and computer vision to analyze the seed's phenotype to detect genetic characteristics or traits (Eg. fruit & grain colour, size, resistance to viruses, germination ability, male fertility, etc.) on the seed level. This can replace expensive genetic lab tests or plant level phenotyping which is time and resource consuming.

# Adopting AI based solutions to transform seed value chains



In the recent years, artificial intelligence (AI) based technologies have been driving innovations in the agricultural industry by creating pathways for analyzing data in ways not used earlier. These tools helps in developing agricultural produce in a more sustainable, efficient and affordable manner. Over the last decade the absorption of such technologies across the agriculture value chain has grown considerably and witnessed transforming results. To witness the next level of paradigm shift in the seed industry wide scale adoption of such technologies across the seed industry value chain is essential. The Indian seed industry today is mature and has standardized maneuvers over the course of time, however, is inherently slowed down by low level of automation across the seed supply chain. Seeds are primary building blocks for ensuring improved productivity across crops. The predominant current rate of genetic improvement for crop productivity enhancement is not sufficient to meet the global demand of sustainable food security. Further, operational challenges related to time consuming and labor intensive operations, biotic and abiotic stresses, weather dependency, as well as quality issues hinders efficiency of the business.

Modern AI based technologies today target at shrinking breeding time and costs, increase the probability of achieving breeding targets, multiple trait detection, augmenting physical and morphological seed data, rapid results and secure platform for systematic data storage. These cost effective technologies help in better and accurate selection through seed by seed analysis and thereby ensures seed uniformity. Seed industry players today are partnering with technology providers for acquiring AI based technologies for various stages of the seed value chain (R&D, Production Operations, Supply Chain Processing & Packaging, and Sales & Market Development).

Many innovative and game changing AI and machine learning (ML) based technologies have been developed and are finding increased usage across seed





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This kind of tool helps researchers and breeders to gain accurate seed related insights without need for genomic information, DNA extraction, or any molecular markers.

- Accelerating breeding: Line selection for specific traits for crop improvement related to pest and disease resistance, adaptation to climate change, nutrient content, and effectiveness of water and nitrogen use is a tedious and time consuming process of breeding. AL and ML based technological advancements take decades of field data to analyze crops performance in various climates. Based on this data breeders can build probability model that would predict which genes will most likely contribute a beneficial trait to a plant.
- Assessing seed quality: Efficient & uniform seed germination & its appropriate establishment are key for achieving maximum crop productivity. It is mandatory for seed suppliers to test seed samples to ensure a certain germination rate is met. Commercial scale germination tests and large scale experiments being laborious, time consuming and prone to human errors demands for automated solutions. Limitations of current seed imaging and scoring approaches have prevented automated and scalable analysis of seed germination.

<u>A new method</u> integrates costeffective hardware and user-friendly software for performing seed imaging and ML-based analysis for measuring establishment and germination related traits including seed germination frequency and seed vigour measurements. This next generation high throughput phenotyping platform for analysis of crop seed germination has been tested on different crops such as corn, brassica, pepper and tomato. This tool will be groundbreaking addition to the seed value chain for ensuring seed quality.

- Precision Sowing for seed production: AI based solution platforms are available for providing advisories related to weather forecasting, satellite based real time monitoring and alerts for potential pest infestation and crop diseases, agronomic, crop and pest management practices which helps in providing precise advisory for sowing and thereby help in improving crop yields in farmer fields.
- Seed Traceability: Technological intervention through usage of QR code tagging during packaging and warehousing process of the seeds ensures maintaining seed traceability and farmers are aware of the seed quality and credibility of the seed producers. Recently an AI-based solutions for Seed Potato Traceability was

applied to curb the sale of counterfeit, low-quality seeds and improving the quality of potato seeds. The effort helped in capturing farm data at critical points for establishing end -to-end traceability to the life cycle of seeds. Following tests and certification, these seed potato packets have been QR coded for distribution to farmers, thereby ensuring purchase of high quality seeds by the farmers. The technology is expected to be further replicated across other crops including wheat, rice among others.

Amalgamation of such AI based technologies across the seed industry value chain can not only bring about the needed time and cost effective solutions for the industry but also improve operational efficiency across seed business operations. Adoption of such AI based processes would mean better, quicker, informed and accurate decision making regardless of rapid changes in the environment. Wide scale adoption and deployment of such technologies by several seed companies will trigger accelerated introduction of game changing solutions for the farmers and achieving enhanced productivity. On the overall agricultural front, this would help in mitigation of the environment risks since the most critical agricultural input seeds will be precisely delivered.

# Remote Sensing, a promising Agtech tool

Recent Government announced that there will be liberal geo-spatial data policy for providing remote-sensing data to tech-entrepreneur. This will provide a huge boost to the rapidly growing sector of remote sensing. In almost a decade, it has created a significant mark in agriculture by enabling the acquisition of the infield data without making any physical contact with the agricultural fields! From satellite imagery based remote sensing to use of Unmanned Aerial Vehicles (UAVs) popularly known as drones, remote sensing has facilitated data collection from complex landscapes such as inclined or terraced fields, different soil types, and highly heterogeneous small farmer plots. It has enabled timely estimations of crop acreage, forecasting sowing/ harvesting time, crop damages, draught assessment, cropping system analysis, crop yields at any given time, identification of pests and diseases, management of





irrigation based on soil moisture, crop intensification, and in weather monitoring among many other of its applications. Regardless of national, regional, or local level, information gained from remote sensing has the potential to facilitate timely decision and make valuable inferences regarding market forecasts, production, economic impacts, and related decisions. Due to COVID19, visiting fields and collecting data is going to be challenging, as a result remote sensing applications would find several uses.

The global remote sensing services market is projected to grow at a CAGR of 15.14% to USD 21.62 Billion by 2022 owing to the growing popularity. Globally there are around 145 drone companies and it is expected to grow further. New exciting trends have been emerging resulting from evolving business models, dynamic market, and advent of technology. Additionally, the introduction of cloud computing and Big Data analytics in remote sensing are predicted to drive the demand for remote sensing services. Antrix Corporation (India), Maxar (DigitalGlobe, US), Remote Sensing Solutions (Germany), Terra Remote Sensing (Canada), EKOFAST-BA (Spain), Geo Sense (Malaysia) and Mallon Technology (UK) are few of the key market players globally. Many Indian agtech companies have been rapidly establishing and expanding their global presence in this space. A recent trend of companies entering the Indian agricultural market as imagery processing providers has also been observed. Few of the leading companies globally which process the satellite images and extract the required data from the images include: Ceresimaging, Hummingbird Technologies, Orbital insights, IBM, Descartes Labs, Geosys.

Remote sensing, although not a very new tool for monitoring and analyzing



agricultural activities, has proven vital for assisting decisions regarding industry investments, business agreements, etc. due to its ability to provide forecasts and valuable insights for precision agriculture. As the technology is improving, powerful sensors are being developed, effective prediction models are being generated and powerful tools for image analysis and interpretation are being developed to utilize the full potential of remote sensing and GIS. In India, currently, Remote sensing using Stratification optimization, pixel optimization and Early Warning Systems (EWS) are optimized with more than 90% national coverage for the major 8 crops including rice, wheat, cotton, sugarcane, jute, rapeseed, mustard, and Rabi sorghum are monitored through radar and optically (Ray et al., 2014). The use of remote sensors in agriculture has been rapidly increasing and few of the fields where remote sensing has been proved effective include:

• **Crop Classification:** Use of Hyperspectral sensors have enabled not only detailed crop classification, but also crop acreage and forecasting yield. Detailed analysis of these parameters is done through imaging and image processing techniques with high precision which enables distinction between different crops.

- **Crop Health Assessment:** Tracking and assessing crop health by following physiological changes in the crops is done through spectral analysis of various parameters such during the different stages of crop growth. Yields forecasts can be made through remote sensing by deriving the relationships between vegetation indices and crop yield.
- Pest & Disease Management: High resolution multispectral remote sensing can facilitate accurate monitoring of diseases and pests in crops and provide advisory about management strategy. Based on the correlation of different patterns of defoliation of leaves associated with different diseases or pest, predicting, and managing the pest/ diseases can be also done.

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- Nutrient & water Assessment: Using remote sensing and Geographic Information System (GIS), site specific nutrient deficiencies can be detected and addressed. Water use efficiencies can be maintained by using models to measure temperatures which can monitor the water use efficiencies. Using Vegetation indices such as Normalized Difference Vegetation Index (NDVI) and Vegetation Condition Index (VCI) and GI, predictions on stressed and non-stressed plants can be made.
- Weed Management: Remote sensing can facilitate weed management through site specific weed mapping using the differences in spectral reflectance between the weed and crop. Using the radiance ration and NDVI, weeds can be identified and managed with the help of GIS (Kaur et al., (2013)).
- Precision Agriculture: Precision agriculture offers the tools and technologies to identify in-field crop and soil variabilities, offering a way to improve farming practices and optimizing agronomic inputs. Remote sensing is key to precision agriculture. Use of handheld or tractor mounted sensors, satellite, and aerial imaging

by wavelengths from ultraviolet to microwave portions of the spectrum has improved accuracy of precision agriculture.

Different prediction models can be built based on various geological parameters and precise predictions can be made at farm level to decide the exact course of action for effective farm management using remote sensing images. For remote sensing images may be captured through sensors or electromagnetic radiation using satellite imaging or UAVs But Each of the remote sensing devices have their own spectral band and hence data captured from one device cannot be directly compared to the data captured by other remote sensing device. It is also critical to know that high special resolution will provide lower temporal resolution and vice versa. So, depending upon the application, remote sensing models and data captures must be used.

As per the latest Government announcement, the private sector will also get access to ISRO's currently used cartosat-1 and 2 (Cartography satellite), Resourcesat (Multispectral imaging satellite), Risat-1 (Radar imaging), Kalpana-1 & INSAT (Meteorological forecasting and observation) for remote sensing of all weather, dawn-to-dusk imaging,

disaster management and agricultural monitoring. Access to these sophisticated ecosystems will provide a platform to nurture entrepreneurship throughout India including the rural areas which offer the advantages of field-testing on farms which are critical for obtaining quality assurance certifications, marketreadiness of the final technology product, and generating systematic upgrades based on direct feedback from farmers. ISRO in collaboration with private sector is planning to launch satellites to meet the growing demands and to augment the overall capacity. With the changes in the regulatory environment and policies which will be introduced shortly, Private sector will get the opportunity to explore and rapidly grow in this sector. Although, in India there are a lot of small holding farms which pose a challenge in implementing these technologies, digitization of farmlands as proposed and prioritized by the Government and the support provided by the Farmer Producer Organizations (FPO) can empower the farmers to embrace remote sensing technologies to make agriculture a scalable and sustainable sector. Hence, remote sensing is undoubtedly the future of Agritech and a tool to facilitate resilient growth in agriculture and make it viable!

# Traceability in Agri - Food Industry and Need for Standards

Globally food production, trade and consumption are changing today. Expanding world economy, liberalization of food trade, growing consumer demand, developments in food science and technology, and improvements in transport and communication are leading to increased international trade in fresh and processed food. The agriculture and food sectors are increasingly getting integrated within global value chains wherein different stages of the process of transforming raw materials into a final consumer product are located across different countries/regions. Standards and regulations are required to ensure that food is safe, meets quality and labelling requirements to protect the consumers; as well as to protect the environment, animals and plants. Consumers are also increasingly becoming aware of food safety risks, food frauds,

climate change and sustainability. As a result, certification of products with traceable or verified source claims like Organic, Sustainable, Non-GMO, Plant-based, Fair Practices etc. are gaining momentum. Industry players in the agri-food value chain are increasingly focusing on traceability by improving their supply chain management and adopting appropriate practices or relevant technology.

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Emerging players in developed countries are disrupting the value chain with unique business models relying on building partnerships/synergies with seed companies, aggregators and processors. Traceability is the key for such business models that connect the growers with buyers looking for traceable/ sustainable products.

Traceability is the ability to trace the history, application or location of an object. When considering agri commodity or food, traceability can relate to production and origin of crops/raw materials, processing history, distribution and location of the product after delivery. The benefits of traceability include:

- Efficient supply chain management,
- Increased compliance with regulations and safety & quality standards,
- Faster recalls/ tracing contaminated products, in case of outbreak of disease, or fraudulent products in supply chain,
- Verification of Identity Preservation/ Sourcing claims like Organic, Non-GMO, Non-Allergenic, Plant based, Sustainable, Fair Practices etc.,
- Increased market acceptance and international trade, and
- Maintaining trust and transparency in supply chains - much needed during public health crises like the COVID-19 pandemic.

To enable traceability, supply chain actors need to identify and trace product's movement from farm to fork. Growers must maintain records of information related to the production of the produce such as seed type and date of sowing, fertilizers and crop protection including date of application, irrigation source and quality, packaging material, harvesting method, labour used, storage etc.). Tracking the pedigree of planted seed to verify its source of origin is the starting point in traceability and becomes more crucial in wake of spurious & lowquality or illegal seeds in the market causing losses to farmers. To address this, Ministry of Agriculture & Farmers Welfare, GoI is putting in place a barcode based National Seed Traceability System. This traceability system covering grower to retailer will be based on Global Traceability System (GTS) framework for the movement of seed across supply chain.

Traceability and integration into global value chains in developing countries can be challenging due to lack of infrastructure and enabling policy frameworks, low capacity of smallholder farms and small-scale agro-processors, confusion between various industry practices, standards and data capturing applications. Many industry players today use several systems at various stages of the processes (e.g. ERP, Processing equipment, Logistics, CRM systems) which are often not connected seamlessly. Interoperability - the ability of different IT systems or programs to communicate seamlessly for the purpose of using, interpreting, exchanging data among supply chain actors - is a critical component of digital traceability. Since all actors in the supply chain may not use the same systems, industry needs to ensure interoperability by using systems that are able to support standardized data. Since a large number of small-scale operators in the value chain cannot invest in new systems, industry player's traceability should be based on a system/ technology platform that can make use of data capture systems already in place like labels/ barcode scanners. Adoption of appropriate standards that cover the fundamentals of traceability i.e. identification of objects, data capture and sharing can help industry avoid maintaining multiple systems for different suppliers/ buyers and reduce data duplication and



reconciliation. Adoption of traceability standards can help the industry collaborate with various supply chain actors and agree on scalable processes. Some of the standards for traceability include GS1 Global Traceability Standard and ISO 22005:2007 Traceability. The more popular GS1 Global Traceability Standard defines a minimum set of traceability requirements within business processes to achieve full chain traceability, which are independent of any technology. This standard outlines a common framework to build a traceability system using other GS1 standards - such as barcodes, data carriers and also covers more recent Blockchain technology.

Globally, major agri-food players have started implementing end to end traceability for their products and are sharing information across the supply chain to meet food safety regulations of destination market, buyer requirements & specifications or to share true source of origin/ product or process information to consumers in a transparent manner via QR Codes/ labels on the product etc. Hopefully Indian Agri Food industry also, on wider scale, adopts traceability across their supply chains and in this journey empower the small farmers and smallscale producers with enhanced market visibility and enhanced incomes.

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#### Digital Transformation and smart farming empowering agriculture

Increasing productivity using lesser resources through smart farming and digital transformation is the need of the hour. Systems like cloud computing, big data platforms, IoT, predictive analytics will enable transformation of products and services and optimize operations. Microsoft is offering start-ups build these industry specific solutions through their vast industry experience.

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# Centre releases Rs.553 Cr to states to promote farm mechanization

Centre releases Rs 553 crore from a budget of Rs 1,033 crore to state governments under the scheme, Sub-Mission on Agricultural Mechanization (SMAM) which was launched in 2014 to promote mechanization in the agriculture sector. Agricultural mechanization helps in increasing production through timely farm operations and cut in operations by ensuring better management of inputs.

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# Unfold: New joint initiative by Bayer and Temasek to unlock potentials of Vertical farming

Unlike other vertical farming start-ups, Unfold will be focusing on unlocking the genetic potential of vertical farming by developing new seed varieties using vegetable seed germplasm for unique indoor vertical farm environment. These efforts will enable high productivity, enhanced flavor and incorporate customer preferences.

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# OPDPA aims to encourage oil palm production in the North-East

Oil Palm Developers and Processors Association (OPDPA) welcoming the Union Government's vision on the need of being self –reliant in edible oil according to according to the Atmanirbhar Bharat scheme has asked the government to bring in structural and policy changes to promote the domestic potential of oil palm through changes in pricing mechanism among others.

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# Covid disruption unable to hamper Indian farm agricultural exports

March – June have observed around 23% increase in the farm agricultural exports despite the disruptions caused by Covid. Agricultural exports in 2018-19, as a part of India's agricultural GDP, have increased to 9.9% compared to previous year's 9.4% and imports have declined to 4.9% from 5.9% indicating decreasing dependency on import and export surplus.

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# Private sector lender ICICI Bank to use satellite data to assess credit worthiness of farmers

ICICI Bank will be the first bank in the country to use satellite technology to help farmers to get better access to credit. The bank will be using imagery sent by Earth observation satellites to measure an array of parameters related to the irrigation and crop patterns. It has already conducted a pilot study in 500 villages and would scale up to 63000 villages soon.

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#### Kashmir on the global map for its saffron

Kashmir saffron has been awarded the GI tag. This will prevent adulteration and fetch the Kashmir saffron a good price. This saffron is the only saffron grown at 1600m altitude and has a distinct bitter taste, deep red color and long stigma.

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#### Government launches an online platform to monitor its Agri Infrastructure Fund

The government launched an online Management Information System (MIS) platform to manage and monitor its Agri Infrastructure Fund (AIF). An integrated monitoring system will be developed at district, state and national level to monitor the implementation of projects. Effective real time monitoring will be carried out by geotagging of all assets created under the scheme.

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# Technology in Agriculture– The Path Less Taken?

The COVID-19 pandemic is a global health crisis; lack of sound measures may further lead to the global food security crisis and form a vicious cycle. Therefore, it is imperative to minimize the adverse effect and disruption of livelihood of the poor and marginalized citizens. Agriculture has taken the centre stage and technology is seen to be the next growth driver of the same. Capital Investments and focus has risen around the AgTech Industry from both the Private and Government sectors.

Research & development in seed business plays a critical role in ensuring the product pipeline for business sustainability. Conventional breeding is augmented with molecular breeding to accelerate line and hybrid development. It has been offering significant genetics gains to USAgriseeds® highly adaptable products across wide geographies in India & Abroad. SeedWorks continues to experiment the use of Artificial Intelligence in precision phenotyping to deliver best seed solutions. One of the examples is use of AI for physical purity assessment of paddy grains, segmenting them into true hybrid seeds, other differentiated varieties, and impurities.

The seed production is digitally enabled to capture vast amount of agronomy with environmental data. SeedWorks is continuously working on utilizing the data with the power of data science to increase efficacy of the process, forecasting of the seed supply and incremental monetary gains to the thousands of farmers involved. Over the years, seed producing farmers has seen significant improvement in their farm incomes and enhanced livelihoods.

The vast knowledge gathered in two decades of association with Indian farming community has positioned US-Agriseeds® as a strong brand in the minds of millions of farmers. The technology driven assessment of consumer needs, segmentation the markets and product positioning are the key to success of the fast growing USAgriseeds® brand.

The frontline staff is well equipped with the appropriate tools to conduct product promotional activities along with physical presence to deliver superlative customer experience. The utilization of digital applications for data capturing, visualization, and reporting in the multilocation product trails for the product advancement assessments. Digital Marketing has become an integral part and is being used via social networking platforms like Facebook, YouTube, WhatsApp, and other advertising enablers like Zapr and InMobi. Rural changes such as increased mobile/ internet penetration, cheaper data & storage and increased technology awareness are leading to mainstream VC/PE funds expressing interest in Agri sector and high-quality tech-entrepreneurs starting up, therefore making AgTech attractive. SeedWorks is also tirelessly



Venkatram Vasantavada MD & CEO – SeedWorks International

working with several AgTech start-ups, Government bodies, FPOs and Academia to develop a digital ecosystem to take the Indian Farmer to the next level. The pursuit of doubling farmers' income has been the top agenda of the organization and it believes that technology will bring the next Green Revolution in India.

In this journey, SeedWorks strongly believes to strengthen these AgTech start-ups by providing a pilot ground to test their solutions and a launch pad to take the best solutions to millions of its loyal farmers. To enable the same, Seed-Works organized a day-long Think-a-Thon in joint efforts with FICCI, which saw participation from 11 start-ups and many opportunities to collaborate were identified. SeedWorks dreams to bring scale to AgTech solutions, primarily leveraging Artificial Intelligence-enabled Internet of Things across the value chain. Surely, all these efforts will make goal of doubling the farm income by 2022 a reality. The evolved Agri ecosystem will propel India towards its goal of becoming a \$5 trillion economy by 2025.



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