

HOW TECHNOLOGY IS ENABLING SMART FARMING

A nascent movement to introduce more tech into the average Indian farm is gathering steam. Will it click?



Millions of farmers in India, who often rely on luck or favourable weather for a decent harvest, could do well with access to better technologies. It also doesn't cost much.

ISTOCKPHOTO

Ayushman Baruah
ayushman.b@livemint.com
BENGALURU

For several years, 33-year-old Ashish Sariya, a farmer based in Madhya Pradesh's Ujjain district, has been cultivating onions and garlic on his 17-acre field. Pests and weather are an eternal problem.

In Kachnariya village, where Sariya farms, the summers can get extremely hot and dry, with the maximum temperature climbing up to 42 degrees Celsius. Understanding the level of soil moisture and predicting the right time to start sowing is a fine art. After a series of trial-and-error experiments, Sariya finally hit on a viable solution after the local representative of an agritech startup called Gramophone reached out to him.

Gramophone's advisory nudged Sariya to move away from guesswork. With the use of technology, he now has a far more accurate sense of soil health as well as the amount of fertilizer that might be needed to maximize yield. "I have increased my annual garlic production from 80 quintals to about 108 quintals," he said over a phone call. "I am also saving on pesticide costs... since I know exactly which fertilizer to use, when to use it, and in what proportion."

Like Sariya, millions of farmers in India, who often rely on luck or favourable weather for a decent harvest, could do well with access to better technologies. It also doesn't cost much. Gramophone's farm management services, for instance, are priced at ₹1,999 per crop season.

For long the domain of district-level agriculture department officials, crop advisory is finally getting the attention of startups in many parts of India. These agritech startups often have access to better technology, claim to offer more reliable and timely information, and their channel of communication is via intuitive apps. According to Zion Market Research, the global smart agriculture market was valued at around \$5.09 billion in 2016 and is expected to reach approximately \$15.3 billion by the end of 2025—growing at more than 13% year-on-year.

The most popular applications of technology in Indian agriculture appear to fall into three major categories: crop and soil monitoring (where companies are leveraging sensors and internet of things, or IoT, -based technologies to monitor crop

and soil health); predictive agricultural analytics (where artificial intelligence, or AI, and machine learning, or ML, tools are used to predict the optimal time to sow seeds or to raise an alert about possible pest attacks); and real-time data analytics to build an efficient and smart supply chain.

This nascent movement towards introducing more tech into the average Indian farm is not without its fair share of doubters. "Many of these startups which claim to help growers undertake intelligent farming are only solving about 5% of the (farm-level) problem," said Yogesh Dwivedi, chief executive officer (CEO), Madhya Bharat Consortium of Farmers Producer Companies (MBCFPCL), among the largest consortium of farmer producer firms in the country. "Their reach is limited and they are only targeting the progressive farmers," he added.

It is also not easy to convince farmers to invest in tech solutions without overwhelming evidence of an adequate return. Innovative financial arrangements and micro-loans might be required to increase adoption, which is currently absent.

However, despite these caveats, there are enough people who are convinced that Indian agriculture might be at an important crossroad. "We are at a key moment. We can leapfrog from the traditional methods to a new, technology-friendly way of growing, processing, and selling food," said Prashant Sarin, partner at the consultancy firm Bain & Co., which recently released a report titled 'Indian agriculture: Ripe for disruption'. "The traditional form of agriculture will be disrupted and overhauled over time... and \$30-35 billion value will be created in new value pools across the agricultural value chain over the next few years," Sarin added.

GROW MORE
Madhya Pradesh-based agritech startup Gramophone is helping farmers with a full-stack technology platform. "We (have) strived to build a platform that makes farming scientific, data-driven and easy," said Nishant Mahatre, co-founder, Gramo-

phone. "We empower farming decision-makers with all kinds of knowledge, data and intelligence as a software-as-a-service (SaaS) offering."

Gramophone is currently building a proprietary database that combines weather-based parameters and agronomical data to provide more accurate advice to farmers.

Various sensors and IoT-based devices are placed across the farm and the data generated from these helps to measure soil properties. The technology aids farmers in three key areas: farm management with personalized agronomic intelligence, access to inputs, and post-harvest commerce.

"We provide farmers with agronomy intelligence required to manage the crops right from land preparation to harvest. This broadly involves nutrition management, pest and disease management, water management and inter-crop operations. This gives the right diagnosis and builds personalized solutions for the farmers. Then, we provide access to inputs based on (the) farmer's needs across the cropping cycle, and lastly, we enable farmers to sell the produce to buyers at a better price through Gram Vyapaar," said Mahatre.

Farmers associated with the agri startup say they were able to reduce input costs by 10-15% and increase crop yields by 30-40%. Mint was not able to independently verify the claims.

Technology giant Microsoft Corp. is also offering smart agriculture solutions. FarmBeats, which started as a Microsoft Research project in 2014 to enable data-driven farming, is now available as a set of solutions in the form of Azure FarmBeats. The goal of FarmBeats is to remove the guesswork inherent in agriculture and provide farmers with data-driven insights.

The solution creates a digital map of a farm using drone or satellite imagery, which is overlapped with a grid of sensors spread across the farm that monitors multiple soil parameters—ranging from temperature and moisture to carbon and nitrogen levels. Armed with the data, farmers can get actionable insights through AI and ML-based models. The solution is already live in a few farms across the world, including in India.

PREDICTIVE ANALYTICS
Unlike Gramophone, Bengaluru-based CropIn is involved in digitizing farm operations through a business-to-business (B2B) model, where the firm does not directly deal with farmers and instead works with agri-businesses.

CropIn claims to have digitized over 16 million acres of farmland and touched the lives of nearly seven million farmers in over 56 countries. "The SaaS solutions offered by CropIn are crop and location agnostic and are available on the web and on mobile devices," said Krishna Kumar, founder and CEO, CropIn.

While India is its largest market with 60% share of revenue, the company also has operations in the US, Latin America,

**MINT
SHORT
STORY**

WHAT

Crop advisory is finally getting the attention of startups. Armed with better technology, these startups claim to offer more reliable and timely information through intuitive apps.

AND

The global smart agriculture market was valued at around \$5.09 bn in 2016 and is expected to reach approximately \$15.3 bn by 2025-end—growing at more than 13% y-o-y, said a report.

BUT

Innovative financial arrangements and micro-loans might be required to increase the adoption of technology in agriculture, which is currently absent

Africa, South-East Asia, and Europe. CropIn's SmartFarm data management solution leverages ground data, weather advisory, and accurate insights based on satellite monitoring to enable data-driven farm and business operations. SmartRisk is an AI- and ML-based platform that detects cropping patterns and predicts the future of the crop, thereby highlighting the associated risks and opportunities for agri-stakeholders.

"Our SmartRisk platform is built on a powerful agri-AI engine with proprietary algorithms that enables accurate acreage estimation, crop stage and health analysis, and yield forecast," said Kumar.

The solution sends out SMS advisories to farmers to alert them about likely future events. This makes the farmer future-ready for pest and disease control and the timely SMS alerts have shown a significant increase in yields for the farmers, the company claims.

CropIn's journey of working with agri enterprises in India hasn't been easy. "A majority of agri enterprises that have been working with conventional practices view any drastic change towards digitization with scepticism. Also, the common mis-

conception that the use of the application is only to track them and evaluate their performance adds to the challenge and distracts them from the larger picture," Kumar said.

SMART SUPPLY CHAIN

Despite the promise of AI and ML-based solutions for farmers, it is supply chain digitalization that dominates India's agritech sector, accounting for 85% of total invested capital in 2020, according to a July report by ThinkAg, an agritech platform.

Startups like Ninjacart are using technology to solve specific crop marketing and logistical woes, such as reducing the intervention of middlemen, price volatility, wastage, and unfair trade practices. Ninjacart provides farmers with an app to help them in demand forecasting and harvest planning. "We analyze consumer purchase history and order frequency to determine the type of produce to procure. It allows us to track (the) produce and provides complete transparency across the value chain," said Thirukumaran Nagarajan, CEO and co-founder, Ninjacart.

Diagnostic analytics techniques organize weekly sales and procurement forecasts at the SKU (Stock Keeping Unit) level by combining growth goals with historical demand data and market conditions. Through predictive analytics techniques, clients can foresee what is likely to happen. It also detects possible hazards in the supply chain.

"Farmers saw a 20% boost in revenue after eliminating intermediaries and gaining direct market linkage access," said Nagarajan. "Payment is made within 24 hours of receiving fresh produce. We have also developed a responsive, real-time logistics network to manage inventory and reduce processing time."

Quality assessment is a crucial cog in the supply chain wheel, and Bengaluru-based Intello Labs uses computer vision and deep learning tools to provide quality monitoring and grading solutions for participants in the agriculture and food industries. At the simple click of an image, the user can objectively determine the physical composition of a commodity sample within minutes. The data is shared in real-time across the supply chain, bringing in standardization and scalability.

Intello Labs' greatest challenge was to source sufficient data to train ML algorithms to distinguish agriculture products

based on their quality. The huge variation and absence of any standardization in the quality checking process across commodities posed significant challenges.

To overcome this, the startup collected images from various markets to train its algorithms on quality grading. As the solution was rolled out on a pilot basis, it was confronted with issues of poor network connectivity and poor lighting conditions in which the images are uploaded. Intello Labs said it adjusted its algorithms to overcome these operational challenges apart from training staff on using the application. Today, Intello Labs is seeing a strong demand outlook. "We are already seeing significant interest, specifically from the North American and Indian market," said Milan Sharma, co-founder and CEO, Intello Labs.

Alongside startups, the Indian government is also encouraging the use of technology in agriculture. Policy think-tank NITI Aayog has partnered with technology company IBM Corp. to develop a crop yield prediction model using AI to provide real-time advisory to farmers. The first phase of the project is currently on in Assam, Bihar, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, and Uttar Pradesh.

Similarly, Microsoft India is working with NITI Aayog to lend its expertise in cloud, AI, and research for new initiatives and solutions in the agriculture sector. Microsoft in collaboration with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has developed an 'AI Sowing App' that sends sowing advisories to participating farmers on the optimal date to sow.

Ultimately, the adoption of technology in agriculture will depend on the criticality of the service offering, said Ram Kaundinya, co-founder, ThinkAg. "If it's an essential service, farmers will pay for it. But if it's (only) a good to have service, they will not pay. That's why many of the startups are tying up with corporates rather than dealing directly with the farmers."

But the pandemic has changed the nature of the game somewhat, says Kaundinya. "Globally, the supply chain in agriculture got disrupted due to the impact of covid-19. Food is now recognized as the top-most item in terms of criticality. Therefore, there is a general uptick in investor interest in agriculture since the covid outbreak. Agritech is one of the ways to unlock the full potential of agriculture in India."

The most popular applications of tech in Indian agriculture appear to fall into 3 categories: crop and soil monitoring; predictive analytics; and real-time data analytics

Alongside startups, the govt is also encouraging the use of technology in agriculture. NITI Aayog has partnered with IBM to develop a crop yield prediction model using AI