

Fasal - Setting Indian Farms on Auto-pilot Mode

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It was the calm evening of August 20, 2019 when Ananda Verma, the CEO of Fasal sat in his office with Shailendra Tiwari, the co-founder. It was one of the frequent sessions they held to discuss the future course of action amidst changing business dynamics. They were reflecting on the purpose of setting up Fasal, the successes and challenges before Fasal in the previous one-and-a-half years and the milestones it achieved so far, after being founded in January 2018. Having successfully created positive impacts in the lives of tens of Indian farmers, they felt it was now time to gear up for future challenges and ride over the tide to reach out to millions more.

28 year old Ananda Verma hails from a farming family in Azamgarh near Varanasi. Growing up, he has seen his father suffer because of crop loss due to weather related uncertainties and lack of information. “And this problem is not only with my father, but every farmer faces the same issue because of lack of data points to make a decision,” Verma shares.

After graduating from IIT Bangalore, and working in the IT software industry for over five years, Ananda realised that he had a solution to this problem of guesswork through the use of tech advancement in Internet of Things (IoT) and Machine Learning (ML). This fusion of agriculture and technology and a belief that precision farming and Artificial Intelligence (AI) can bring second Green Revolution in India led him to start Fasal with his co-founder Shailendra Tiwari. The official name of the company is Wolkus Technology Solutions Pvt Ltd. based out of Bangalore, Karnataka. The company has a motto to ‘Give Back To The Society’.

Traditional Farming Practices in India

Farming has been one of the oldest economic activities in India. There are numerous farming methods being practiced in different regions of the country that have evolved over the years owing to changing climatic and socio-cultural conditions. However, they have failed to catch the pace of changing requirements of time as the farmers continue to follow non-scientific, traditional methods of cultivation.

In India, farming has traditionally relied on intuitions and insights of the farmers having generations of experience. However, due to the uncertainties caused by environmental degradation and climate change, even die-hard sons-of-soil today need help. The problem, *inter alia*, lies in the fact that the farming methods deployed by Indian farmers are far from optimal. Seeds are randomly strewn across the field without giving due consideration to

how many plants should grow in a given piece of land. The irrigation system is not robust and agriculture depends largely on monsoon. Farmers lack knowledge on optimal quantity of fertilizers and pesticides to be used on a given hectare of land. Excessive use of such chemicals robs the soil of its natural nutrients, thereby compromising the soil's productivity.

Advanced nations such as the US, reap seven times the yield from the same size of land as compared to India through deploying precise, scientific farming techniques. Therefore, there is an urgent need to take action and avoid a scenario where despite having enough land and advanced technology available, Indian agriculture becomes untenable.

Possible Alternatives to Solve Agriculture Problems

Ananda was convinced that technology could solve the problems faced by farmers in India, particularly due to unavailability of reliable and accurate information. He was determined to level the field by eliminating information asymmetry. His aim was to provide farmers with all the necessary information and empower them to make right and timely decisions. The two choices he had were using 'Drones and Satellite' or 'AI and IoT Solution'.

Deploying any solution using drones and satellites is a challenge in India given the small size of landholding with farmers. Moreover, farmers are skeptical of believing in and adopting recommendations given to them through insights drawn from satellite-collected information. They tend to be more open to relying on information coming from something that stands in their farms and tells them exactly what to do. Additionally, the commercial and operational feasibility of such a solution has not yet been proven. It is a complicated and intensive solution, where even the data and insights cannot be delivered in real-time. Although these challenges are not insurmountable, it would take at least 2-3 years before they are conquered.

AI and IOT solutions on the other hand provide crucial information to farmers that helps them optimise water, fertilizers, and pesticides uniformly in their fields by targeting only specific areas, or even individual plants as per the requirement. This provides the following benefits:

- Increased crop productivity
- Reduced use of water, fertilizer, and pesticides, which in turn helps in keeping food prices down
- Controlled impact on natural ecosystems
- Less contamination of rivers and groundwater through farm chemicals
- Improved safety of worker

In addition, robotic technologies enable reliable monitoring and management of the quality of natural resources, such as air and water. It gives producers greater control over the production, processing, distribution and storage of produce. This results in:

- Higher efficiencies and lower prices
- Safer growing conditions and safer food to consume
- Controlled environmental and ecological impact

Different types of sensors are being deployed in the earth and from the air (Pictorial representation in Annexure 2). For example, a multispectral sensor captures data that will enable farmers to better predict the irrigation and nitrogen requirements of crops. Similarly, in-field water sensors can help pinpoint the best times and rates for site-specific areas irrigation.

It assists not only in production but also in distribution. For example, tech-enabled cold storage chains, which are controlled using smart devices help in preventing post-harvest storage losses. Automated grading and sorting of crops using robotics also helps in reducing efforts and wastage in the supply chain.

Quite often, farmers can be hesitant to try out and invest in such technologies due to lack of clarity on ROI. Infrastructure issues such as power supply and internet connectivity in remotely located farms can be a great challenge in building connected farms or deploying IoT solutions. Last mile logistics, to get farm products into the hands of farmers, is still a big challenge. They often need to rely on cash-based traditional distribution channels that are not nimble enough.

Ananda's Choice- IoT Solution with Fasal

To address the problems plaguing Indian agriculture, particularly those stemming from poor and inefficient decisions on the farmer's part on which crops to sow, how much to grow, how much fertilizer to use, what prices to expect etc., Ananda launched Fasal. Fasal is an AI powered IoT platform, which eliminates guesswork and manual methods adopted by most farmers. It does so by providing them with data and analytics to grow and reap better.

The target audience/ clients for Fasal are farmers who are progressive and willing to adopt new technology in their fields to improve their yields and income. Various institutional farmers such as Grover Zampa Vineyards, Chawda Bhag and Lohan Krishi Farm among others, are also their customers.

During his interactions with farmers, Ananda observed that there is often poor utilization of important resources by farmers. Fasal guides them to make optimal use of water and electricity resulting in significant input cost savings. Sample information in this regard, provided by Fasal to the farmers is exhibited at Annexure 1. Disease infestation of crops is one of the biggest pain points of the farmers. With Fasal, farmers are enabled to become better doctors of their crops through accurate threat assessment of plant diseases. Thus, farmers can approach the problem through prevention instead of reaction.

Their business model includes a nominal monthly subscription fee. There is no upfront charge or deposit. It's a pay-as-you-go model. "It has worked pretty well for us to penetrate the Indian agriculture market which is very price sensitive," Ananda informs. For large scale and institutional farmers, they also offer to sell their IoT device for an upfront installation charge and bill less subscription fee on software usage.

Recently, Fasal has received acceleration support from Zeroth, which is Asia's first AI and Machine Learning (ML) accelerator. Fasal has also successfully raised \$120K from them with the aim of enhancing their AI capabilities. Besides, Fasal is also collaborating with the UC-Berkley Andhra Pradesh Smart Village Initiative. It is a collaborative initiative between Govt. of Andhra Pradesh and the University of California Berkeley. Fasal has completed its first installation under the smart village initiative in Kuppam, Andhra Pradesh.

Impact Created by Fasal

The Fasal Smart Agriculture Basic Solution kit enables monitoring of environmental parameters in agriculture fields, vineyards, greenhouses or golf courses. Specialized sensors for detecting soil moisture and temperature, humidity, leaf wetness and atmospheric pressure are installed to control the amount of sugar in grapes that enhances wine quality. The sensors also gauge micro-climate conditions that are more useful to the farmers than weather forecasts in maximizing the crop yield.

The two levels of depth of the soil moisture sensor help in reducing water wastage through selective irrigation in dry zones. On the other hand, controlling humidity and temperature levels in hay, straw, etc. help prevent contamination by fungal and other microbial attacks.

Fasal has created its own AI based weather forecast system Fasal μ Climate. This is because the company believes that the costs of depending on weather forecast as seen from weather apps can be huge for a farmer. Imagine the consequences for a farmer who sprays his farm in the morning going by the 'clear weather' prediction, but it actually rains in the evening. All the spray and his money along with it, will get drained in the rain. Not only this, but changes in the weather greatly affect growth rate of the potential crop yield, the disease pressure, the irrigation and fertilizers scheduling. Not only plantation, but also the demand and supply for the yield depends heavily on weather conditions. Directly and indirectly, weather is one of the major reasons for crop loss. Even the United States have sustained over 90 weather related disasters in the 30 years in which overall damages to agriculture have exceeded 1 billion dollar. That is why Fasal has built its own micro-climate model for weather forecast. Fasal's micro-climate forecasts are tailored to specific farm location and performed at a point scale, instead of a kilometer-wide spatial scale. In essence, as Fasal collects more data, the AI based micro-climate forecasting algorithm incorporates real-time in-field information and relates it with the publicly available weather forecasts, so that farmers get real-time, actionable information relevant to day-to-day operations in their specific farm fields.

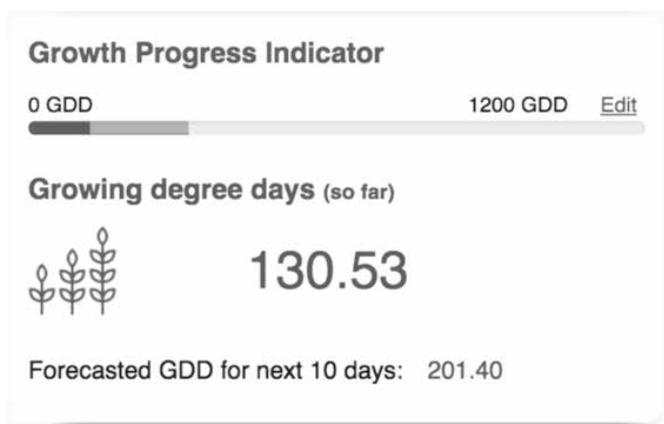
Another interesting offering by Fasal is the Fasal GPI (Growth Progress Indicator), which is built on top of Growing Degree Day (GDD)¹, calculating accumulated GDDs, based not only on real-time farm data but also with the power of Fasal μ Climate, it makes GDD prediction for next 10 days. This helps the farmer plan their week well in advance. A sample of GPI can be seen in Picture 1.

Compared to companies in the Western part of the world, Fasal is at a competitive advantage because India is much more cost-efficient. Furthermore, Fasal team believes that their farming background has enabled them to reach out to farmers in a more empathetic way, which will continue to be an advantage going forward as well. They are currently in traction stage and actively looking for more partners to collaborate with them and help them in taking their offering to farmers. They also plan to onboard more agro-based companies as customers in this year.

'We were running six pilots across the three states of Karnataka, Madhya Pradesh, and Chhattisgarh. We started our paid subscription model in February and have three paying subscriptions today. We have also pre-booked three more for next month, and planning 10-20 more selective customers for the next three months,' Verma reveals.

To summarise, Fasal provides following the benefits to its customers:

- Costs savings through judicious usage of resources such as water, energy, fertilizers, and pesticides
- Prevention of product losses by preparing for precise weather conditions
- Automation of the daily farming routines that help farmers focus more on critical farming tasks
- Real-time monitoring and alarm notifications about the field and crop conditions to help farmers make early adjustments to reach the optimal growth conditions
- Insights, future predictions and analytics to help farmers make more data driven scientific decisions and eliminate guesswork



Picture 1: Sample GPI

¹. GDD means measuring plant growth by daily heat accumulation. It is a more reliable method than calendar days to predict crop and insect development. Differing threshold temperatures and beginning accumulation dates are used to determine accumulated heat units for different crops.

The company has fared well in the face of challenges. *‘One of our biggest challenges was managing the operations. We are operating in three different states and installing devices on the farm at remote locations. It is a huge challenge to make farmers understand the technology,’* says Ananda. To solve this problem, Fasal has distribution partners and have also appointed their product engineers to manage operations. *‘From the technology point of view, we make sure we have less operational overhead,’* he adds.

The company also faces challenges in acquiring customers. Talking on this Ananda says, *‘We work in smart agriculture and it is a challenge to acquire customers. Farmers do not want technology. They want solutions to help them save costs and increase production. Traditionally, farming has been about guesswork and it will take time to shift to data-driven techniques. But yes, despite all the challenges we are making it happen, because we understand the whole ecosystem. We sit with farmers and try to understand the real problems that they are facing, which technology like IoT can solve. Rather than building technology for them, we are building solutions for farmers’ pressing problems.’*

With agri-tech startups buying investors’ interest, Fasal is looking at an interesting opportunity. As per BIS Research, the global market size for precision agriculture is going to grow over \$6.34 billion by 2022 at an estimated Compound Annual Growth Rate (CAGR) of 13.09 percent from 2015 to 2022.

Fasal’s Key Accomplishments

The success of Fasal lies in the success of the various farmers it has helped so far. Deepak Taunk, a progressive vegetable farmer of Chhattisgarh reveals that with Fasal, he is able to correctly analyze the irrigation and fertilizer requirement in his farms, thus enabling cost savings. Grover Zampa, one of the largest vineyards of India, has been able to maintain required water stress level in the soil, improving the quality of yield. Mr. Bhupendra, an influential vegetable farmer has been able to save 50 percent in irrigation costs ever since he deployed Fasal’s solution. He also successfully saved his bottle gourd crop through preventive spraying upon disease prediction by Fasal. Another farmer from Raipur better understands his soil suitability and grows crops accordingly without wasting valuable resources such as time and investment. Similarly, Mr. Amol Rakibe, a progressive grape farmer has successfully reduced his disease management cost by up to 50 percent, simply by using Fasal’s smart farming solution. Another farmer from Chhattisgarh, Mr. Abhishek Chawda, who studied in Australia and came back to India to undertake scientific farming, expects a yield of 60 tons per acre, thanks to support from Fasal. His ambition is to undertake farming on an industrial scale and improve the current state of affairs with respect to agriculture in India. Another farmer named Kiran Patil reaped a direct monetary benefit of INR 78,250 simply by implementing Fasal’s solution. Similarly, Nayan Taunk, a farmer from Raipur reaped a direct monetary benefit of INR 85,000 after subscribing to Fasal. A few case studies are presented in detail at Annexure 3.

Since its founding, Fasal has won several awards and accolades - Center of Excellence for IoT and AI (CoE IoT), NASSCOM selected Fasal for incubation. The company is one of

the three winners of Seaside Startup summit. Also, Fasal is being listed as the Great Indian Startup by Tech in Asia and Top Six Indian AgriTech Startups that are Revolutionising Agriculture.

The future prospects for Fasal appears bright, especially in the light of steps taken by the Government (Refer Annexure 4 for Government Focus on Use of Technology in Agriculture). The Ministry of Electronics and Information Technology (MeitY) recently released a draft policy related to IoT plans with the goal to create an IoT industry of \$ 15 billion by 2020. India is expected to gain a 5-6 percent share in the global IoT market.

The IoT Policy has proposed the implementation via a multi-pillar approach comprising five vertical pillars - Demonstration Centers, Capacity Building & Incubation, R&D and Innovation, Incentives and Engagements and Human Resource Development and two horizontal supports - Standards and Governance structure. The CoE-IoT incubation center in Bengaluru where FASAL was incubated is one such example.

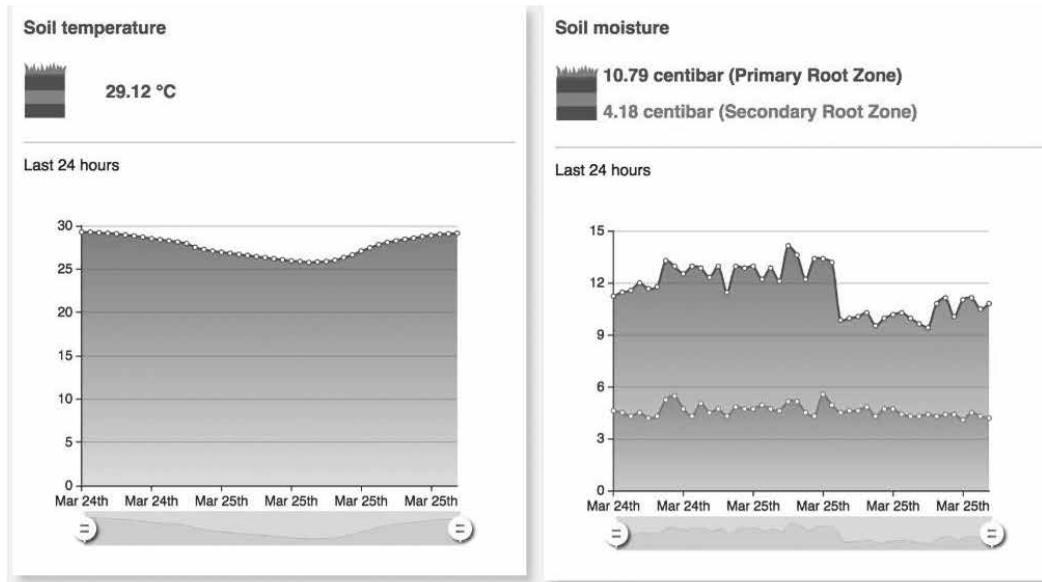
Conclusion

Ananda sees great future potential. About the agricultural ecosystem in India, Verma said, “The Indian food industry is poised for huge growth. The Indian food & grocery market is the world’s sixth largest, with retail contributing 70 percent of the sales. The Indian food processing industry accounts for 32 percent of the country’s total food market, one of the largest industries in India and is ranked fifth in terms of production, consumption, export and expected growth. It contributes around 8.80 and 8.39 percent of Gross Value Added (GVA) in Manufacturing and Agriculture respectively, 13 percent of India’s exports and 6 percent of total industrial investment.” Fasal has huge plans going ahead. “We would like to see Fasal in every farm in India in coming years and farming on auto-pilot. We are on a mission to help farmers grow more and grow better and we would like to make sure that they also sell better. A very far vision is – Fasal should be able to tell you what crop you should grow this season for a better outcome and what will be the market price once you harvest,” said Verma.

However, there also remain apprehensions about the future. Bright prospects in the field has resulted in increased competition. Fasal is competing against Indian startups such as Yuktix and eXabit Systems, while the competition worldwide includes CropX, Pycno, The Yield Technology Solutions, and more. Besides competition, there are other questions that occupy Ananda’s mind as he sits down for a discussion with Tiwari. What should be ideal growth plan and timeline? How will Fasal expand its reach to more farmers, agri-institutions and companies in India? How will it grow beyond India to solve agriculture problems in other countries?

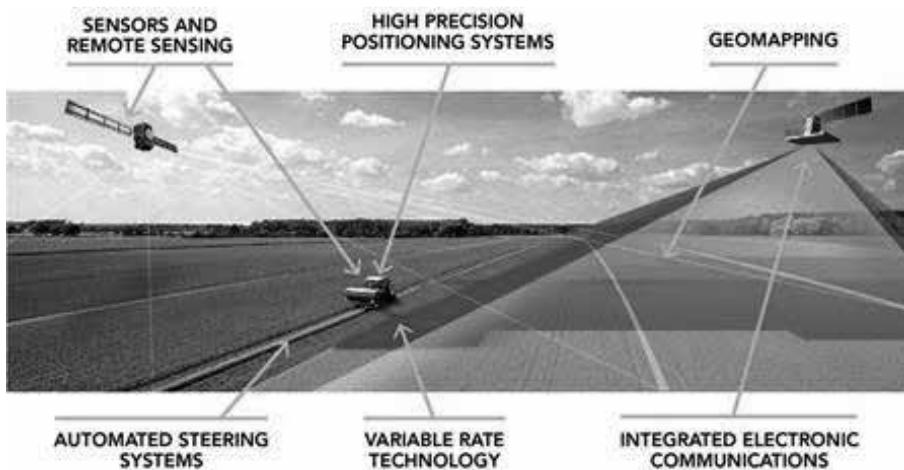
Annexures

Annexure 1: Sample Information about Soil Given by Fasal



Soil temperature and Soil moisture at Primary and Secondary root zone

Annexure 2: Precision Farming



Annexure 3: Farmers' Testimonies and Case Studies

Kiran Patil's story of success with Fasal



Case study - ROI on Grapes





Direct monetary benefit of 78,250/- INR



Disease management: Direct saving by cutting 14 sprays of Downey and Powdery Mildew worth 47600 INR. By virtue of this, saved 14 tractor passes for spraying saving 7000 INR in fuel cost.



More Yield: Increase in yield of about half a metric ton, converting into better revenue realisation of ~ 20000 INR



Optimum data driven irrigation: About 8.5 lack litres of water saved this season from irrigation. There was a 30% decrease in irrigation frequency. Saved about 10% in fertigation cost. A cumulative saving of 3650 INR



"Saheb, Kranti hona rey"

Farmer's Name - Kiran Patil
Region - Tasgaon, Sangli ,Maharashtra
Crop - Grape
Land area ~ 1 hectare
Date of pruning - November, 2018
Mode of irrigation - Drip

Kiran Patil, a grape farmer from Tasgaon, Sangli (Maharashtra, India) used Fasal for his grape plantation for the last season starting the mid of November 2018 to April 15, 2019. And midway through this journey he concluded the experience by saying "Saheb, Kranti hona rey", which in english translates to "Sir, this is a revolution". Kiran Patil is an experienced grape farmer who has been doing grape farming since last 15 years. In his region Downey mildew and Powdery mildew are a big menace. Afraid of loosing his crop, just like all other farmers of the region, Kiran Patil also had developed the practise of spraying fungicides on any sign/ feeling of threat from the mentioned diseases. Just like other farmers of the region Kiran patil also had the practise of irrigating everyday for 1.5 hours. This time, with Fasal as his companion, he decided that he will not just follow the decade old practises but, will take decisions based on hard facts. Kiran Patil sprayed this time when the concrete data and intelligence told him to, irrigated when the crop needed water and was on preventive mode rather than reactive this entire season. Kiran Patil has already sold his produce and is now busy encouraging other farmers to adopt Fasal.



Case study - ROI on Onion



Direct monetary benefit of 85000/- INR

Farmer's Name - Nayan Taunk

Region - Raipur ,Chhattisgarh

Crop - Onion

Land area - 10 acres

Date of sowing - December, 2017

Mode of irrigation - Drip



Disease management: Direct saving of 33,000 Rs in managing Downey mildew by precision and preventive spraying.

Nayan Taunk, a vegetable farmer in Raipur (Chhattisgarh, India) used Fasal's services for his onion plantation. And he sums up the whole journey by saying, "My onion was of the best quality in the whole region". Equipped with data and actionable recommendations this year, he is waiting for the next season to grow onions more profitably using Fasal. Downey mildew and purple blotch, are two major problems in his region with onion. Downey mildew is only identifiable when the leaves start to turn yellow and the damage in terms of yield loss has already happened. This time, Fasal sent him alerts on 3 instances that Downey spore generation has already happened and advised him to do take preventive sprays. Nayan sprayed a combination of M-45+Blue copper, preventive spray, which costs 500 Rs per acre, instead of reactive sprays, which cost 1500-1600 Rs per acre. The Downey mildew passed the whole season without any damage to the crop with only 3 preventive sprays. His farmer friends who grew Onion and suffered from Downey lost ~1.5 Tonnes per acres, but Nayan did not. Owing to proper irrigation and precise disease and input management the quality of Produce was superior and was sold in the first flush itself.



More Yield: Approx 1.5 Tonnes more yield per acre than other farmers in the same region. A total of 12 tonnes more. 42000 Rs from the yield.



Optimum data driven irrigation: maintained at 20 Cb cutoff. Saved ~ 10K in fertilisers by checking leeching.



"My onion was the best in quality in the whole region"

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