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# Agriculture & Industry Survey

## India's Leading Business Magazine for Agriculture

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- **Pranam Kisan, Hanumangarh Town, Rajasthan**
  Elaborates on Fintech for farmers. He is an agripreneur, farmpreneur by passion and Agri technopreneur by profession. (Page 14)

**Devan Chandrasekharan, Managing Director**

- **Fuselage Innovations, Kochi, Kerala**
  Narrates his experience in agriculture drones start-up in a recent interview. (Page 18)


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Nagachaitra Mysore

**Dr. Sanjay Bala, Regional Director**

- **National Medicinal Plants Board Jadavpur University, Kolkata, West Bengal.**
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# How to reshape the future of Indian agriculture

***Innovation in agrifood life sciences is the need of the hour. The fledgling ecosystem needs to be revitalised with talent and capital, Mark Kahn, managing partner and cofounder, Omnivore, writes***

Less than a decade ago, channeling capital into India's now-thriving agritech sector was a Herculean task. Before the ubiquity of mobile data and smartphones across rural India, venture capital (VC) investors focussed on urban themes, including ecommerce, e-grocery, and restaurant delivery. Around 2016, when these categories consolidated around a few unicorns, mainstream VC investors began exploring B2B themes and agritech popped onto their radar, which is appropriate given that around 25 percent of India's economy is agriculture and agribusiness. As of 2022, India has the third-largest startup ecosystem globally and ranks third after the US and China in agritech funding. However, agrifood life sciences (AFLS) as a sub-sector of agritech is yet to experience the same boom in entrepreneurship and funding.

We think about agrifood life sciences as including four broad categories: Agricultural biotechnology, novel farming systems, bioenergy and biomaterials, and innovative foods. Agricultural biotechnology includes on-farm inputs for crop and animal agriculture, including hybrid seed breeding, genetics, microbials, and animal health. Novel farming systems include controlled environment agriculture (CEA), RAS aquaculture, insect protein, and algae production. Bioenergy and biomaterials include agri waste processing, biomaterials production, and feedstock technology. Finally, innovative foods refer to various forms of alternative proteins (plant-based, fermented, and cellular), as well as functional foods and other novel ingredients.

### Why is AFLS so critical for India?

Indian agriculture faces a grim catch-22 situation in the coming decades, where there is an urgent need to increase crop yields to feed a growing population even as increased agri production depletes already declining water tables and soil health. Making matters worse are the advancing effects of climate change. Within a decade, Indian farmers will bear the full force of climate change, and digital technologies alone are insufficient to ensure a bright future in rural India.

Innovations in agrifood life sciences can play a critical role in tackling climate mitigation (reducing India's GHG emissions) and climate adaptation/resilience (securing a future for India's farmers). We are also moving towards a more protein-intensive future alongside rising concerns for animal welfare and environmental sustainability. Agrifood life sciences have the power to transform India's bounty of millets and pulses into innovative plant-based proteins to meet global demand.

ALFS can even reinvent entire agricultural value chains, for example, replacing unsustainable ingredients like fishmeal with insect protein, creating a circular economy at scale. Finally, biological substitutes can be developed for chemical fertilisers and pesticides, simultaneously improving human and planetary health. There are innumerable challenges ahead for India, but agrifood life sciences can solve them with innovations.

### Current state of AFLS in India

Agrifood life sciences are the most neglected aspect of agritech in India's startup ecosystem. Globally, $6 billion was invested in AFLS startups in 2020, while in



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India, only $10 million, in aggregate, was raised by startups tackling these immense challenges. India is becoming a global outlier, with the US, Israel, Europe and China all building unicorn startups in agrifood life sciences. The lackluster state of entrepreneurial activity in this category in India is mystifying. More so when we consider how innovations in synthetic biology, chemistry, and biotechnology have the power to catapult Indian agriculture and food to a profitable and sustainable future.

Many blame India's de facto ban on new transgenic traits in seeds, but this is a flimsy argument since we also lack startups in biological crop inputs, microbial biotechnologies, cellular alt protein, and animal/aquaculture health products. In part, the answer lies in the lack of world-class talent. In the digital startup ecosystem, over the past few decades, entrepreneurs and investors returned to India with global exposure. In contrast, Indian life sciences talent continues to migrate abroad at the earliest possible opportunity and rarely returns home. In India, scientists are not considered wealth creators, and there is very limited spending on R&D domestically.

How do we fix the ALFS gap? Despite operating on shoestring budgets, the public sector in India has done more to help the nascent life sciences ecosystem than it gets credit for, with DBT, BIRAC, C-CAMP, and NCL helping to support entrepreneurs in the absence of meaningful private investment. As opposed to the generous capital flow in other categories in agritech, the trickle of VC investments in this space is conspicuous. It might be because most VCs in India come from digital technology backgrounds, as opposed to having been trained in the life sciences.

It is clear we can no longer afford anaemic progress in agrifood life sciences. The fledgling ecosystem needs to be revitalised with talent and capital. In spite of painting a rather sad picture of the current state of affairs, it would be unfair to lose sight of India's strong universities and research institutions shaping future life science innovators. Now is the time for VC investors to step forward and help reshape the future of Indian agriculture and food systems. On our part, Omnivore has launched the OmniX Bio initiative to back early-stage agrifood life science startups. OmniX Bio aims to catalyse venture capital towards India's nascent agrifood life sciences ecosystem and also provide mentorship from global agrifood life sciences leaders, institutional partnerships, and business development support to access domestic and export sales channels. The path ahead for Indian agrifood life sciences might not be an easy one, but it is definitely the surest way to ensure a truly atmanirbhar future of India.

(The writer is managing partner and co-founder, Omnivore)

Source : www.forbesindia.com

# Agriculture startups can help make India a global leader in farming

***Karandlaje gave away awa-rds to 32 agri startups, which included five national-level awards, two special ones for women-led agri startups and 27 State-level ones.***

Minister of State for Agriculture and Farmers' Welfare Shobha Karandlaje emphasised the need for agricultural startups to play a key role in handholding small and marginal farmers in the country by ensuring higher income for their produce in domestic and global markets.

Addressing the 'MANAGE- Samunnati Agri Startup Awards 2022' event at the National Institute of Agricultural Extension Management in Rajendranagar, she encouraged agri startups to make India a global leader in agriculture through their innovations.

Highlighting the initiatives of the Centre to support the agricultural sector through the agriculture infrastructure fund, Remunerative Approach for Agriculture and Allied sector Rejuvenation, oilseed mission, and promotion of FPOs, agri startups and One District One Product (ODOP), she reiterated Prime Minister Narendra Modi's vision to make the country self-reliant in agriculture.

Karandlaje gave away awa-rds to 32 agri startups, which included five national-level awards, two special ones for women-led agri startups and 27 State-level ones. The winners received cash prizes and mementos.

During her visit, she also inaugurated the 15-day International Technical and Economic Cooperation (ITEC) training programme of the Ministry of External Affairs on 'Computer Applications in Agricultural Extension', which was attended by 30 delegates from 15 countries in Asia, Africa and Latin America.

Source : www.newindianexpress.com

## India's food production industry worth over $400 billion, but food processing significantly low

India's food production industry is worth over $400 billion, the primary source of livelihood for over nearly half of the country's population but the level of food processing across categories is significantly low, said a recent study.

India's share of agri-production is 9.5% globally, while its share in the export of overall food products is 2-3% - with share in export of processed food category even lower at 1-2%, according to a report by Boston Consulting Group (BCG) in association with Federation of India Chambers of Commerce & Industry (FICCI). "We live in an increasingly connected world, where consumers can access products from across the globe. With fundamental shifts in consumer behavior owing to the pandemic, growing awareness, convenience and lifestyle changes and health consciousness, consumers are gravitating towards processed and packaged foods. These newly created opportunities in the food processing industry make it crucial for India to focus strongly on exports and seize the opportunity to capture a burgeoning global market", said Hemant Malik, Chairman – FICCI, Food Processing Committee and CEO-Food Division, ITC Ltd.

The total agriculture and food related exports from India were valued at nearly $50 billion in FY22. Some of the key challenges contributing to this trend include low-cost competitiveness, product quality concerns, limited brand strength in overseas markets, lack of infrastructure for processing, storage and logistics, as well as limited compliance to sustainability and ethical requirements.

"Given India's strong position in production of agriculture products, there is a huge opportunity for India to develop its food processing industry with a strong focus on the export markets.

Source : economictimes.indiatimes.com

## How India has gone to become the world's second largest shrimp producer

### Once dogged by diseases, the shrimp sector saw a turnaround post-2009

Till 2008, like any other shrimp farmer in India, Saji Chacko too was struggling with his farm at Bilimora in Gujarat because of repeated outbreaks of diseases. He decided to do something about it and in 2009, became the first farmer in India to get a licence to commercially produce pathogen-free Pacific white shrimp (Litopenaeus vannamei).

With that, the story of his shrimp business turned. And so did that of India's shrimp industry, as the country opened the doors to farmers like Chako to start producing this disease-free variety. Today, the country is the second largest producer of shrimps in the world, second only to Ecuador.

Shrimps now make for 67 per cent of India's seafood exports of $7.8 billion, according to the Seafood Exporters' Association of India (SEAI). In 2009-10, they formed a miniscule percentage. Around 45 per cent of the shrimp exports is to the United States, followed by China, the European Union and Japan. The number of shrimp hatcheries has, consequently, seen a multi-fold jump in terms of seed supply – from a mere 6 billion seeds (postlarvae) in 2009 to 100 billion now. For Chacko's company, production has jumped from 100 tonne to 1,100 tonne from 100 hectares. And his annual revenue has shot up from Rs 1.5-2 crore to Rs 27 crore.

"I started aquaculture in Gujarat in 1994, and till 2009, the crop was a gamble and the produce was very inconsistent because of diseases," Chacko said. "Introducing the vannamei variety changed my fortunes, and also of our country's." According to the Union commerce ministry, India's shrimp exports have recorded a jump of over 33 per cent in the last one year – from $3.9 billion in 2020-21 to $5.2 billion in 2021-22. "Though the sector was hit by Covid in 2020-21, we are seeing a 50 per cent growth, at least, in shrimp export compared to the pre-Covid level," said Elias Sait, secretary general, SEAI.

This growth is majorly driven by states like Andhra Pradesh, West Bengal, Odisha, Gujarat and Tamil Nadu, where large areas are available for farming. According to data shared by the Chennai-based Society of Aquaculture Professionals, India's total shrimp production zoomed from around 100,000 tonnes in 2010 to 937,000 in 2021.

It, however, took the industry some five years of lobbying, starting 2005 when India had a vannamei trial-run, to get the go-ahead from the government for its production.

Until 2009, Indian farmers were heavily dependent on the domestic variety called Black Tiger. Industry sources indicate that now around 90 per cent of the shrimp produced in India if of the vannamei variety, and a mere 10-odd per cent accounts for other varieties including Black Tiger.

"We would not have achieved this growth without vannamei," said K Senthil Kumar, joint secretary of the Society of Aquaculture Professionals. "It requires a small area for production and has high resistance to diseases. It used to be an exotic item till 2009, until the government started giving licences to farmers to produce it."

Farmers want to ramp up production. "We have the capacity to increase the production to 150 billion," added Ravikumar Yellanki of Vaisakhi Bio-Marine, which is engaged in the hatcheries business.

Read full @ https://bit.ly/3eYjJQL

Source : business-standard.com

# How India is building a pearl farming industry

In 2016 Narendra Garwa was facing a desperate financial situation. His small book store in the village of Renwal, Rajasthan, was running at a loss. With a family to support and little education, he searched the internet for other money-making ideas. He had some success growing vegetables in plastic bottles, but then came across a potentially more profitable crop - pearls.

"Rajasthan is a dry area with water issues. It was a challenge to think of growing pearls with limited water but I decided to try," he says. Pearls are formed when a mollusc reacts to an irritant in its protective membrane. The mollusc deposits layers of aragonite and conchiolin, which together form nacre, also know as mother-of-pearl.

In the wild, pearl formation is rare so most pearls sold these days are from farmed molluscs, usually oysters or freshwater mussels. To spur the mollusc to form a pearl, an irritant is artificially introduced into the creature. However, it is a delicate process and the mussels or oysters must be carefully handled, as Mr Garwa found.

“My first attempt was a disaster,” he admits. Of the 500 mussels he purchased, only 35 survived. Mr Garwa had travelled to Kerala to buy the mussels - a journey of 1,700 miles involving a 36-hour train journey. He also used his savings and borrowed money to come up with the 16,000 rupees (£170; $200) needed to buy the molluscs.

In addition, Mr Garwa had dug a 10ft by 10ft pond in his back garden to keep the creatures in. Despite the setback, he did not give up. Instead, he took a five-day course in pearl farming. “Growing an oyster is like bringing up a baby,” he says.

“Monitoring the the water throughout the growth period is crucial to achieving high quality and volume of produce.” Now he has a 40ft by 50ft pond, which he treats with multivitamins and alum which maintains the correct pH level required for growth.

The survival rate of his mussels has risen from 30% to more than 70% since becoming more familiar with the process. Mr Garwa expects to produce around 3,000 pearls this year, which he can sell for between 400 and 900 rupees (£4-£10; $5-$11). The Indian government has been encouraging pearl fishing as part of its Blue Revolution, a plan to modernise the nation’s fishing industry.

Under the scheme the government pays for half the cost of setting up a pond for pearl fishing, and so far the Department for Fisheries has given financial support to 232 pearl farming ponds.

“Pearl farming is one of the most lucrative aquaculture businesses and the government is encouraging farmers to take up this farming,” says Jujjavarapu Balaji, Joint Secretary of Marine Fisheries. Not everyone is impressed with this wave of pearl farming activity. Critics include Gunjan Shah, who is the fifth generation of his family to be in the pearl trading business.

“The culture of pearl farming has increased in India but I think the pearls grown in every nook and corner are not of very good quality” says the owner of Babla Enterprises, based in Mumbai.

He says India is producing too many of the wrong kind of pearls. “What India needs at present is people who can grow sea water pearls if we want to compete with China. Indian oysters are small but China has hybrid oysters which produce large pearls.

“Cultured South Sea pearls are the most valuable type of cultured pearl on the market today. These pearls come in a gorgeous variety of sizes, shapes and colours. A strand of South Sea pearls can be as expensive as $10,000 (£8,500) or more. They are very rarely produced in India.” He says the government should be looking to develop this part of the industry.In its defence, the government says it will take time to build up a competitive pearl farming sector.

“Pearl family is specialised farming, so this sector will take time to grow. The plan is to see the increase in the next three years,” says Mr Balaji, from the Department for Fisheries.

“Once we are able to grow enough pearls for local consumption then we can focus on exports,” he adds. As for Mr Garwa, as well as farming pearls, he also offers courses for those who want to learn how to do it.

Reena Choudary, 28, was one of his students, and just like her tutor her first effort last year was a failure. “I lost all the oysters - none of them were able to produce,” she says. But this year, she expects to produce around 1,000 pearls.

Starting an independent business was a big leap for her, particularly as women in her region are often expected to look after the home rather than work.

“For people like us this smells like freedom,” she says. “We have learnt how we can be independent, help towards contributing to the family and have a say in family matters.”

Source : bbc.com

# Smart farming can prove to be a game changer in the coming days

India has embraced technology in every field of activity. It is adopting smart farming methods through technology and innovation in the agriculture sector and this may prove to be a game changer in the days to come by substantially raising farmers income.

How is this method beneficial?
Smart farming involves the application of sensors and automated irrigation practices. It can help monitor agricultural land, temperature and soil moisture. This would enable farmers to monitor crops from anywhere. Moreover, smart farming can help integrate digital and physical infrastructures, which would benefit small farmers.

Agri-based startups can reach out to the farmers and help them gain access to such viable and cost-effective solutions. Agri-based, tech-driven startups have been very innovative in assisting farmers and revolutionising farming techniques. They have also addressed one of the most powerful headwinds (climate change) through climate-smart farming.

In a unique move, the Indian government is implementing a Digital Agriculture Mission (DAM), which includes India Digital Ecosystem of Agriculture (IDEA), Farmers' Database, Unified Farmers Service Interface (UFSI), funding to the states on the new technology (NeGPA), revamping Mahalanobis National Crop Forecast Centre (MNCFC), Soil Health, Fertility and profile mapping. According to a report published by the National Association of Software and Services Companies (NASSCOM) in 2019, there were more than 450 argi-based tech-driven startups in India as of 2019. This number has skyrocketed in the last two years as the sector witnessed a surge in investments and funding.

Agri-based tech-driven startups have been very innovative in assisting farmers and revolutionising farming techniques. They have also addressed one of the most powerful headwinds (climate change) through climate-smart farming.

Under the NeGPA programme funding is given to the governments in various Indian states for Digital Agriculture projects using emerging technologies like Artificial Intelligence and Machine Learning (AI/ML), Internet of Things (IOT), Block chain etc. Adoption of drone technologies is being done too. To promote smart farming, the government promotes startups in the agriculture sector and nurtures agri-entrepreneurs. The 'Per Drop More Crop' component of the Pradhan Mantri Krishi Sichai Yojana (PMKSY-PDMC) aims to increase water use efficiency at the farm level through micro irrigation technologies like drip and sprinkler irrigation systems. PMKSY is a scheme initiated by Prime Minister Narendra Modi.

The Indian Council of Agricultural Research (ICAR) promotes innovation, extension and education in agriculture. A total of 1,575 field crop varieties were released for different agricultural crops during 2014-21. During 2014-21, 91.43 crore agri-advisories were provided to farmers through mobiles. ICAR developed 187 mobile apps on different farm and farmer related services during 2014-21.

The agriculture sector plays a vital role in enriching India's economy. Agriculture accounted for almost 17.8 per cent of India's Gross Value Added (GVA) in 2019- 20. According to the World Bank's collection of development indicators, employment rate in the Indian agriculture sector stood at 41.5 per cent in 2020.

From a socio-economic standpoint, agriculture is a vital sector which requires focus and awareness at all levels. According to India Brand Equity Foundation, the rising population and changing diets have created a huge pressure on land in India. Farmers are struggling to keep up as crop yields level off, soil degradation rises, water shortage increases, biodiversity declines, and natural calamities become more frequent. Furthermore, agriculture accounts for almost 14 per cent of India's total greenhouse gas emissions.

Read full @ https://bit.ly/3UstXZX

Source : businessinsider.in

## Agriculture, Processed Food Products Exports Up 30% To $9.6 Billion In April to July: APEDA

*Citing data of the Directorate General of Commercial Intelligence and Statistics (DGCI&S), it said that exports fruits and vegetables registered a 4 per cent growth during the period*

**India's agricultural and processed food products exports rose by 30 per cent to USD 9.6 billion during April-July this fiscal, an official statement said . For 2022-23, an export target of USD 23.56 billion has been fixed for the agricultural and processed food products basket, the commerce ministry said.**

**Citing data of the Directorate General of Commercial Intelligence and Statistics (DGCI&S), it said that exports fruits and vegetables registered a 4 per cent growth during the period. Basmati rice exports witnessed a growth of 29.13 per cent in the first four months of 2022-23 as its export increased from USD 1.21 billion in April-July 2021 to USD 1.56 billion during April-July 2022.**

**Exports of non-Basmati rice rose by 9.24 per cent during the period under review to USD 2.08 billion. Similarly, the export of dairy products recorded a growth of 61.91 per cent to USD 247 million in the first four months of the current fiscal.**

**Source : outlookindia.com**

# How technology investments are revolutionising the agriculture sector in India

Technological interventions are taking over the world gradually. We are entering into the fourth industrial revolution or Industry 4.0 with a focus on digitization and automation. With this, farming operations are no longer run with basic technology. Farmers and agriculturalists are too stepping ahead for agritech sophistication. There has been an aggressive investment in agritech approaches involving IoT (Internet of Things), smart logistics, Artificial Intelligence (AI), Kisan drones and Machine Learning (ML). Given these practices, India's agricultural sector has witnessed massively improved growth in the last two years, with exports touching an all-time high of about $50 billion.

Starting from awareness campaigns run by Non-Governmental Organisations to the Government of India's aggressive push toward modernising India's agricultural sector, the results will scale up further. As per a FICCI and PWC joint report, $500 million has already been invested in India's agritech startups in 2020-2021. The agricultural arena today is one of the largest employers in the country, registering a growth of 3.6% in the pandemic-hit 2020-2021 and further rising to 3.9% in 2021-2022. Here is a look at some of the interventions that are modernising our agricultural infrastructure:

## Drone tech investments to make farming less labour intensive

Drones are a popular farm tech tool used to spray agrochemicals and nutrition onto crops, This is now taking a major headway forward with the Indian agricultural drones market forecasted to achieve a four- figure rise by the year 2028. The projected CAGR in this domain is 25% during the period of 2022-2028. These unmanned aerial vehicles reduce the dependence on manual labour, enabling the spray of insecticides, pesticides and soil conditioners automatically, that too efficiently at time-specific intervals. This technology also supports monitoring yields through aerial photography, so farmers can inspect their fields without having to walk through the entire field on foot.

Recently, in May 2022, the Government of India inaugurated a programme to provide 50% or Rs. 5 lakh subsidies to SC/ST, small and women farmers for employing Kisan drones in their fields. For all other farmers, this subsidy amount was kept at 40% or up to Rs. 4 lakh. This aims to make agritech farming more affordable, which supports crop assessment, digitization of land records and spraying of vital agrochemicals on farms. Through this, the overall labour-intensive costs shall be reduced and farmers' income will get an overall boost.

## IoT investments to bring process automation to farming

The last few years have seen a rise in the concept of smart farming, wherein one of the major transformations has been the usage of the Internet of Things (IoT) devices for farm process automation. Sensors are being deployed on fields to measure the soil topography and assess the agrochemical needs of a particular area.

These smart sensors are placed on fields, gather critical growth data and produce detailed analytics for farmers, who can view these readable insights on their smartphones. Even though the current adoption of this technology remains low, it has been projected that IoT-enabled connected agricultural practices are estimated to grow by three times by the year 2025.

Parameters like soil quality, water levels, moisture, plant diseases and temperature can be read by these IoT-enabled sensors to bring out insights for farmers and act out interventions accordingly. Further to this, IoT technology can also be enabled for water management in the fields, wherein water flow can be regulated on the basis of the moisture content in the soil or ambient air. In closed farming spaces or better known as Controlled-Environment Agriculture (CEA), IoT sensors enable strict environment checks like automatically regulating light brightness or even turning on water when required.

## Investment in robust supply chains to reduce food wastage

As per statistics released by the United Nations, about 14% of food is lost between harvest and retail, while about 17% of total food production gets wasted globally.

Taking into account India-specific statistics, about 45% of food produced in India is lost because of inefficient supply chains, and some estimates also, go on to state that this causes a monetary loss of about $14 billion a year. This can be solved by tech investments in a smart logistical infrastructure, that transports food with the least wastage.

Recently, the United States International Development Finance Corporation pumped in a loan of $5.5 million to one of India's food supply chains startup to support the "farm-to-fork" supply chain approach.

This means that products from farms reach consumers directly, through a technology-backed supply chain, and do away with a nexus of middlemen, eliminating wastage and losses. We need more funding for automation and platform-based tracking interventions in supply chains, especially when about 30% of the world's population lacked adequate food in 2021.

In retrospect, the investments in the agritech sector are sure to revamp the entire segment and transition India's approach from traditional farming to technologically backed automated farming solutions. These advanced solutions will empower farmers to become futuristic by enhancing profits, introducing safe practices and being more efficient.

Read full @ https://bit.ly/3SAjjyx

Source : timesofindia.indiatimes.com

# Climate change is hurting India's rice crop

**With extreme weather events affecting cropping patterns, growers need to be equipped with new farming methods.**

In Haryana's Bithmara, about 200 kilometres (124 miles) northwest of the capital New Delhi, 37-year-old Satish Jangra is distraught after seeing his paddy crops destroyed due to untimely and incessant rainfall in early August. "I am compelled to leave farming. The cost is much more than the output and I am falling into a debt trap," he said.

Each year, Jangra would till 3 hectares (8 acres) of his neighbour's land in which he cultivated mostly paddy and other grains like wheat and millets. That has now been reduced to 1 hectare (3 acres). He is thinking of either changing the paddy field to another crop variety or stopping tilling the land altogether so that he does not have to worry about the losses each year.

"You spend thousands on different fertilisers, diesel, water etc and when it's time for output for paddy especially, you just get into losses," he told Al Jazeera. Traders pay according to the quality of the rice, but over time farmers say, the quality has decreased. He still has to pay a $600 loan to the bank and for that, he is now looking for an alternative.

"I have started working in a small furniture shop because I cannot be dependent on just farming," he said. In eastern India's Jamui Bihar village, farmer Rajkumar Yadav's troubles are the opposite of Jangra's as he waits for rainfall so that his paddy crops do not dry up. Each morning and evening, the 55-year-old's family takes water from their well to sprinkle on the crops. He says his family can no longer rely on the monsoon. "In our area only 10 percent sowing of crops has happened so far because there is no rainfall. We all are dependent on the Tubewell [used to pump groundwater], which is also drying due to high temperatures," he said.

Researchers say that the production of rice in India is constrained by both droughts and heavy rains which can flood the fields. About 68 percent of the total cropping area in India is rainfed. Of the roughly 40 million hectares (100 million acres) of the rice-harvested area in India, 60 percent is irrigated leaving the rest dependent upon rainfall, and hence susceptible to drought. Aditi Mukherjee, principal researcher at International Water Management Institute (IWMI), a nonprofit research organisation, said overall, climate change has increased the probability of extreme events.

While "impacts of droughts can be somewhat mitigated through access to irrigation, parts of India [such as eastern India which is a major rice basket], do not have adequate affordable irrigation, and depend mostly on expensive-to-operate diesel pumps," she said. This year paddy sowing has been affected in key rice-producing states like Uttar Pradesh, Bihar and West Bengal, resulting in a 13 percent lag in area under paddy.

## A ban on rice exports?

IWMI's Mukherjee told Al Jazeera that it is going to be a hard year for farmers. "Heat waves, followed by drought-like conditions due to late arrival of monsoons, have impacted two main crops, wheat in the previous season, and now rice," she said, adding that such late sowing of paddy is likely to affect yield, and also delay the next cropping cycle. And while it is not clear as yet what sort of shortage that will result in when the harvest finally comes, the United States Department of Agriculture has estimated that rice production may reduce by 0.9 per cent, the first decline since 2015. That leads experts to say they need to monitor the situation closely, especially if the government decides to ban or limit its exports as it did in May for wheat. Tavseef Mairaj Shah, who works in agroecology, warns that while a ban on rice exports would be catastrophic for the global food supply, such a move is not currently expected, although a rise in rice prices is not off the cards.

The threat to India's rice production also comes at a time when countries are already grappling with soaring food costs. The decline in production that farmers foresee could make India's battle against inflation more difficult and lead to export restrictions. In India, rice is a staple food for more than half the population. Bangladesh, China, Nepal, and certain Middle Eastern nations are among some of its top clients, as India exports rice to more than 100 countries. "India has to take in consideration the domestic food security aspect. While we currently have grain stocks, we may have to buffer in case the Ukraine war continues," said Srinath Sridhan, an independent markets commentator.

Read full @ https://bit.ly/3roDDop

Source : aljazeera.com

# Online Meetings @

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## Upcoming events

**OCTOBER 3, 2022**

**3:00 pm**
Dr. Nagulapalli Sneha Latha on "What is scientific bee keeping?"

**5:00 pm**
Prof. G. Sudarsanam on "Soilless hydroponics – An introduction to innovative farming"

**OCTOBER 6, 2022**

**3:00 pm**
Ms. Priyanka Rani on "Pollinators – Their significance in food production"

**5:00 pm**
Mr. Kiran HB on "Gypsophila cultivation, economics and marketing techniques"

**OCTOBER 7, 2022**

**3:00 pm**
Dr. Chandrakiran Sant on "Dairy Farming : Boon or bane for Entrepreneurs"

**5:00 pm**
Dr. Rupesh Agarwal on "Spirulina – Potential product from agriculture for food and pharmaceutical industry"

**OCTOBER 10, 2022**

**3:00 pm**
Mr. G A Balakrishnan on " Cardamom cultivation and value addition"

**5:00 pm**
Ms. Nagamandla Ramya Sri on "Integrated pest management"

**OCTOBER 11, 2022**

**3:00 pm**
Mr. Mithun on "What is Occupational zoonotic diseases?"

**5:00 pm**
Ms. Peddaveeri Pravalika Reddy on "Conservation agriculture practices for high-end horticulture cropping systems"

**OCTOBER 12, 2022**

**3:00 pm**
Ms. Kavimukil Sivanrajan on "Pradhan Mantri formalisation of Micro Food Processing Enterprises (PMFME) Scheme"

**5:00 pm**
Mr. George Eapen on "Agriculture fencing – Safety and efficacy of Agrifenz"

**OCTOBER 13, 2022**

**3:00 pm**
Mr. Ankur Agarwal on "Marketing opportunities for oil seeds"

**5:00 pm**
Mr. Shekhar Chaturvedi on "Tulsi – Processing, uses and advantages"

**OCTOBER 14, 2022**

**3:00 pm**
Mr. Rajender Kumar on "Commercial use of rain shelter technology in horticulture crops"

**5:00 pm**
Mr. Ramana Rao KV on "Stevia cultivation and value addition"

**OCTOBER 17, 2022**

**3:00 pm**
Dr. Raj Kumar Yogi on "Job opportunities for agri graduates"

**5:00 pm**
Mr. Rajesh N. Gaidhani on "Managing pre and post harvest crops"

**OCTOBER 18, 2022**

**3:00 pm**
Dr. Devesh Thakur on " Confident Public Speaking : A necessary skill for agriculture extension professionals"

**5:00 pm**
Dr. V K Jayaraghavendra Rao on "Soilless protected cultivation prospects"

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## Recently Completed Meetings

**Dr. Purushottam M Dewang on "Tomato leaf miner ( Tut Absoluta) – Pest management with pheromonelures & traps"**
Dr. Purushottam M Dewang is the Founder , MD & Chief Scientific Officer at CropG1 Agro Research & Development Pvt. Ltd., in Bengaluru, Karnataka. To know more view https://bit.ly/38TW9PS , https://bit.ly/2XPVzw3

**Mr. M.Nallamuthu on "Complete dairy machinery"**
Mr. M.Nallamuthu , CEO, Thumba Agro Technologies, Palani, Tamil Nadu are special machine designers for dairy and sectors. Following are their own designed and manufactured machines for dairy and poultry sectors.

**Ms. Natalie Duerden on "Discover how essential oils can transform the way you manage your health"**
Ms. Natalie Duerden says "doTERRA International is the the largest essential company in the world, with over 13 million people in 150 difference countries ordering products monthly. In 15 short years doTERRA has come to be known for the most tested, most trusted essential oils in the world and the only brand used in hospitals and research universities. To know more view https://bit.ly/3RHWTeE

**Mr. Dipankar Verma on "Moringa – Exports, marketing and quality"**
Mr. Dipankar Verma is Managing Partner of Terry Exports LLP established in 2016. Terry Exports LLP is engaged as a wholesaler, trader and exporter of Clove Oil, Essential Oil, Moringa Capsules, Moringa Powder, etc. The sheer devotion and hard work of Mr. Dipankar Verma has gifted an enormous glory and repute in the market.

**Mr. Peeyush Pandey on "Cauliflower – Cultivation and all other aspects"**
Mr. Peeyush Pandey is an Agronomist in Agriplast Tech India Pvt Ltd. in Lucknow, Uttar Pradesh. Speaker likes to talk on cauliflower cultivation, nursery raising, raised bed plantation, manure and fertilizer, production economics along with drip irrigation system and benefits.

**Mr. S.K.Babu on "How to start a eco- friendly projects and how to sell the eco- friendly products"**
Mr. S.K.Babu is the Project Director at Eco Green Unit in Coimbatore, Tamilnadu. Eco Green Unit is established in the year 1999 and stands ahead in this competitive market by providing quality products and services.

**Ms. Jissy George on " Pineapple & passion fruit processing aspects"**
Ms. Jissy George is a Subject Matter Specialist, Home Science at ICAR KVK -ALAPPUZHA in Kerala.

**Mr. Parikshit Sampat Sai on "Employment opportunities in agriculture – Local & global"**
Mr. Parikshit Sampat Sai is a Founder & CEO at Pranam Kisan in Hanumangarh Town, Rajasthan. He is a Die-Hard Agripreneur, Farmer by birth, Farmpreneur by Passion and Agritechnopreneur by Profession. To know more view https://bit.ly/3lWMP3q

**Mr. Ganesh Shahaji Pawar on "Non-chemical plant protection for sustainable future"**
Mr. Ganesh Shahaji Pawar, subject matter specialist (plant protection) at Krishi Vigyan Kendra, Tadsar. He says, post green revolution in our country the dependency on chemical based input has increased tremendously. Today, we are facing many problems especially due to use of pesticides.

**Dr. V K Jayaraghavendra Rao on "Nano technology in agriculture"**
Dr. V K Jayaraghavendra Rao is the Principal Scientist ICAR-IIHR(Indian Institute of Horticultural Research) in Bengaluru, Karnataka.

**Mr. CH V Narasimha Raju on "What are the problems faced in cold storage for agro products"**
Mr. CH V Narasimha Raju is Managing Director of Coldspace Agrotech India Pvt. Ltd. in Hyderabad, Telangana. They are established in 2013 and have pressurized ripening chambers. These are international standard chambers. Mr. CH V Narasimha Raju says they have done ripening of more than 40000 tons of fruits till now and have rich experience in production, processing and promotion. Coldspace Agrotech are working with Government Organizations, Agri Colleges, Central Institutions, FPO's, Farmers and Retailers.

**Ms. K. Indira Reddy on "Double the farmers income by Apiculture"**
Rutika Innovations Private limited is a Honey Farm in Kothapet, Hyderabad, Telangana. Ms .Indira Reddy is the Director of the company.

**Mr. Rajkumar Chandrasekar on "Profitable murrel fish farming: Hybrid approach"**
Mr. Rajkumar Chandrasekar is a Junior Research Scientist (Aquaculture) at Eruvaka Technologies Private Limited in Vijayawada, Andhra Pradesh. His interest is farming of fish in pond or cage systems.

**Mr. Yelanaduramaiah Lakshmisha "Gherkin is a successful story of contract farming in India"**
Mr. Yelanaduramaiah Lakshmisha is General manager (Agri- operations) in Indospanish Tasty Foods Pvt Ltd., in Tumkur, Karnataka. He will speak about gherkin cultivation following good agriculture practices to meet the export quality.

**Ms. Ashwini Gopal Lamani on "Tissue culture techniques in banana"**

Ms. Ashwini Gopal Lamani is a Ph.D. Research Scholar at CSIR-CIMAP, Bengaluru, Karnataka.

**Mr. Seshagiri Rao on "Can agriculture in India be a profitable business?"**

Mr. Seshagiri Rao is the Director at Hive Organics in Pavagada, Tumkur District, Karnataka. He is engaged in growing of crops, market gardening and horticulture.

**Ms. Brundha A R on "Effect of cold chain management on millets"**

Ms. Brundha A R is a Senior Research Fellowship at CSIR-CFTRI in Mysore,Karnataka.

**Mr. Anil Patil on "Management of nutrition in horticultural crops "**

Mr. Anil Patil is the Managing Director of Shresta Seeds Pvt. Ltd. in Bangalore, Karnataka. He is also a Consultant at Agriprojects Consultants who holds a Master's in Horticulture and a Post Graduation in Business Management. Mr. Anil Patil has been into Agri. Project Consultancy for the past 40 years. His interests are high tech agriculture project consultancy and techno economic appraisal of agriculture project.

**Miss. Yugandhara Suryakant Patil on "ICT: Importance and its use in Smart Agriculture"**

Miss. Yugandhara Suryakant Patil is a Subject Matter Specialist (Agriculture Extension) at Krishi Vigyan Kendra, Sangli-II, Maharastra. The speaker says, Information and Communication Technology (ICT) supports farmers by facilitating access to markets through real-time data on market prices, weather forecasts, information on pests, seed varieties and planting techniques. To know more view https://bit.ly/3zSre2o

**Mr. Vasudevan V on "How to make a failed FPO into a successful one"**

Mr. Vasudevan V says they are member of a Consortium Producer Company in Tamilnadu. They make arrangements both domestic and foreign markets for value added agricultural products. They are also member in various All India Forums such as Association of FPOs, APEDA. Their leaders of Consortium company are having well connected with CII, FICCI etc.

**Mr. Channa Basappa on "Mobile app based smart irrigation with wireless valve control"**

Mr. Channabasappa Kolar is the Managing Director of Avanijal Agri Automation Pvt. Ltd., Bangalore, Karnataka. They help farmers automate their agriculture irrigation and nutrient/ fertilization. To know more view https://bit.ly/3fqmy7V

**Mr. P. Srinivas Vasu on "Understanding the soil visually and practically"**

Mr. P. Srinivas Vasu is a founder and trustee of the organization named Soil Trust in Bengaluru, Karnataka. He believes in understanding the soil visually and practically to measure the status of soil productivity and managing soil to improve its structure and increase soil biodiversity.

**Dr. Renu Agrawal on "Opportunities on value addition for agricultural crops"**

Dr. Renu Agrawal is the Ex. Chief Scientist and Rural Program Coordinator at CSIR-CFTRI (Central Food Technological Research Institute) in Mysuru, India. She is the advisor, outreach activities at CFTRI. She has over 20 patents to her name, with 65+ publications in International and National Journals. Dr. Renu Agrawal has been awarded at multiple scientific associations. Some honorable mentions are Scientific fellow awards at FAMI,FNABS,FSAB,FISBT. She has been felicitated by REX-UN Global Karamveer Fellowship, Karamveer Chakra, Best woman sci. To know more view https://bit.ly/3pz6Cpb

**Mr. Kiran Bhaskaran on "Points to ponder before taking the plunge into organic agriculture"**

Mr. Kiran Bhaskaran is the Founder and Chief Consultant at Indian Farm School in Ramanagara District, Karnataka. To know more view https://bit.ly/2T8RKDp

**Mr.Vijay Kaw on "Mushroom growing in india – The present status and future scope!"**

- Mr.Vijay Kaw is a Mushroom Consultant and Advisor from Gurgaon, Haryana. He is into
- Planning for execution of projects for button mushrooms / oyster mushrooms especially growing technology and on-farm training for yield management.
- Online consultations for mushrooms and possible entrepreneurship setup.
- Training and marketing of herbal health mushrooms and products.
- Ganotherapy – Health advisory – A viable and effective means of maintaining a healthy lifestyle with ganoderma and other natural food supplements.

To know more view https://bit.ly/3vyPmG3

**Ms. Supriya Suhas Gaikwad on " Spirulina value added products"**

Ms. Supriya Suhas Gaikwad is the Founder CEO at Nutrigien Agrotech in Pune, Maharashtra. Nutrigien Agrotech Pvt. Ltd is established in the year 2016 at Pune, Maharashtra. They are engaged as the foremost Manufacturer of Spirulina Powder, Spirulina Tablets, etc.

**Dr. T. Sumathi on "Anthurium cultivation -Exporting opportunities"**

Dr. T Sumathi – Assistant Professor at College of Horticulture, Ananthrajupet, Andhra Pradesh.

**Mr. Altaf Aijaz Andrabi on "Rural tourism way forward for economic and cultural development"**

Mr. Altaf Aijaz Andrabi is the Former Director at Department of Agriculture Kashmir in Srinagar, Jammu & Kashmir. He is presently working as Advisor at Laxman Roa Inamdar National Academy with NCDC ministry of Agriculture and Farmers Welfare Govt of India.

**Mr. Aruneswar MGB on "Farm advisory and management"**

Mr. Aruneswar MGB is the Founder & CEO of Grow Your Farms Private Limited in Tiruchirapalli, Tamil Nadu. To know more view https://bit.ly/3zEHl52

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Talking to

# Parikshit Sampat Sai

Founder and CEO
Pranam Kisan, Hanumangarh Town, Rajasthan


He elaborates on Fintech for farmers. He is an agripreneur, farmpreneur by passion and Agri technopreneur by profession.

The research during the last 14 years has shown that agriculture is the most unorganised sector. We started our journey to understand the real problem, did pilot projects with rural farmers, small and marginal farmers, markets, consumers, families, input distributers, agriculture experts, researchers, and scientists. The sustainability of agriculture is a journey of "Soil to Sale", and we found Four core pillars of Agri economy: Farmer, Farmworkers, Crops and Market.

Pranam Kisan is working to build the portfolios of all core pillars. Farmer portfolio includes livelihood, assets, and basic infrastructure available with any individual farmer. Secondly, we building the portfolio, market, and FPOs which is a big and individual sector segment managing the farming community. Third one is crop portfolio as each crop has its own protocol, storage, procurement harvest, seedling, etc. There is also location wise potential production because we talk about new start-ups in agriculture, farmers follow farming practices of nearby farmers which often fails miserably due to lack of diversity in crop production.

We aim to build the portfolio of each crop. Fourth is managing green collar portfolio management which means agriculture employment. Farmers need good and skilled farm workers, but there is no mechanism or place where they can find good farm workers. Even if skilled farm workers are available, they do not know where to find work. This is a universal problem and not related to India alone.

We have to understand the main problem of agriculture sector i.e., unsustainable farming methods and unorganized market linkage. The small and marginal farmers are unable to improve productivity due to limited resources and inadequate knowledge. Consistent and easy availability of quality inputs is not observed in most areas along with lack of financial backup to get inputs whenever necessary. There is no processing facility available in nearby areas which adds to the logistic cost of the farmer's production. In addition, they are forced to sell their produce to local commission agents as they do not have any direct market linkage, machinery or storage facilities. They do not have any assured income option other than to rely on local agents or moneylenders. There is no insurance or any kind of security for them even after the efforts of the government to reach the marginal farming community. Such problems are coupled with the uncertainty that the future holds due to ever-increasing naturally occurring calamities.

Even after the existence of a few help centres, Kisan Call centres and local level institutions, they have failed in penetrating the farming community in need of assistance; which is partly due to the lack of infrastructure & lack of any dedicated assistance for the farmers in regional (understandable) language. Farmers who face the above-mentioned issues need complete assistance in soil preparation, pre-sowing, sowing, field treatment, post-sowing, pre-harvest and post-harvest management, apart from market linkages. There is no specific information or general awareness in farming community regarding the type of crop to be grown, future prediction of markets, etc.

All of this compels us to think as to why is this the state of farming sector as of now which feeds the entire nation. On the demand side, the problem for customers is that there is no price transparency. There is a big gap between what the farmers sell and what customers pay. Many farmers are also unable to fulfil the requirement. There is also no traceability of quality assurance. There is poor customer service, and variations in supply of the goods along with lack of variety. Each farmer grows different type of crops, and the customer cannot be unreasonably expected to go directly to the farmers to buy products in order to overcome these issues.


So, the need of the hour is community supported agriculture. It means a completely proven mechanism in India and abroad where the farming community is empowered by connecting customers directly to the farms and farmers. Farmers find out the requirements of the customers before they start the farming. This helps the farmers in farm level trading, facilitation of field assistance, pre and post-harvest activities management, quality inputs availability, and farm equipment. The customers get chemical free farm products at reasonable price with traceability and transparency. The customer can schedule his delivery time and get the produce from the farm directly with controlled prices. It also helps in tackling price fluctuation caused due to the fluctuations in final harvest.

We inspect and analyse the farmland with minimum annual revenue marking. We manage the farmland portfolio, inspect the farmland quality, suggest best crop type according to the irrigation resources, soil & climatic conditions. Accordingly, we mark the minimum annual revenue for farmers.

We interact with the farmers, shortlist them, train and provide basic skills along with do's and dont's of farming practices. We discuss collaboration option with some group of farmers. We discuss about customer acquisition in group housing, educational institutions, hospitals, corporate offices, and government offices. In group housing, customers come together and approve social pooling in which we provide our help so that we can fulfil the customers' requirements.

We have rigorously tested in our model farm where we have done 10 pilot projects successfully. We are able to provide permanent employment to daily labours. Customers can visit our farm, choose what they want, enjoy their own farming, subscribe to the farm, and understand what happens in a farm and how. Then they can pick and pack. We aim to grow according to the demands of our customer which in itself is unique. On the other front, we give the farmers skill training, study tours, land inspections, and farmer acquisitions.

Farm level processing is taught to reduce the cost with every stakeholder enjoying the collaboration. The customer joins the app, chooses from the variety of products, and as per their choice, the farmers grow and supply in return to a fixed monthly subscription paid by the customer; thereby eliminating the scope of any price fluctuations. Farmers can be located and connected with each other. We monitor all the farmers along with their crops, and provide prediction of weather. The subscription model in agriculture helps as urban communities who do not know how to interact with the farmers are connected and informed about farming practices, what to get and how. In short, we want to connect farmers to consumers directly. When a customer subscribes to the service, he is subscribing to the entire farming community who fulfils his requirement.

Farmers face the problem of lack of financial support, no assured income, and no market linkage. When a customer subscribes to this app, the farmers get assurance of price for their crop. Even if there is any market fluctuation, they are assured by the customer that they will buy the product, and the farmers will grow as per the customers' need. The farmers need not worry where to sell, how to avail any government subsidy, or worry about financial assistance. The farmers do not need any charity but only support in order to foster sustenance in agriculture. The basic idea of our project is to connect, organise, and provide with the help of advance methods & technology.

### What does subscription-based community farming mean?

It means a community that directly avails the service of farming community. Subscription is provided by the community which assurance to the farming community w.r.t the price & sale of goods. Such assurance is the best thing that can happen to the farmers. They get good price from the buyer for their produce whereas customers get a suitable purchase price. The subscription based community farming stands for a community helping the other leading to the growth of both.

### Has this model been actually tried anywhere?

Yes, It has been successfully tried and run in 2019 as a pilot project. It is being supervised by National Institute of

Agriculture Marketing. We have been running it for 3 years. We started with one acre and three farming labourers, and now, we are growing at a rapid pace and proved profitable from the first season itself.

**Why are you restricting subscription-based community farming to preharvest trading and not post-harvest?**

During post-harvest, you harvest first, then look for the market, find the market and buyer, and sell it. To do so, you have to store the produce until you get a buyer and there is always some wastage of the produce. So we help in post-harvest too because not every farmer sells in a subscription-based model nor each customer is subscribed. It is reference based which is growing when someone experiences the model and is happy.

Both farmer and consumer continue with each other. Till date, no consumers have left us because in terms of farmers or issues, they do not have any issue. Everyone is in a win-win situation. So preharvest model is to prevent the loss basically and provide stability to the widely unorganized sector. This is also to manage losses during post-harvest period.

**Is it not FPO also where farmers have shared subscription based community farming model?**

FPO is not a subscription model. Activities here are aimed to combine the farmers into suitable groups or clusters in order to work together and avail services. Not all the FPOs are doing the same thing. Some provide input to the farmers, some help in post-harvest trading aggregation of farm produce, and some help in processing the produce for more income to the farmers. FPO is the mechanism where farm pooling can be done.

The subscription model is not community farming, but we do work with FPOs, collaborate with them as they have groups of farmers. We do not have to go to individual farmers to help them reach us. FPO is a provider of group of farmers, while subscription-based model farming is a business model in itself.

**Why do you feel digital or technology alone is not enough to transform Indian agriculture?**

If agriculture has to sustain in the world and power the sector, it has to be Phygital. We can say physical and digital technology has to work together in congruence. You can use the technology as a tool but it is not the only requirement in agriculture sector.

Technology helps you to improve the productivity, manage things, but you need skill and physical work in farming. Therefore, sustainable farming or organised farming is an outcome of an empowered farming community with the combination of both digital and physical, which is termed as Phygital, to maximize results.

**What challenges do you face in connecting farmers directly with the consumers? Can we totally eliminate middlemen?**

Initially, there is always a need for middlemen to organise because the process of moving a product from farm to consumer needs somebody to complete it on every stage. If you have to harvest, process, and transport, we need somebody to do it. So just like we cannot replace start-ups for big companies, we cannot remove the middlemen without giving birth to a whole new set of problems. Therefore, we have to organise them in a sustainable manner.

**Is Pranam Kisan also a middleman**


**between farmers and consumers? What services do you provide?**

In a wholesome manner, Pranam Kisan is much more than that but to answer your question, yes, we stand by the farmers to practice farming for our consumers. The company act as a middleman providing services to both the farmers and consumers. We work as a part of the service sector. We believe in the philosophy of soil-to-sale, check the portfolio of farmers, provide quality seeds and inputs, guide them on how to take care of crops, how to use minimum chemicals to sustain and improve the quality of soil, and help the farmers by getting the consumers, market, and all the other assistance.

**Please tell us your educational background and how you started Pranam Kisan.**

It might come as a shock but I initially was a medical student aiming to become a doctor, I soon realised that it was not for me. I travelled a lot and started a software company. Due to my agricultural background, I formed an inclination towards it and wanted to reform it for a better future. I completed a project for dairy-farming community and government irrigation sector. We had to collect the requirement of the farmers in order to build the software which made me realize that huge problems are faced by the farmers. Coming from a farming family, I understood that agriculture is the most unorganised sector rooted with problems. I had to meet more people to get the holistic picture and collected the data while also working with them. We started with our pilot projects and learnt from our failures.

We learnt the right way to practice organic farming, product procurement process and getting inputs. So, I started this company in 2007, and still we are learning, progressing and achieving our goal of making a better sustainable future. It is a must to work with the people in order to understand the ground realities which we often overlook. With loops in agriculture supply chain and eco system, we are rigorously working towards finding the solutions. The journey is as much intense as interesting. This is being done in the interest of the farmers who act as the backbone of the society. If I can contribute something to the farming community in any way - small or big, it would make me intensely happy.

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Phone 9810567477

# Devan Chandrasekharan

## Managing Director - Fuselage Innovations
## Kochi, Kerala

He works on skill in technology leadership, technology management, technical leadership, product management, and integration. He narrates his experience in an agriculture drones start-up in a recent interview.

When Kerala agriculture sector faced serious natural calamity issues in 2017 and 2018, we identified some basic problems at the agriculture scenario in the agriculture eco system. After that, UN initiated to divide the agriculture landscape into 23 agroecological units based on the soil nutrients' characteristic. Kerala is not an agricultural state compared to the other states. So after the natural calamities affected the whole agriculture practices, we started identifying the problems such as crop damage, pest, and micronutrient efficiency in the soil. Also we found some unscientific farming practices. It was then that we started to think that we need references related to the data between agricultural practices which was one of the major obstacles. That is why we started the analysis and based on the assumptions, how it can be effective in the farming sector.

We are processing Unmanned Aerial Vehicles. We have two products – Spectra UAV and Agron UAV. We are implementing these in the eco system, and the user can use our products for any kind of operations. The Spectra UAV which has integrated multiple sensors helps the drone to identify any nutrient deficiency. Farmers usually provide foliar applications to their entire land and identify any crop damage in a particular location. Instead of doing it manually, we are helping them to move on with the controlled and photo application in the affected area so that the Spectra UAV identifies the unidentifiable things. We can see only certain things through our eyes, but beyond this the drone can capture multiple layers, such as crop damage in the initial stage, nutrient deficiency such as NPK in the soil, and any other problems. What we are doing is we are identifying the status of plant data and process the data for 2D or 3D images and crop modelling. We visualise and understand the crop stages, pest and weed identification, and yield estimation. Based on the vegetation concentration, we inform farmers about the deficiency of the soil and what would be their current yield after harvest so that the farmers can predetermine the farming activities according to that data. So we integrate these deficiencies like GIS information to Agron UAV which can fly to those areas and provide the prescription application to control.

We are thus using Spectra and Agron UAV. We have also developed some nozzles to determine the entire nutrients and exact sizes of droplets needed for pest spraying. We use the nozzles to provide controlled application in the farming practices. Our unique product provides better prediction, targeted use to make an impact in the form of increased yield and reduction in agriculture inputs.

Now we can see that with our pilot projects all over India have shown about 70% reduction of agriculture inputs, as normally the farmers are doing for crop protection, we do based on the crop damage. So there is reduction in expense. We know our entire project can make an impact in the form of yield in food and cash crops, and we can see 30 to 45% yield increase. About 2200 farmers are now availing our services and products. They get in one crop season about Rs. 3 million as profit. One of the unique feature in our project is that we do not apply any pesticide since we identify pests at the initial stage itself and include bioagents like Pseudomonas to counterattack the pests. We found reduction of 51 kg of Co2 per hectare by implementing our technology when compared to conventional practices. Currently our entire project is provisionally patented and market size based in between agriculture eco system and traction. Tractions look very promising for our implementation on how we are working with the eco system based on the farmland size, and all types of farmers use our service, sales, and services through collaboration agencies. Our business model also helps farmers to become entrepreneurs by procuring our drone and help in the eco system with the other farmers who are willing to change their farming practices.

To talk about our journey so far, we started on some research work and got this idea. When the pilot project was done, we could see that the technology can make a great impact on eco system. We are working with tribal agriculture system because of UNDP who recognised our project into sustainable development and zero hunger category. We are working with tribal area agriculture sector for developing their agriculture practices. They are following organic farming practices. So we see challenges like pest, deficiency parameters. We are also studying about the data collection and what the next step in the agriculture sector should be. We got a lot of recognition from Government of India and grants for the development work.

**What are the main services offered by your company?**

We provide product solutions as sales and service model. We provide our ser-

vice for those farmers who can afford. If a farmer can spend about Rs. 5 thousand per hectare in a particular crop season, we offer a service model that assures a return of about Rs. 15 thousand in the form of yield increase and reduction in use of agriculture inputs.

**What are your service charges?**

If we offer spraying and drone services, we offer at Rs. 3 lakhs and for Spectra we charge Rs. 4 lakhs. Per acre the service charge is Rs. 400.

**Did you raise any funds for your start-up?**

When we started the company, we did not accept any extra funds, but we got funds from Ministry of Agriculture as loan, and some grants for our infrastructure and prototype development. We got some innovation challenges in Hitachi India, and we won the 2020 competition Basically we raise funds through the grants and innovation challenges.

**You had mentioned in a LinkedIn post about difficulty in raising agriculture funding from banks. What motivated you to write this?**

Initially, when I started the company, we needed some funds. But the investors could not see any unique thing in the earlier days. Even a bank felt they were taking a risk by funding us. We met several banks, talked about the project, and in the final price point of view, there was no initiation taking place as they felt they were taking the risk by funding us.

**What are the main challenges you face in running your company?**

It is mainly setting up the infrastructure in the eco system. We are planning to move with 100% made in India products, but it is difficult to get material and infrastructure. It takes time to set up a manufacturing drone which is a daunting task. Next adoption of technology in the eco system. From the farmers' perspective, they are taking a risk by changing their farming practices, and they are not aware of how to avail the services. But most of the time, we provide free of cost service in a small area, and they decide what to do and what to offer in the next crop season.

**How do you market your business?**

We do marketing through direct and indirect method based on our impact in the eco system. We contact social media and interact with ministry of agriculture and departments. They also publish about our initiatives and how we are changing the tribals also, apart from our unique parameters. We are also doing some R and D work, and we take up commercial orders. We engage in more ecosystem participation through multiple study classes, demonstrations, and exhibitions.

**What are your plans for your business in the next 2 to 3 years? What do you want to achieve?**

We are planning to expand pan India. Our product has the capability of capturing international market. Many brands around the globe are not accepting the task due to security issues. We offer a good solution with a good system for attending to needs of farmers. We plan to move with international market and expansion at India level.

**Is your formal educational qualification helping you in your business?**

Yes. We observe that some farmers initially challenge for adapting technology, but we offer training and connecting them with training organisations for training, licensing, and other procedures. Through that they can avail the technology, and we are also providing 24-hour support for their farming practices, how to manage any problem in a detailed way.

**What made you personally come into this line of business?**

My aeronautical background was one parameter, and since my family is an agricultural family, I know the problems and scenario due to the flood in 2017 and 2018. Earlier I was doing some freelance projects with some foreign countries, and so based on the agricultural scenario I entered this sector.

**How is your company generating revenue? What are the services your drone can provide?**

We earn through sales and services, through implementation, services, and product sales. We can provide data analysis, prescription protocol, and aerial services to farmers who need it. We can identify severe conditions like pests and deficiency, for which earlier the foliar application was the solution. Now we can offer aerial service and thus solve the problem. If they want to procure the drone, and by becoming entrepreneurs they can use our products on huge lands.

**How easy it is for a farmer to operate the drone?**

Basic training of 2 weeks is given by us. There is no need for any particular qualification. For official certification and license, he needs to be 18 plus years old and should have passed SSLC or 10th standard.

**What are the challenges you face to make a farmer avail use of drones in his farm?**

We provide training in the beginning, and then we do not see any particular challenges, but lot of technical challenges are there, and we sort them out.

**What are your charges?**

Charges depend on the size of the farmland. Below 50 acres, we charge Rs. 600 to 700, and more than 250 acres, we charge Rs. 400 to 500.

**Can you name a few current clients?**

We have clients from food and cash crop in fields in Kerala. Most of the paddy fields, spices and tea plantation industries, pineapple, banana farmers and spices extraction industry Synthite Industry avail our services. Harrison tea industry is making use of our services.

**In India in which states do you provide services?**

In Kerala, Tamil Nadu, and Karnataka we operate. We will soon be expanding in other states.

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# Dr. Sanjay Bala

**Regional Director**
**National Medicinal Plants Board**
**Jadavpur University,**
**Kolkata, West Bengal.**

*Explains the various details in cultivation of Brahmi (Bacopa monnieri) in low lying areas for doubling the farmers' income.*

The botanical name of Brahmi is Bacopa monnieri and is also called thyme leaved gratiola, water hyssop etc. The leaves are thick, and the plant is from Plantaginaceae family. It is an herb prioritised by NMPB for cultivation. The phytochemicals and chemical constituents present in Bacopa are saponin, bacoside A and B which enhance the medicinal qualities. We find them mostly in West Bengal in large quantity because the bacoside content is high compared to other areas. The plant is useful for improving nervous system, epilepsy, insanity, anaemia, dropsy, arthritis, dyspepsia, rheumatism, diabetes and so on. It is also used in curing ulcers, tumours, and enlargement of spleen. It is a good memory enhancer.

This plant is used in ayurvedic medicines since a long time ago. It grows in marshy lands, from where the villagers collect and sell to local market. Now a more organised cultivation is followed in South 24 Parganas district. About 250 MT of dry bacopa is collected and supplied to a company in Bangalore from where it is exported. We are not into cultivation, but we regularly train the people and update them for cultivation, value addition and marketing. We learn from case studies, and the project is being implemented by Madhyamgram Kalpataru Welfare Society, an NGO. It is done as a contract farming through a cluster model.

So before you start cultivating any medicinal plant, you have to ensure the market for the same. If you grow in a small quantity it cannot be sold easily and will not be economical too. So we encourage you to gather group of farmers and cultivate together and make forward and backward linkage. You have to get quality planting material, seed, saplings or propagation material for cultivation, ensure market demand, identify the trader, industry or exporter. Selling to local traders will not be profitable as such.

You have to do cluster-wise cultivation which is preferred. You can also make Farmer Producer Organizations (FPOs)/ Farmer Producer Companies (FPCs), if there are more clusters, so as to link directly to the industry, trader, or exporter. Bacopa is a high water demanding plant like paddy. So you need plenty of water, even slightly salty water is acceptable, and it can be cultivated near coastal areas as well. The land has to be muddy and, then you need to level the land and spread bacopa propagation material. I am saying spread bacopa because it is generated through mother plant, and you have to chop it first into 8 to 10 inch pieces with internodes and make it a planting material. Then the material is shifted to the field and spread. This is called vegetative propagation. You can see about 4 to 5 inches of water in the field when you spread it. The internode generate roots and establish as plant. The transplantation is done manually with soil that can be medium sand, sandy loam soil and mixed with well decomposed farmyard manure in nursery under the shade during May to June. No chemical fertiliser is used. The demand is more if Brahmi is produced organically. The value is less if there is any residue of any pesticide or fertiliser. The rooting begins within a week and is ready for transplanting in the wet field in rainy season.

After 20 days the root grows well with water availability. It takes about 2 to 3 months to mature for harvesting. Not much maintenance is needed during transplanting except when you prepare the field for cultivation of bacopa. After that you have to take are of weeding only. The harvested product has to be processed immediately as otherwise it will be damaged before transportation to local drying units. Processing involves chopping and drying. One chopping unit is needed apart from drying unit. Some cleaning has also to be done to remove the mud. Depending on the quantity, you can get different size of driers. Then the dried product is put in plastic bags to sell easily. The farmers sell it directly to industry with the help of Kalpataru Agro Farms.

You have to take care of substantial water availability. The taste of the leaves is very bitter. So there is normally no grazing and no protection needed. From bacopa cultivation, the cost is only Rupees Twelve thousand per acre, but you can sell it at Rupees Fifty-three thousand for 6 months. This calculation is done based on two harvests. Thus farmers

can double their income. This is done through SHG model who cultivate in groups and sell to local traders, local producing unit, and then exported.

**How popular is Brahmi cultivation compared to other medicinal crops in India?**

The content of phytochemical in medicinal plants decides the spread of cultivation. In dry areas, Safed musli and Ashwagandha are popular and in wetlands and with more water availability, Bacopa can be cultivated. It has more water content unlike Ashwagandha. Bacopa is easily grown in many places in India like West Bengal, Chhattisgarh, Maharastra and in southern states. If you have water availability, you can easily cultivate Brahmi. The phytochemical constituents may vary, but it is acceptable.

**How can Brahmi cultivation double farmers' income?**

It depends on the quality of land available and existing cultivation. In West Bengal and other parts of India, 3 to 4 crops are grown in a year. You need not cultivate in these areas as you get more income from these lands, but in case of rainfed areas and low productivity areas, you can grow only paddy. And profit is less compared to other crops. But when they cultivate Bacopa, they can earn manifolds. This is a single crop with cultivation cost of Rupees Twelve thousand and selling price Rupees Fifty-two thousand and profit of Rupees Forty thousand which is double income when compared to paddy cultivation.

**In which regions of India is Brahmi cultivation more popular?**

Due to high content of bacosides in South 24 Parganas district, they cultivate Brahmi more. Apart from this, Chhattisgarh, Kerala, and Maharashtra also grow. So spread of cultivation is there in India, but I do not have statistics of how much is produced and where. The demand is there for organic crop, and so organic cultivation can be promoted.

We cannot ensure if it is an organic product if you cultivate in an area where in the surrounding areas using high amounts of pesticide and fertiliser. There may be leaching. That is why in some places, the crop is rejected. So to avoid that, you have to organically cultivate the crop. I know about these three states only. Among southern states, in some parts of Kerala and Tamil Nadu this crop is being raised because the export is channelled through Bangalore. One big company collects huge amount of Bacopa. Many companies are coming up also as the international demand is huge now-a-days. The medicinal properties of the crop make the crop demanded. You can also find the crop in kitchen garden area as it can be consumed as vegetable though the taste is very bitter but good for health. With people becoming more health conscious, they are cultivating in their house, rooftops, etc. The only requirement is availability of water. Testing companies are in Hyderabad, and you can have the cultivated product tested and see if bacosides is more in your area so that you can cultivate more.

**Does it need more water?**

Yes, especially when you prepare the bed and sow the cuttings. Even if the water is little bit salty, it is not a problem. In coastal areas also it can be cultivated so that they have better bacosides content.

**Can they be grown in small pots at homes?**

You can grow in a small pot even on the rooftop in your house. It does not need much care. You have to have some propagation material and put water to it regularly. I emphasise on the water needed by the plant as it will grow anywhere where there is enough water.

**Are saplings easily available?**

Yes, there are some good stockists, and there are many places where there are components and quality planting materials available. Similar to Bangalore based company, they are also doing research and improving the varieties. The bacoside content is more. Such varieties are available on demand from those industries. If you can assure that you will cultivate organically, you need not worry about the marketing part because they will buy it back, or contract farming will be there. So you can easily grow Brahmi using good quality planting materials. I think it is easily available in most of the places.

**Will there be difficulty in marketing the yield as it is not so common?**

You have to ensure about marketing feasibility before you start cultivating. This can also

be sold in the local market, but consumption level is very less because of its bitter taste. In some developed countries, it is extracted and sent back to our company for using in different kind of formulation. If you have connections, it will be easy to sell if the product is of good quality and organic, and you can get premium price. NMPB has an online platform, e-Charak where you can get the details of the product. It has to be cleaned properly before drying. You can also store it. You can get good profit from the product.

**What are the health benefits of Brahmi?**

Memory enhancing, improving nervous system, curing epilepsy, insanity, dropsy, diabetes, asthma, and flu are the benefits due to the chemical constituents of Brahmi such as saponin, bacoside A and B, hersaponin, and monnierin.

**Do you give guidance in processing Brahmi oil?**

The extraction process is not easy. So it is exported to European countries, extraction done there, and returned to our country for further use. Right now in India it is not popular, and we are working on it. If successful, we should be able to help others.

**Other than India where else is Brahmi grown?**

In our neighbouring countries like Bangladesh, and Asian countries it is grown as they have temperate climate with water availability.

**Please let us know your career background and how you got interested in agriculture field.**

I am a chemical engineering graduate from Jadavpur University, post graduated in Forestry Management from IIFM, Bhopal. I studied non-timber forestry products including medicinal plants. I have travelled extensively in India in most of the forest areas when I came across different kinds of medicinal plants which are becoming extinct due to unscientific approach of people. After Corona, the medicinal plant business is growing fast. When we produce them, the market can be tapped. I studied if farmers are getting benefits cultivating medicinal plants compared to others. All the medicinal plants are getting more popular and grown which benefit the farmers. This can be one way of increasing the income of farmers. We can train people from Eastern part of India in physical mode to benefit farmers. It will help in meeting the national and international demand, leading to India's development.

**Are you also providing training?**

Yes, we offer training to the farmers of eastern region states of Bihar, Jharkhand, Odisha and West Bengal like our counterparts in each region covering the all states and UTs of India. They are informed about value chain, on how to get good planting material, how to cultivate, and post-harvest management. Bacopa also has to be processed immediately as it will be spoilt due to fungal and other pest attack after harvesting. Due to the market demand, exporting the medicinal plant will be highly beneficial, and that is why we are encouraging cultivation of medicinal plants.

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# Dr. Manjunath Mandikal

**Director, Stevia World Agrotech**
**Bengaluru, Karnataka**

**He has been a first generation entrepreneur since a decade and taken the initiative to acquire sufficient knowledge based on cultivation techniques and post-harvest technologies. He explains the stevia market potential and contract farming model in a recent interview.**

Stevia is a natural sweetener with a host of of medicinal and therapeutic values. We can save billions of dollars being spent on curative measures of lifestyle disorders. Today we do not find many houses without lifestyle disorders like diabetes, obesity, or cancer. Disorders mean that the body system is not working the way it should because of certain ailments within. No external agency like bacteria or virus is creating them. With the highest number of people suffering from diabetes according to the statistics, India have more than 80mmillion people suffering from it and witnesses 50% or more of adult death due to disorders like diabetes as an underlaying cause. According to WHO these number may double up rapidly by 2030, and the disorder starts these days even at a younger age.

The cause for this calamity is the lifestyle and added calories. Sugar has been identified as one of the root causes of this disorder as it adds to the calories and needs higher insulin load (glycaemic index) to convert glucose into energy. Also adding processing chemical residues. But it has never been easy to give up consuming sweet altogether also. The industry came up with artificial sweeteners like sucralose, aspartame, saccharin etc. Though these are sweet in nature, they have been proved to be highly toxic and carcinogenic. To change the mindset of the society that sugar is sweetness and vice versa, we at Stevia World want to define sweetness differently by using safe and natural sweeteners which the whole world is looking for. We say "Sweetness is just not sugar...and sugar is not sweet at al!"

Mother nature has given us alternatives for everything to make us healthier. Stevia is one of them for sweetness and our wellness. the botanical name of stevia is Stevia rebaudiana bertoni with its origin traces back to Paraguay in South America. The local Gurani Indians has been using it for thousands of years to bring sweetness to their food and also as medicine. Dr. Moises Bertoni introduced this to the world, did lot of research and applied for approval for human consumption as sweetener as early as 1935. It was not approved till very late due to many reasons other than technical or safety!. Stevia extract is almost 300 to 350 times sweeter than sugar. It has a phyto chemical called Steviol Glycoside which brings the sweetness, which does not add to calories or require insulin in our body to digest it. Stevia has antioxidant, antimicrobial, and detoxing properties. Stevia reverses the disorders in many cases according to various studies and clinical trials in Japan. Japan has adapted the usage in 1977 for its proven benefits and is a leader in its use by replacing more than 40% of sweetener market according various market studies . The polyphenols, flavonoids and detoxing effect help the normal body function. It is rich in minerals like magnesium, zinc, calcium, phosphorous, potassium, and niacin. It improves immunity, detoxes, restricts cancer cell development, and other benefits.

Stevia is also very helpful in agriculture, dairy sector, fishery, goatery, poultry, piggery etc and thousands of studies have been done in Japan on these and documents are available on these research works done. Stevia is natural and has zero calories. It has been approved now in 160 countries with many nations following the US FDA approval in 2008. India approved its usage in 2015 after approval by FSSAI.

Everybody wants to grow something that has assured market and buyer for the produce. The market for sweetener is very huge and humongous. Though India consumes about Rs. One lakh and fifty thousand crores

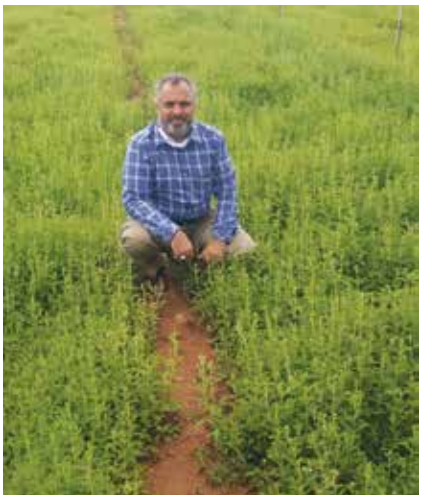

equivalent of sugar every year, the market for stevia is hardly Rs. 15 to 18 crores. It is still in a vary nascent stage of growth in the market. Japan has replaced sugar with stevia by 43% in all its food and beverages. In many countries, after seeing the adverse effect of sugar on human health respective governmentshave sent out advisories on reduction of sugar in food and beverage industry and also have imposed heavy additional taxs based on sugar content

Stevia World was started about 8 years back as a socio-economic project. We grow stevia, get it grown, cultivate through contract farming model, buyback the produce, process, extract the concentrate, and do the formulation so that people can use it in the form of powder, tablet, liquid at various concentration levels. In India, only few industries have started to replace sugar with stevia at least partially today. Stevia World assists the industry in migrating to Stevia from Sugar in their applications with their formulations.

One of the major advantage of stevia is that it needs very less water and helps in conserving the rapidly depleting water level. With the amount of water needed for one acre of sugarcane, we can cultivate 12 to 15 acres of stevia and get a produce which is ten times or more sweeter than sugar. Stevia needs 25 to 35 degree Celsius climatic conditions. The roots are sensitive, and so red loamy or red sandy soil is preferred. The soil should be slightly acidic with pH level between 5.5 to 7.5.

As the roots are sensitive and short, they go up to 5 to 6 inches into the ground. So we cultivate the plants on raised beds of half a feet so that the roots do not touch the ground and rest on the bed itself. Even if there is some water down there, it does not affect. We have beds of 4 to 6 feet raised with 1.5 feet gap between two beds. We work with University of Agriculture Sciences and IIHR, Bangalore. We have two drip irrigation lines and two plants planted on either side of the drip irrigation.

We have tried many methods of irrigation and found that drip irrigation is ideal. As the roots are sensitive, jet or flood irrigation will not work. The plants do not need much water. After plantation, the plants stay commercially viable for almost 5 years, and you can harvest it like grass. You have to leave one inch from the ground and cut the plants which acts like pruning to help the plants grow faster and bigger. We



can have 4 to 5 harvests every year depending on the climatic conditions.

Once the harvesting is done, the leaves should be shade dried. We will lose the glycoside content if we dry under hot sun. We need air circulation and no direct sun light. We have to design drying stands with simple shade nets and dry in the shade. The leaves should not be put on the ground for drying too as the bottom layer tends to rot. Modern technology of drying like solar or microwave based can be used.

Every acre can have forty to forty-two thousand plants. We sell the matured plant roots at Rs. Three each after growing it for6- 8 months, cut the top, and sell the root as germination and transportation are easier. Theoretically you can get about 3500 kgs of dried leaves per acre but we have seen yield of 2000-2500 Kgs average per year, which can be sold at Rs. 80 to 120 per kg depending on the quality. After an expenditure on various heads for Rs. 5.6 lakhs per acre, you can expect about Rs. 1.08 lakhs profit per acre per year.

When you go for contract farming, you need not worry about market, how to grow, where to sell, and the price you will get. Most of the farmers face perishability as the main problem in other products, but in stevia, since it is dried leaf, there is no such issue, and it has longer shelf life too. We can help you in these aspects by our contract farming. Once we bring the leaves to the factory, extraction of phytochemical steviol glycoside is done. We are ISO 22000/2018 and HALAL certified for a global supply chain, and we are also approved by FSSSAI for manufacturing. We have our own R and D where we follow standard operating procedures. We produce the sweetener formulated products for both individuals and industry applications.

We sell leaves directly as it has wonderful medicinal and therapeutic values. The package comes with 50 g of leaves to be used directly, as medicine, in hot water. We also have tablet, liquid, sachets, jars, pouches and we reduce the concentration by 12 to 15 times so that the normal person can also use in the brand name Cerovia. For industries we have higher concentration sweet-

**What is your contract farming model for stevia cultivation?**

We supply and sell our planting material to the farmers. We train them to grow it, right from land preparation, planting, plant maintenance, irrigation, harvesting, drying, and to packing. If the produce is of acceptable quality, we buyback at the agreed price. The whole model starts from plant to produce.

**In which regions of India can you offer the contract farming model?**

Currently, our processing ability allows to produce in Andhra Pradesh, Tamil Nadu, Karnataka, and southern part of Maharashtra. With increased processing capacity, we can do in many other places also soon.

**What do you think are the main problems faced by farmers who grow stevia?**

The main problem is the lack of availability of stevia quality planting material and processing factories in INDIA. There are more than 164 breeds in the stevia family. All of them are not useful except a couple of them. It is the Total Stevia Glycoside content which is important for extraction. We have to ensure that we get the right breed of plant to grow to be useful.

**What is your experience with contract farming? Have you faced any problems in dealing with farmers?**

We attended a small course on contract farming in IIM, Ahmedabad, where the instructor said that contract farming will not work in India. When I questioned his statement, he said that enforcing on farmers legally is very difficult in India. So contract farming will not work but contact farming will work. It means that having one to one relationship, respect, and mutual commitment will alone work. We have to win the confidence of the farmers and work closely with them to make things work. Trying things legally will not work.

**What is your advice to farmers starting stevia cultivation?**

You have to check if you have red sandy soil. Black clay soil may not work well. A little bit of water requirement is there. You can check the soil and water content for pH and organic content which we will validate to confirm if the soil is good for growing stevia. We also advice, even if you have one hundred acres, to go for one or two acres initially, let the plant get adjusted to the soil, you get adjusted to the plant, and if you are successful in the small area, you can expand further.

**Can you please tell us about your background? What made you to take interest in this business?**

Just pure passion… I am basically an engineering graduate with work experience of 25 years in IT and infrastructure, and I am an entrepreneur since 10+ years. After my return to India, I wanted to contribute to our country, our society, help farming community, in specific and bring in a new crop which has a good future and market. Then I realised nobody knew about stevia's use, went for formulation of making products by doing a forward integration. The whole purpose was to help thousands of farmers, millions of people, save billions of dollars for development and wellness of society. I do not have agriculture background, but now I take classes in University of Agriculture Sciences. I have developed a passion for it.

ener, SweeteXX, which is 22 to 25 times sweeter than regular sugar for using in Juices, Beverages, MilkIndian sweets, Chocolates, Chyawanprash etc.,. We also have tea bags to get tasty green tea with medicinal properties. You can use it in all beverages, smoothies, lassies, milk products, bakery, confectionary, as it has sweet and is good for health too. We have many documents in our YouTube channel on stevia available in many languages.

Many government entities and private institutions have appreciated our product as it will affect society in a big way. We have received many awards and recognitions both domestically and internationally. The entire project was built on a mission to have impact on society for wellness, farmers, with higher income per acre with assured buyback, Environment as it consumes less water. Thus we go by what our Hon'ble PM's vision of doubling of farmers' income, Swasth Bharat mission, Make in INDIA initiative and others. It helps in decreasing lifestyle disorders caused by sugar. Economically also, it has better impact. The world is looking at India as a large quantity supplier because of its wonderful agroclimatic conditions and technology. Thus the economy of the country will improve. Since it consumes less water during cultivation, it will conserve water level.

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# Jayant Kumar Bhan

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**Discusses the facts on bees, misconceptions of people, processing, packaging, lab testing, and marketing of bee products.**

Bees go to the flora, collect the nectar from the flowers, bring it to the hive, do the process, and flap wings to remove the water and make the nectar thick. Then the honey is stored and sealed by the bees.

When you want to go for beekeeping for commercial use, you should know the avenues of supply of beehives, beekeeping equipment, Beekeepers, Bee Groups, Flora around you and so many more. Once you have the beehives, you can multiply and sell also. You can also have a Beekeeper Advanced Training Centre for more people to join this business.

The bees also help in pollination support to the farmers. You can do the removal and relocation activity mainly for a comb in cities, industries made by Dorsata bees which create problems for the people around.

Apitherapy is a good avenue where the bee sting is given to the patient for medical relief. The honeybee products include honey, propolis, bee pollen, royal jelly, bee bread, bee wax, bee venom, and drone brood. The honey you get is multi-floral honey which involves nectar from different varieties of flowers and mono flora where the bees take the nectar mostly from one kind of flower only.

Apis Dorsata produces multi-floral honey and forest honey. Apis cerana is an Indian subcontinental bee that is small in size and produces generally only multi-floral honey. Mono flora honey may cost between Rs. Two hundred to Rs 2000 per kg depending on the flora the bees take the nectar from. When you take honey as ayurvedic medicine the nutrients of the ingredients go into the honey and benefit you.

From the sting of the bees, you collect the venom in a glass plate by using Bee Venom Collector Machine. You do not harm bees in any way when the collection takes place. The machine manufactured by us is of international standard with all safety measures. After collecting the bee venom, it has to be properly stored and transported without affecting the bioactivity. If the venom is exposed to the sun or air, it gets degraded. The quality parameters and certification of the venom are performed. Melittin is the main component of bee venom, and pharma companies need it for medicines and are useful for cosmetic purposes also.

The propolis collector collects the propolis from the beehives. After collecting, they clean the raw propolis, extract it out of the solution, purify it, and store it in a proper way. Mellifera bee is known as the Italian bee. Cerana bees are small in size, and the beehives have different size of frames and cell sizes. An automatic flow beehive is used where by using a lever, you can get the honey directly from the hive. A Queen rearing kit is used for making a new queen bee in the hive or when you intend to collect the royal jelly. the bee brought from the field can be collected by Pollen trap which is kept at the entrance of the beehive. A honey Extractor is used to harvest honey without damaging eggs, larvae, pupa, or brood. You can also see the white sealing on the honeycomb which indicates that the honey is ready for harvesting. This sealing is actually the wax.

The essential facts you should know about bees include: when you do beekeeping as your business, you should love or respect the creatures. Bees have five eyes to help in tracing back their hives after collecting the nectar on cloudy days. They have six legs. The male bees are called drones and fly 25 to 30 km an hour. Female bees except the queen are called worker bees. The queen bee can lay up to two thousand eggs per day.

An average beehive can hold ten to fifty thousand bees. They collect nectar from two million flowers to make half a kg of honey. The life span of a worker bee is up to 50 days, while the queen lives for 2 to 3 years. Bees carry pollen on their hind legs in a pollen basket. They communicate through a chemical called Pheromones. The bees in India pollinate about 130 varieties of crops. Only female bees can sting while the male bees do not have stings. They communicate through a series of dance moves about the location of flora, nectar, giving direction, and distance, and also quantity of flora.

A bee produces 5 gm of honey in its lifetime. Drones or male bees are in the hive for the mating purpose only. The bees give special food to the larva to make it a queen bee. People believe that crystalized honey is spoilt. But you have to watch that the crystalized honey gets back to its original form if some heating is done.

**What is the minimum investment a farmer has to make for a commer-**



**cial beekeeping farm?**
If you want to go for commercial beekeeping, you should have a minimum of two hundred beehives or more than that, and you should have a team of beekeepers to start with.

**How long does it take to harvest honey once everything is set up?**
If you keep your beehives in bloom, with a good number of flowers, you can harvest the honey within 15 to 20 days. If the number of flowers is less and the bloom is low, it will take time a month.

**Can beekeeping and honey production be the main income-generating activity for a farmer?**
The problem with mellifera which produces a good quantity of honey is that you cannot give a surrounding with plenty of flora throughout the year. So you have to move the beehives out. Hence farmers cannot do it and have to employ beekeepers. But if you make a group, invest money, and have a beekeeper along with you to take the beehives from one place to another, it is possible. It will in fact be a good investment for all as the price has doubled now.

**Do you offer any training courses for people to learn about beekeeping?**
Yes, we do. We are part of the government's sponsored training programs too. It is a free-of-cost training for 3 days. But it will be online and not offline. If you get theoretical knowledge, you will be in a better position to manage beekeeping. After the government announced a white paper on honey, a lot of government agencies turned up to help people in training in beekeeping.

**Will you help me to start a beekeeping business on my land with my investment?**
The main problem starts when you cannot give flora throughout the year to the mellifera bees. So you have to keep moving them out often. If you are interested in good pollination, the Indian bee, Cerana can be helpful. It does not require so much maintenance or attention. Only for a few months in between, you have to take care. For this also we train you.

**Does the laborer in beekeeping also need the training to handle bees?**
Yes. They will spend most of their time with bees, and they should be trained to handle any situation. It is a continuous process. They have to be trained.

**When you say respect and love bees, what do you mean exactly?**
Just like bringing up your child, you have to take care of the bees to get a good return. It is very good for the environment too. You have to take care that the bees are not damaged in any process.

**What is the lifespan of a bee?**
The queen bee lives and lays eggs for 2 to 3 years. Worker bees or females live for 45 days which may extend depending on the weather. Drones go up to 70 days.

**When does a bee sting?**
Only during stress, do they sting. They will think that you are an enemy and they will sting when you are disturbing them.

**Is it possible to earn Rs. One lakh per month by doing beekeeping? What is required to achieve this?**
You should have at least 300 to 400 beehives, at a good location, and continue moving to different flora areas. You can make use of the other

products of the honeybees and earn money.

**What steps should be taken to ensure the purity of honey?**

The consumer should be educated enough to identify the purity of honey. The wax has to be removed from the honey, otherwise, it will be seen on the top because it is lighter. But it is not an impurity. It is the original honey with more benefits to the consumers. They should know crystallization is a natural process. Even with wax on it, there will not be any problem with its color, texture, and taste.

**Should there be a lot of flowering plants on the land for a good beekeeping farm?**

Bees do not go to all flora, it depends on the size, and availability of nectar, and pollen. Some flowers may have good nectar but less pollen. Pollen is a natural protein, and it has to be taken from the flowers and can be taken as a food supplement. For energy you need honey, and for growth you need pollen.

**Can beehives be managed in hot Indian summer or rainy seasons?**

Both are difficult seasons. In winter there will be a lot of places with good flora and in the rainy season it will be less. You need to artificially feed the bees then.

**In urban areas is keeping a small beehive allowed?**

No. Trigona or stingless bees are small in size, and they can be kept in urban areas. The honey produced by these bees is expensive. But they are wonderful agents for pollination because of their small size.

**Is beekeeping full-time work requiring a lot of effort?**

If a farmer starts producing and selling, it takes much of his time. Similarly, you should have a different approach and effort for beekeeping and selling.

You can have a team of beekeepers who can take care of the beehives, and you can take care of the marketing part of it. Both are difficult.

**What is the domestic honey production in India, and what is the demand? Are we importing honey?**

Indians are shy to use honey even though Ayurveda says honey is good. But we prefer sugar which Is not healthy. Honey has vitamins and proteins, and it gives instant energy and gets easily digested.

**How to achieve moving beehives around? How is this done normally?**

You have to have like-minded people, or FPOs, or cooperative societies to achieve this. When you want to achieve something, you have to exert and take care of the bees. You can have beekeepers take care of the bees while you take up marketing the products. You can get honey and other products from the beehives and earn money from them by selling.

**In what ways do Bee Farm Products help farmers to take up beekeeping?**

The farmers have to learn new techniques, avenues, and ideas, and cannot stick to the age-old techniques. They have to change fast. We spend time and effort to make them see and believe, remove their doubts and apprehensions, that this is an ongoing business and will benefit them.

Nowadays farmers want us to keep beehives on their land as they know the importance. This awareness should be spread to all people. It generates good returns on investment. We can guide them and help them.

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# Nagachaitra Mysore

**Founder - Anusha Ventures**
**Chickmagalur, Karnataka**

**Talks in detail about the potential opportunities in jackfruit value added products. Super Jack is a project where he is trying to popularise and promote the benefits of jackfruit to help farmer get more income for his produce which is currently getting wasted in the farm.**

Jackfruit grows on a tree trunk as well on branches in bunches, hence few times it is also considered as berries. jackfruit has abundant nutrient value, fibre, protein, and many other unique things which are not found in any other fruit. It can be consumed as a vegetable when tender, snacking item in mid stage, and consumed as fruit when ripe. The seeds inside the fruit is also nutritiously rich with a spectrum of minerals and starch.

### Origin & Geography

People in north India are not too familiar with jackfruit as it is a seasonal fruit and not much celebrated like other fruits, while in south india Jackfruit is so popular that it is traditionally imbibed in many communities.

India is a tropical country which is ideal for jackfruit cultivation. Nearly 30% of the entire world's jackfruit production is happening here in India. People plant it for reaping fruits or for the purpose of timber which gives a handsome return after 30 - 35 years. In some parts of the western ghats the jackfruit trees are grown on the boundary for the sake of elephants and other wild animals. Since this fruit satiate the animals hunger and pleasure they do not disturb other crops grown in the farm. Such is the natural co-ordination which reduces human to animal conflict.

India produces 1.2 million tons of jackfruit every year, and so far most of it is naturally grown as a complimentary crop along with the other cash crops. It is emerging as a good vegan substitute and currently exported in minimally processed raw vegetable format. Western countries and Middle East countries are increasingly consuming jackfruit with much enthusiasm. By 2025, the export is expected to cross fifty thousand tons.

There is also very good scope in domestic market as raw jackfruit has the ability to control diabetes. Raw Jackfruit has low Glycemic index (GI), and when blended with other food product like roti or other staple food, it brings down the GI index of the other food too. In Kerala, which is the leading producer of jackfruit, during certain festivals they do not use any non-vegetarian food hence the people consume raw jackfruit as a meat substitute. And at these time, many diabetic people have reported normal blood sugar levels which is a testimony. These observations are reported in international magazines like NATURE.

The ripe jackfruit has an established market in south India but not so much in north india. But we have found encouraging response from people of north india for the ripe jackfruit. With the modern cold chain facilities, faster logistics and visibility this ripe jackfruit can be successfully marketed across north India. On the international front the ripe jackfruit is currently being exported to Australia, europe and middle eastern countries. Apart from primary processing the ripe jackfruit can be value added into pulp, paste, powder or leather and preserved for a longer shelf life. These products have found good demand in bakery industry, confectionary industry and ice cream industry.

Jackfruit seed is rich in dietary fibres and has gut-friendly carbohydrate which is unique feature of this fruit. Jackfruit seed also has moderate protein content. This is a good opportunity for making many value added products. The seed powder has the tendency to tone down your body by removing excess cholesterol. Hence there is a good scope for making slimming food supplements like milk shakes or diet cookies etc from these. There are many many more products that can be made out of jackfruit flour by mixing them with wheat in bakeries. Example breads, pastires, noodles, pastas etc which can be diet friendly and diabetic friendly. This offers huge opportunity for those who are in food processing or bakery industry. Modern generation are realising that they need to consume protein and fibre rich food for balanced health.

It is said that jackfruit has the flavour of pineapple, mango, and banana, and somebody can try to extract essence from it.

### What is the current road block?

Karnataka, Tamil Nadu, and Kerala have many home industries which make value added products from jackfruit. Kerala tops the list with plenty of

variety of by-products. But the industry is fragmented. All the home industries are limited to a certain surrounding of geography. They do business by knowing their customers on personal basis. No attention has been paid to get proper branding, marketing, or visibility for the products. But when these small scale industries want to market them globally, they need visibility, brand, and right quality of packaging. The gap has to be fixed, and once done, it will take the opportunities of jackfruit to the world standard.

### What is the current status?

About 85% of the fruit is wasted at the farm level. Even the remaining 15% is being used with limited exposure. To bring everything together, we need a good networking. The fruit is a delicate one, and the moment it is harvested the internal quality of the fruit starts changing. So it has to be processed within 2 to 3 days. This short window for processing is the limitation for Jackfruit. We need to establish a good network to make the best use of jackfruit at different stages.

From tender jackfruit, we can make vegan meat which has a huge potential. Since today's conventional meat is loaded with lot of antibiotics which when consumed will affect the health of people too. The Vegan meat can easily substitute the conventional meat industry. Lot of R & D is happening to make the experience of jackfruit similar to meat eating. The food entrepreneurs can create their own vegan recipes and market effectively. The networking part involves connecting the jackfruit growers, microprocessors, and consumers in a well structured manner. Once the efficient networking is done, jackfruit can be marketed easily. The marketing effort should be a collective one. Once there is awareness in the market the entrepreneurs can sell the product in the market easily.

The identification of quality is important to know which type of fruit they grow, season of maturity, and for which value add product it is suitable. We have conceptualised to identify the resources at the root level. The farmers are scattered, and the fruits have lot of varieties. Approximately three


hundred varieties are there in jackfruit. While some are helpful for vegan meat, some for snacks, some for sweets making, some are ideal for eating just as fruit. There are very good varieties with less seeds and more fruit which are crunchy, juicy, and good size. Rudrakshi is a variety that has less spiky outer skin and less latex.

### Network structure

The products after harvesting should be taken to the nearest micro processing clusters where primary processing happens. Mostly rural women work in such facilities. Then they are taken to the mega clusters where they can be value added to make them more market friendly. Farmers are thus benefited as the fruit that was earlier wasted is getting value in the market. Micro clusters create employment. And with right value added products, right packaging, and branding the product can be easily marketed internationally. This is the structure we feel will benefit the market. The central government has approved substantial money to set up the clusters, with one coming up near


Mangalore. We are associated with them to set up the processing unit to make it more industry friendly and export friendly so that farmers can visit and get their processing done at a nominal fee. Northeastern states have also come up with a similar initiative. Odisha is also a good source of jackfruit, and the government is setting up nearly ten mega clusters and two hundred micro clusters. This is going to be a very good business opportunity in the near future.

Super Jack project wishes to create value products through R & D using industry consortium. We want to create such products in partnership with various food processing units and recipe builders. Many processing techniques can be used to make them more shelf life friendly without using preservatives. we want to transfer the technology to micro clusters on buy back agreement. By giving them the opportunity and knowledge, it will better the life for them, and they will not waste the fruits anymore. It leads to creation of market.

### The role of government:

We expect the government to provide all the support needed and assist the public. We want the access to agriculture and food research institutes to actively participate in product innovation. They should not limit their scope limited to their curriculum. If in co-ordination with processing Industry when a successful project or product is developed then the government should fund open heartedly for the product to make it commercially viable. So it is a product based funding that helps the product to reach the market. We also want the government to enable showcase facility or exhibition facility through fairs and international exhibitions.

### QUESTIONS & ANSWERS

### Which are the states in India where jackfruit is grown in large areas?

Primarily in Kerala and Tamil Nadu jackfruit is grown in large quantities. It is also promoted extensively by these governments. They have declared jackfruit as their state fruit. The Tamil Nadu government has gone an extra mile by getting a GI tags for the jackfruits grown in Panruti area. It

is an area where the fruit is grown all through the year. In other places it is a seasonal product. You can also find substantial volume of jackfruit grown in Karnataka, Odisha, and Northeast.

**Which variety is more preferred by the customer – yellow or red variety?**

Brix is the sugar content, which is not very different in yellow or red variety. It is the colour of red fruit which appeals to the consumer more. The red variety has a shiny surface, but if you eat the fruit, you may not differentiate the variety. There are many varieties each one of which taste differently. People who are sweet toothed may prefer the red variety. Horticulture department in Lalbagh in Bangalore, you can find many varieties of jackfruit, identified and recorded. It is a good place for people to try the new varieties.

**Is jackfruit grown mainly in boundary areas or in the field?**

It is mostly grown as a boundary crop as earlier it was never considered as a primary agriculture crop. Now there are many varieties which have commercial potential. Many people are cultivating it in large scale. Maybe in the next 3 to 4 years, the cultivation will fetch them sizable profit which will encourage more and more farmers to practice organised farming.

**From where do we buy good jackfruit planting materials?**

You can contact me, and I will connect you to nurseries and scientists who can guide you about the right varieties for your specific geographical location. The new horticulture practices have


developed saplings which help you to grow sustainable and geographical location friendly jackfruit varieties.

**What is the utility value of leaves and barks?**

I have heard leaves and barks are being used in some medicine preparations, but the extent of revenue from leaves is not much. The wood or timber of Jackfruit is very valuable. It is the most sought after wood for making furnitures, doors and musical instruments. In Thailand it is customary to make house doors only from Jackfruit tree. Over a period of 20 years the right size timber will yield more value as compared to the annual revenue received from the fruits.

**Which part of the jackfruit is used to make flour?**

We make flour using seeds. It is diabetic friendly, good with carbohydrates and dietary fibre. It is used in bakery industry to make cookies. We also try to make flour from unripe Jackfruit. The feedback from the customers who used these products has been encouraging, and lot of experiments are conducted all over the country.

**What is the usual shelf life of the value added products?**

You have opportunity to get fresh products once the season starts. The fruit is processed and packaged in cold chain environment which can be delivered to supermarkets. This can help the product to have shelf life for 10 to 15 days. I hear with new packaging technology emerging with which the shelf life of these fresh products can be extended. The other processed products like pulp, mock meat, vegan recipes, sweets etc can be packaged in a certain hygienic environment and achieve a shelf life of upto 1 year without adding any artificial or synthetic preservatives.

**What is your education and career background? Why did you get interested in this field?**

I am a mechanical engineer and had my own technology start up. During lockdown, we had to return to our native during which I got extensive exposure to organic food products and natural farming practices. After realising it's immense benefit I realised that I wanted to devote my life towards food industry. We started to focus on Jackfruit products as it looked to me as an opportunity to help more people who are having bad health due to life style practices. Once I started helping people and found good results I realised that it is going to be my purpose. We have done extensive research, working with many organic societies and FPOs to get the right value addition done. We are working with jackfruit clusters which may become operational by 2023.

**What are the other activities of Anusha Ventures Pvt Ltd, Chickmagalur?**

Initially we focussed on organic food products. we are building the network of food produces and promoters. Once the network is robust enough, we want to promote the concept through online and offline marketing. The whole thing will be put into motion as soon as our processing plant is operational.

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# Mrs. Leelavathi MP

## CEO - Tubugere Horticulture Farmer Producer Company Bangalore, Karnataka.

It is involved in agriculture, horticulture and animal husbandry service activities except veterinary activities. She talks in detail about Tubugere FPO's business activities and their experience.

An FPO is formed by bringing farmers into a group. The FPO is created only to help and serve the small farmers. The FPOs have farmers as the shareholders with them, doing all agriculture activities, helping them to get inputs, harvest, cultivation, and in technology based programs. In India, nearly 70 to 80% farmers are very small land holders. To help them, FPOs give good services and help them with good marketing linkage.

Tubugere Horticulture Farmer Producer Company is the first batch established in 2016. We have an office and godown at the back. The FPOs are formed by SFAC, Small Farmers Agriculture Business Consortium. The company comes under Companies Act. In THFPCL, many farmers who have agriculture and horticulture background are members. We have presently one thousand farmers as shareholders, with a total land holding of 8737 hectares. The total working capital is Rs. 7.5 lakhs received from SFAC. The proposed paid up capital is Rs. Twenty lakhs from farmers. We have our own land from the gram panchayat of our village and we can construct our own building on the land and help more farmers.

**ORGANISATION:** the FPO members are also farmers. Board of Directors are selected from each village where the shareholder farmers are there. We have currently 14 Board members as Directors, President, Head of Board Members, and another CEO. There are also marketing manager, finance and accounts staff, and including me eight people are working in this company. We presently deal with input supplies and output business.

**OBJECTIVES:** THFPCL purchases bulk variety of inputs and deliver to farmers needed for farming and cultivation. We control the marketing linkage for them and act as a bridge towards the companies and farmers. We guide them to get higher price for the harvested produce by aggregation and sales. Since the farmers are in clusters, when they buy the inputs in bulk, they can buy in reduced price which can also reduce labour shortage also. We suggest on how to grow commodities, how harvest has to be done, how marketing is done, and specifications of other companies.

**HOW DOES FPO STRENGTHEN THE LINKAGES?**

The FPO gives them knowledge and information, guidance on bank and commercial lending institutions, connect them to input suppliers and traders for seeds, pesticides, and fertilisers.

We also connect them to the insurance companies about compensation for any loss and to give first preference for claims and to give insurance cover for each crop. We get them logistic providers by providing a database of resource persons and institutions for FPO. We create a network between the farmers and traders to connect with them to sell their produce.

Our FPO was established 5 years back. Initially we had six hundred members which has now gone to 1030 members. Those who have the share are quite active, and many do not interact as they are non-farmers who have land but not doing any farming activity. But we do not differentiate between shareholders and non-shareholders. We provide services to all farmers who need our services.

Many farmers are horticulture and agriculture commodities growers. Vegetables, ragi, tomato, and fruits are grown in large quantity. Everyday activity is growing, we procure the produce from them for selling. We assist them on what type of vegetables we procure, the specifications for good quality, and how to maintain the same. Capacity and utilisation of equipment: FPOs are doing input and out activities apart from CHC which is Common Hiring Centre. Input activities are getting fertilisers, seeds, and pesticides for the farmers. CHC is getting the agriculture equipment for cultivation in the land. Output business is whatever produce is there, we help in packing and value addition for sales so that there is additional business.

Farmers who are in FPC buy the machinery and equipment needed for the crop pattern, operate them, get trained staff to operate the machinery and teach the farmers too. The farmers pay a small fee for the CHC which is about Rs. 200 to 800 per hour. It increases the business activity and turnover of the FPC. Apart from the regular machinery and equipment that the farmer needs, we have others like sprayers. My FPO is running on CHC basis. Our records go to prove what we have purchased, sold, and gained profit through output practice. We purchase vegetables from farmers for selling and gain profit. We also follow CHC to earn. We have grown manifold in the last few years. There was a reduction only due to the pandemic.

SWOT analysis of FPO: This includes the strength, weaknesses and challenges. When we talk about strength, FPOs have more knowledge, production activity, approaching farmers, give service, explain the benefits of FPO, and knowledge of products. The CEO of the FPO should know the production level of farming within the surrounding belts to generate income and production in huge volume. Since the head of FPO is a farmer, he should know the technology adoption. We help the NGOs and students to become agriculture professionals. Those who leave their current profession and join agriculture can help the farmers professionally as they know the details.

Weakness: we have limited financial resources. Whatever income we get from horticulture and SFAC will be used for the previous years' expenses and other inactive business activities. Also skilled human resource capacity is lacking. If a skilled person joins an FPO, he cannot exhibit his creative ideas because others do not understand. Many of the Board Directors are inexperienced in administration. Poor infrastructure is another problem as the FPO constitutes poor farmers. They can focus more on helping other farmers if they have their own building and other infrastructure. Many farmers want quick returns for their investment in FPO shares. But we cannot give any such benefits to them within a year. None of the farmers are trained to be an entrepreneur which is also important to run the business. Low investment capacity of members' equity is another problem, which if improved will help us to assist more farmers. For need financial support, when we approach a bank, they have many criteria to sanction loans. Within the belt we are not eligible to apply for a loan too.

There are plenty of opportunities in FPO. Good inputs business, seed production, increase in membership, agriculture tools provided on hiring basis, value addition, financial access, joint marketing of produce avoiding middlemen and using only connectivity with the markets, better and competitive marketing opportunities, and minimised cost of production and cultivation to get more produce value are some of the advantages.

Challenges include the failure of crops faced by farmers due to unpredictable weather conditions, accident disasters, and market fluctuation. There are many companies, but none of them are stable enough to do business with FPOs. They work for a maximum of 1 year, drop from the FPO, and connect with the vendors. Many FPOs are not connected with a stable market. Changing government policies are also detrimental. Competition from local business who sell inputs at a lower price is high. Farmers do not want to pay the higher amount and go to them. We suggest that there should be no local shops near the FPOs which also do the same activity. Otherwise FPOs will run in loss only. The cooperatives have a huge impact on the minds of the farmers.

**How did the idea of starting an FPO come? Who are the main people behind starting this FPO?**

Department of Horticulture formed our FPO. The plan is to make the group


of farmers, do their activities on their own basis to make it run like a company. The cluster will be handled by the team where activities happen.

**How many members are there in your FPO?**

There is no limit to the number of members in an FPO. We have 1030 members now.

**What is the main benefit to the farmers from FPO?**

FPOs are formed to focus on the small scale farmers and give service to them. We offer services such as input and output activities. Cultivating is also a big matter for the small farmer as he does not have the financial resource and needs support. There are many companies that produce fertilisers. But farmers are not clear which one to use for their land. Similarly seeds and other inputs are also not clear to them. So we help them to change to good agriculture practices.

**As CEO of the FPO, what are your responsibilities?**

We have to help all the farmers so that they are benefited by the formation of FPOs. We provide good services, handle staff members, run the business, and improve the business.



We have to work all over the day. We have to maintain the records of our activities, tackle Board of Directors also as many of them are farmers and not educated enough. We have to approach them in good manner.

**How many other people are involved in FPO administration?**

FPO administration includes Board of Directors, CEO, and staff. One person from the department such as scientist may be there to act as advisory to the director of FPO with guidance for their business activities.

**What are the challenges you face as CEO of the FPO?**

The local shops who are our competitors are the main challenges. Lot of business has reduced as they sell at a low price. Farmers cannot understand the concept of FPO and the services. Many feel it is only for those known to the FPOs and blame us that they do not get any benefit from the FPO without knowing the activities of the FPO.

**What is your education and experience in agriculture?**

I am a M.Sc. in Biotechnology. I am here since 2020, and I have gained experience in agriculture in these 2 years only.

**What is the revenue of your FPO in the last financial year? Do you think all the FPOs in India will be successful in future?**

Rs. 2.5 crores is the revenue. There are many FPOs in Karnataka but only a few of them do good business. The future of FPO depends on the surrounding, CEO, team, and Board members, and farmers. If they are interested in making business with FPOs, they have to buy all and do business with FPO only. The farmer should not think it is not required. If there is no interest in people, FPO cannot develop. I see only 35% of FPOs active in Karnataka, and the others do not show any performance.

**If a group of farmers want to start an FPO, what advice will you give them?**

An FPO cannot give good performance if there is no plan or backhand working activities. They should know the commodities grown, the mentality of farmers, what they plan to cultivate, and harvest, area of land. The board members should be knowledgeable. The CEO should be more skilled with more knowledge on how to make the FPOs do good business and connect to farmers. The farmers should approach us if they need anything. By using a smart phone, a farmer can find out what he needs to do farming and approach the FPO. The FPOs should establish a long-lasting relationship with the farmers. Only then the company can give good service and performance.


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# Vegetables are changing shape because of the climate crisis

This year's record-breaking heatwaves and droughts have had many consequences. Making fruit and vegetables smaller and wonkier is one that many would not have expected, but farmers say that is what is happening – and they are urging shoppers not to turn their backs on the oddly shaped produce.

Crops are coming out of the ground stunted or misshapen because so much farmland has been left parched by the dry summer experienced by much of the world. Farmers in mainland Europe and the UK are among those who have been battling with droughts, and farming groups say there could be further hikes in food prices if supermarket chains don't start accepting more wonky fruit and vegetables.

"Consumers have been conditioned to believe that a potato looks a certain way, [but] we need to be more relaxed about appearance," the Vice-President of the National Farmers Union for England and Wales, Tom Bradshaw, told the BBC. Throwing away fruit and vegetables simply because they aren't the perfect size or shape also contributes to a global mountain of food waste. And there are longstanding concerns about how throwing away food fuels hunger and the climate crisis.

## Tackling food waste

The British Retail Consortium – which represents supermarkets – says stores are aware of the problems caused by the dry weather and will support farmers. It says its members are selling more oddly shaped fruit and vegetables, and using them in ready-made meals. But farmers say the biggest cause of food waste is produce being rejected because it doesn't meet cosmetic standards, or because it has been damaged by pests, reports UK newspaper The Times.

An estimated 2.5 billion tonnes of food is wasted around the world each year – representing 40% of production, says a report from conservation charity WWF and UK supermarket Tesco. All of this food is discarded despite widespread global hunger. More than 820 million people are estimated to be malnourished or starving, and food supplies to some parts of the world have been disrupted by the war in Ukraine.

## Climate change impacts

The WWF report recommends changes in supply chains to make sure less food is thrown away because of the way it looks. "By specifying high standards in shape and appearance, especially for fruit and vegetables, produce out-graded from the intended market may command lower prices," it says. This means that "produce may be left unharvested, culled during harvest or used in low value applications".

The huge amount of uneaten food is also accelerating the climate crisis.

"If food waste and loss were a country, it would be the third-biggest source of greenhouse gas emissions," says the United Nations Environment Programme's Executive Director, Inger Andersen. "Let us all shop carefully, cook creatively and make wasting food anywhere socially unacceptable."

The impact on the climate is not just a result of the energy wasted producing food that is never eaten. When food rots on landfill sites, it releases the powerful greenhouse gas methane, a major cause of global warming. Eating more wonky fruit and vegetables won't be enough to solve these problems, but it could help. Some consumers say they are prepared to do their bit, with a survey of UK shoppers suggesting 87% are comfortable with less than perfectly shaped produce.

## The shape of things to come?

Suppliers are stepping in too. The Wonky Food Company says it is tackling global food waste by working with farmers to create products that use imperfect and leftover fruit and vegetables. One of the company's founders says he was inspired by the "pointless waste" of kiwi fruit he witnessed while working on a farm in New Zealand. This year's crop of wonky vegetables is unlikely to be a one-off. Farmers face a future of tough growing conditions caused by global warming. "Climate change studies warn that droughts are going to be more intense, more frequent and longer", Nuria Hernández-Mora, Co-founder of non-profit organization New Water Culture Foundation, told UK newspaper The Guardian. "This is going to be the new normal".

Source : World Economic Forum

- **Heatwaves and droughts have impacted farmland this year, resulting in oddly shaped crops of fruit and vegetables.**
- **Shoppers and retailers are being encouraged to embrace this wonky produce, rather than reject it and add to a global food waste problem.**
- **One study estimates that 40% of food is wasted, despite hundreds of millions facing hunger.**
- **Food waste is also a major cause of greenhouse gas emissions.**

# Why the world needs a new wave of food production

The planet has never been under more pressure to increase food production. And this pressure is only set to grow – by as much as 60% over the next few decades. At the same time, climate change is threatening food systems around the world, with major questions about future food supply and security, livelihoods and human nutrition.

As our planet gets squeezed between these multiple pressures, we need to rethink how we feed people and protect the environment – drastically diversifying crops, improving farming methods and strategically selecting places in which we grow our food. It's no longer just about hedging bets to make sure output meets demand, it's a vital necessity for our already-taxed, overburdened food production systems.

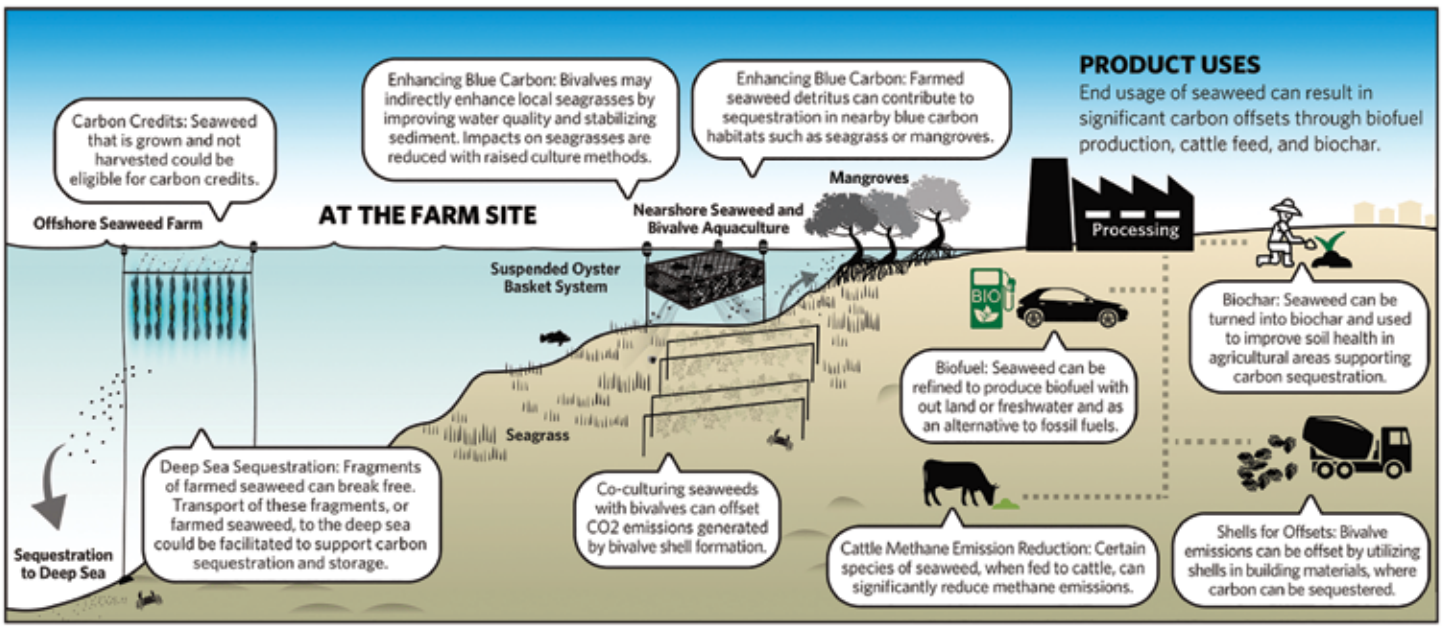
So let's think big – as in 71% of the planet big: our ocean.

Marine aquaculture, the growing of plants and animals in our oceans, is an important source of nutrition –and, research indicates, an emerging climate change solution. Yet it's often neglected in broader conversations about achieving a regenerative, nature-positive food system, in part because of its perceived history of environmental degradation. But significant advances in technology and practices have made it possible to responsibly manage the sector, and there is real potential for aquaculture to restore environmental health and improve human well-being. A reimagining of how and where we grow our food can make all the difference for our climate future. It's time we get to work.

## A resilient food system

Right now, growing the vast majority of our food requires land to produce. And almost all of the world's fertile land is already in use. Our ocean, by contrast, covers nearly three-quarters of the planet, yet currently provides just 2% of our food. Not only is there room to grow here, there's room to grow smartly.

Aquaculture in marine environments allows for three-dimensional farming (think: stacking one farm on top of the



other). A study projects that if we were to farm seafood instead of land-based meat to fulfill the growing demand for protein, we could spare an area of land two times the size of India. And growing seafood instead of most other animal proteins also spares a huge amount of carbon: Most farmed seafood has about a tenth of the carbon emissions as beef.

On top of preventing additional emissions, aquaculture can also help our food systems better withstand and recover from the effects of climate change that we're already seeing, like severe droughts and temperature swings. One way to do that is to produce a wider variety of foods that will respond differently to changes. Marine aquaculture adds to a healthy, resilient mix of food sources. Since it's affected differently by changes in air temperature, rainfall and soil than land-based agriculture, using this method can help food-producing communities and the people that rely on them be more resilient.

## A climate-smart system

New research is backing up aquaculture's climate benefits. Seaweed has lots of promise here. For instance, studies showing how seaweed aquaculture can sequester carbon under certain circumstances, when seaweed fragments break free of farms and are sequestered in deep-sea habitats, or as a contributor of nutrients to near-shore blue carbon habitats like mangroves. Intercropping seaweeds with some types of molluscs could also reduce the emissions created during the farming of shellfish. Even more encouraging are new developments in usage of seaweed in end products that have climate-positive linkages, such feed supplements that reduce methane emissions when given to cows, bioplastics and biochar. Researchers are also demonstrating the ability of seaweed aquaculture to mitigate the local effects of ocean acidification, one of the most significant impacts of climate change on ocean and coastal ecosystems. As seaweeds photosynthesize, they turn dissolved carbon dioxide in surrounding water into growth and oxygen. Studies in China, Chile and the United States are showing that seaweed farms can provide a halo effect to surrounding water, lowering acidity levels through this dissolved $CO_2$ effect and ultimately reducing ocean acidification. Under some circumstances, siting seaweed farms around vulnerable systems such as shellfish reefs may help dampen the shock of changing ocean conditions.

## A living, learning process

Of course, aquaculture farms are not immune to the negative impacts of climate change and carbon pollution. For instance, ocean acidification, which makes it difficult for shellfish larvae to grow their shells, caused a near disaster for the Pacific Northwest shellfish industry in 2008 when oyster larvae production in two major hatcheries collapsed. Growers now engage in expensive monitoring and water chemistry adjustments to ensure shellfish larvae can properly generate their protective shells, and some have even relocated hatcheries entirely. Environmentalists and shellfish farmers are now working together to address these challenges and push for greater climate action. Aquatic farmers who work on the water day in and day out are uniquely positioned to observe how ecosystems are changing and to report back on the lessons that they have learned, helping us all to better understand, predict and address impacts on coastal communities and ecosystems. Plus, new sensor technologies and software are making it possible to collect dramatically more data in real time.

## Stewards of the blue planet

Aquaculture can be a beacon of hope and opportunity – a chance for us to radically alter how we produce food and how our food impacts the planet. We can utilize aquaculture to bring new economic development to coastal communities and strengthen food security at local and global levels. If done smartly and sustainably, aquaculture is the path forward to increase global food production and trade opportunities in changing times and a changing climate. But it is critical that marine farms do their part to continue to reduce their carbon footprint. This means locating farms appropriately, using feed more efficiently, adopting precision technologies and automation, reducing reliance on air freight to transport aquaculture food products to markets and transitioning to renewable energy sources on farms.

Read full article @ https://bit.ly/3E2aSbu

Source : World Economic Forum

# Meet the GROWhort: 3Bee hopes to avert bee-pocalypse with hive monitoring tech

You might not realize it, but we all get a massive buzz off of bees. For millennia, humans have reared these creatures for their honey, prized for its utility as a sweetener, preservative, and for its medicinal properties. More than that, bees are our planet's arch-pollinators; responsible for helping many of the world's plants to reproduce. That means they play a much bigger role in our survival than simply producing honey (tasty as it may be.) Pollination leads to new generations of plants that oxygenate our atmosphere, strengthen our soils, sequester carbon – and, of course, that feed, clothe, and shelter us.

But pollinators — including bees — appear to be in decline. The picture is a complicated one that is yet to be fully explained, but disease, parasites, habitat destruction, and climate change are all argued to play a role. Italian startup 3Bee is aiming to fight back on behalf of our furry friends by using technology to "listen to the bees' needs and intervene when they are unwell," as it states on its website. This tech platform include sensors that can be placed in honeybee hives in order to monitor what's going on inside.

3Bee recently joined the GROW Impact Accelerator, which is backed by AgFunder and GROW. AFN spoke to the start-up's CEO Niccolò Calandri (NC) to find out more about the buzz-iness...

**What problem is 3Bee trying to solve, and how does your tech offer a solution?**

3Bee is trying to buffer the mortality of key pollinators through monitoring and predictive action. Our technology is deployed across a wide network of beekeepers – more than 3,000 in Italy by now, and already present in over 80 countries worldwide – with the aim of mapping the health status of honey hives and providing a quick and effective decision support system. In addition to this, 3Bee has developed several assets to restore the bee to the center of environmental bio-monitoring.

**What have been some of the biggest challenges for 3Bee so far? What have been some of the biggest successes?**

The biggest challenge at 3Bee was to raise awareness about the protection of bees and pollinators in a creative way. Insects are extremely confused within a macro-category of 'annoying little animals that need to be defeated,' and fighting this prejudice with gamification was the real challenge we faced. The success that we feel has been most valuable to date is people's recognition of the very value of the bee as a natural bio-indicator and sentinel of environmental and social wellbeing, and the identification of 3Bee as the activating partner that can [realize this.]

**Do you have any numbers or case studies that demonstrate the impact of your tech?**

Together with ESA [the European Space Agency] we are developing the first predictive system to analyze biodiversity.

With CREA [Italy's Council for Agricultural Research & Analysis of Agricultural Economics] we are developing algorithms for analyzing starvation mortality. Bees — not only honey bees — are facing an increasing danger of starvation mortality due to adverse climate trends.

In collaboration with the CNR [Italy's National Research Council] we are developing intelligent systems to study pollination and how to defend bees during this process.

**What does 'impact' mean to you personally, and to 3Bee as an organization? Why is social and environmental impact so important?**

The concept of impact is the company's driving force. Our sometimes 'activist' mission has fuelled the growth of the team in terms of ambitious and goal-focused resources [and created a] mindset aimed at rapid evolution. 3Bee has added an impact measurement asset to its activities, [aimed at] compensating for the more direct consequences of climate change on pollinators.

Source : agfundernews.com

# Why Oman is investing in alt protein with a US startup

Nearly one in three people in the Middle East and North Africa (MENA) region lack access to adequate food, according to the UN Food & Agriculture Organization. The MENA region faces numerous challenges in food and nutrition security: a dearth of viable farmland is an obvious contributor, exacerbated by rapid population growth, urbanization, low productivity, climate change, and a limited natural resource base.

Inflation, and supply chain issues caused by Covid-19 and the Russo-Ukrainian War, have further aggravated the region's food security problems. But MENA countries had something of a sneak preview of what can happen when food prices spiral out of control. After a sharp rise in food prices in 2008 and 2009 helped launch the widespread Arab Spring uprisings in the early 2010s, pushing MENA countries like Oman to place food security even higher on the agenda.

In 2012, the sultanate created the Oman Food Investment Holding Company (OFIC) with a mandate to invest in food security, economic diversification, and the provision of jobs to Omani citizens.

It also put an emphasis on technology and innovation, according to the Oman Vision 2040 industry plan which targets the long-term economic sustainability of the country. Now with inflation enveloping most of the world, we're already seeing food prices increase dramatically with supply chain shortages brought about by the Ukraine war exacerbating the economic backdrop for importers of core commodities like wheat such as Oman.

That's why when news hit about Oman's central investment agency Oman Investment Authority (OIA) partnering with a foodtech company – MycoTechnology – on protein supply, it was worth taking a closer look.

## Protein demand

According to Expert Market Research, the demand for dairy protein in the MENA region is growing as rapid population growth creates an increasingly health-conscious middle class. The overall demand for protein in the MENA region is also heavily influenced by the demand for whey protein, which had a market size of around $1.01 billion in 2021. This is expected to surge to roughly $1.38 billion in 2026.

Oman's plant protein industry is steadily growing as well, having recorded a CAGR of 27% during 2018 to 2020. This is expected to grow 18.8% between 2021 to 2027 to reach a market value of $41.7 million in 2027. MycoTechnology is a US-based startup that was founded in 2013 by Alan Hahn, Jim Langan and Brooks Kelly. It has raised a total of $207.6 million over several rounds. Its latest round was a Series E investment of $85 million earlier this year led by OIA alongside 12 other investors, both new and existing. The startup uses mycelium derived from mushrooms to make novel food ingredients through fermentation. The ingredients can be used as bitter blockers, to clarify food flavors or boost the functionality or protein levels of foods.

## The deal

MycoTech and OIA have established a joint venture to scale up and commercialize the production of alternative protein ingredients in the country by using leftover dates. Oman is the eighth largest producer of dates globally with over 250 indigenous varieties. However, humans eat less than half of what's produced locally as they often fail to meet certain standards or consumer preferences and are then either wasted or, primarily used in animal feed.

The new joint venture is expected to upcycle a significant portion of these excess dates, using the natural sugar present in the fruit as a source of carbon to fuel the production of MycoTech's mushroom-based protein. The venture, which combines OIA's local knowledge and public sector relationships with MycoTechnology's cutting-edge technology, will see the establishment of a production facility in Oman in the first half of 2023 on a 10-hectare site.

Production is set to begin by the second quarter of 2025, with up to 16,000 tonnes of dates to be processed each year. Once operational, the partners intend for the new facility to evolve into the Middle East's leading innovation hub for food technology. "Oman was looking for a domestic solution and we had a long-term relationship with the Oman Technology Fund. So we explored what would be the best way to tackle that challenge [of food security]," Hahn tells AFN. "With the war in Ukraine and its impact on the global supply chain, every country should be looking at this technology to see if it fits into their strategic initiatives. If you're importing, you need to figure out a way to do all kinds of side stability improvements and so forth. You're not shipping stuff around. So I think it's really critical that they look at their sources of food and how they produce protein for its population," he notes.

Read full article @ https://bit.ly/3qZxpxS

Source : agfundernews.com

# How Anuvia aims to spend $66m advancing biofertilizer for large-scale agriculture

US biofertilizer company Anuvia Plant Nutrients has packed a lot of milestones into a short period of time, its latest being a $65.5 million Series D fundraise co-led by Riverstone Holdings and Piva Capital. Morgan Stanley Investment Management and LK Advisers, the family office of the Mittal steel magnate dynasty, participated along with existing investor Pontifax AgTech.

The round follows Anuvia's $103 million Series C raise from last year. "We've become a sustainable tool that can really help drive large-scale agriculture, and we can do it in a really quick and efficient way in terms of adoption curves," Anuvia CEO Amy Yoder said.

**On background:**
Florida-based Anuvia manufacturers biofertilizer for the agriculture, turf, and lawncare industries. The company says its ag-specific product SymTRX can improve crop yields for large-scale farming operations while replenishing soil and reducing greenhouse gas (GHG) emissions.

Anuvia's technology breaks organic waste materials down into amino acids and peptides combined with nutrients to feed plants and the soil. The process is similar to what occurs in the soil naturally – just sped up to increase efficiency and nutrient uptake in agricultural settings.

SymTRX, which currently targets corn, soybeans, wheat, canola, and sugar beet, is already available commercially in the US. Anuvia aims to have it on 20 million acres by 2025.

The company struck a deal with phosphate-mining company Mosaic in 2019 to use the latter's Plant City, Florida facility for manufacturing. It has the capacity to put out up to 1.2 million tons per year, which would service more than those 20 million acres that Anuvia's targeting.

It has also partnered with biologicals company Novozymes to develop "a pipeline [of] different products" aimed at reducing the agricultural sector's need for synthetic fertilizers, Yoder said.

An audit conducted by consultants Environmental Resources Management found that for every 1 million acres of crops that use Anuvia's products, the GHG reduction is equivalent to removing up to 30,000 cars from the roads.

**How it'll spend the funding:**
Anuvia plans to increase capacity at its US manufacturing facility and accelerate commercialization of SymTRX. Via the aforementioned deal with Mosaic, Anuvia will increase manufacturing in Plant City in order to produce more of its product in North America.

Anuvia will also research potential new products, such as biopesticides and biofungicides. While North America is the focus market for now, Yoder said says Anuvia also has "some global initiatives." Details on those partnerships are still under wraps.

**The bigger picture:**
Yoder suggested that farmers are "much more receptive than they would have been five years ago" to biofertilizers and other bio-based inputs, for a few different reasons:

Continued supply chain disruptions and congestion have caused input shortages around the world and and sent global fertilizer prices skyrocketing to record highs. According to estimates, farmers were paying 165% more for fertilizer at the end of 2021 than they were in 2020.

The Russian invasion of Ukraine has added to the fertilizer shortage and sent prices further upwards, with some more than doubling in price.

Downstream, consumers want more visibility about the sustainability of the food they buy. "Food companies are getting pressure from their consumers, and ultimately, those consumers are also farmers, so they're kind of thinking about it in a holistic way," Yoder said.

Anuvia says these factors have accelerated the acceptance and desire for biofertilizer amongst farmers. In the case of its own products, farmers can integrate them into existing operations without having to add more steps to the process. "Being able to have something that's domestically produced, where they're less reliant on a fragile supply chain is very interesting to [farmers], so they've been incredibly receptive," Yoder said.

Underscoring this, startups developing biological inputs for crops raised just over $892 million in funding worldwide in 2021, well over double their total for the previous year.

Source : agfundernews.com

# Here's why we could be eating more seaweed in future

Edible seaweeds and algae - or sea vegetables - are a group of aquatic plants that are found in the ocean. Kelp, dulse, wakame and sea grapes are all types of seaweeds that are used in seaweed-based dishes. Though eating seaweed is mostly common in Asian countries, today seaweeds are widely growing in popularity as an ingredient in a range of food and beverages. This notably includes sushi, where nori seaweed is used as an edible wrap for vegetable, fish, and rice-based fillings.

Our research suggests that people in the UK, like consumers in other western countries, are less familiar with seaweed as an ingredient. This is important because food neophobia (wanting to avoid novel foods) may prevent consumers from trying new products. And for seaweeds in particular, first impressions may be less appealing when associated with the plant washed up on our beaches. For example, many participants in our research imagined seaweed to be "smelly", "salty", and "slimy" when asked.

Despite this, many European countries have a history of consuming seaweeds. This includes laverbread, a savoury puree made from laver seaweed, which is eaten alongside other seafood as part of Welsh cuisine. A sweet alternative is carrageen pudding, a jelly-like dessert made from carrageen seaweed (otherwise known as Irish moss). However, this traditional consumption of seaweed remains somewhat niche today. And with the exception of sushi, seaweed consumption is relatively low in most western countries.

## Ideas

- Seaweeds are widely growing in popularity as an ingredient in a range of foods, like sushi.
- But consumption of "sea vegetables" is relatively low in most western countries.
- This is depsite them being a nutritious and climate-friendly food source rich in fibre and high in vitamins and minerals.
- High prices, limited high street availability and consumer aversion to novel foods may limit its popularity.

In a recent study, we explored how consumers rate seaweeds and potential food products (that could be supplemented with seaweed) when thinking about eating them. We found that people expected seaweed food products (such as seaweed burgers) to be more appealing than seaweed as a general food source. Notably, as participants already expected seaweed products to be healthy and sustainable, these attributes were less important to their acceptance of seaweed. Taste and familiarity were the two factors that had the greatest influence on participants' willingness to try and buy seaweed-based foods.

This is useful because seaweeds are a highly versatile and nutritious food source that can benefit our diet. Seaweeds are often rich in fibre and high in vitamins and minerals. This includes iodine and vitamin B12, which can be lacking in vegetarian and vegan diets. And seaweeds can be added to a range of products for their taste as well as how they can be used to thicken soups or stabilise the texture of ice cream. As seaweeds have a umami flavour, many chefs also favour seaweeds as a way to enhance the depth of flavour in their dishes.

### Climate-friendly food

Thinking about what we eat has become an important environment-related talking point. As more of us try to eat less meat and dairy, we have seen a rise in the consumption of plant-based products (including burger patties, nuggets, and sausages), plant-based milk (soya, almond, rice, and oat milk), and other dairy alternatives (such as dairy-free yoghurt and cheese).

In the current market, plant-based "meat" is typically made from soya, with other plant-based proteins including peas, mushrooms, and wheat. Importantly, seaweeds and algae could be worthy additions to this list. Though the protein content of seaweed differs between species (particularly as it goes through the production process), protein can account for up to 25% of the dry weight for green seaweeds, and 47% for red seaweeds.

This means that seaweeds could be used to supplement the nutritional content of protein alternatives. In particular, seaweeds are often low in sodium. As the salt content of plant-based meat products can be higher than similar products, seaweeds could be used as an alternative seasoning to salt, helping to improve the healthiness of these items while enhancing taste.

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Source : World Economic Forum

# Democratizing precision agriculture with GNSS and other tech

**Once only accessible to large commercial farms, technological innovation is beginning to bring the benefits of precision agriculture to everyone else.**

Fuel and fertilizer prices are at all-time highs, as farmers the world over are scrambling to find ways to stay financially afloat. Large commercial farms have long had a leg up over smaller holdings. They already have access to artificial intelligence (AI) and cutting-edge hardware to plan their operations and automate tasks. They run broad sensor networks to monitor soil quality, operate vision-enabled drones to monitor crop health, and let autonomous tractors steer across their fields to vastly improve their productivity.

These advanced systems have been prohibitively expensive, to the point that their costs are hard to justify for smaller holdings, less than two hectares in size, which make up the vast majority of the world's more than 570 million farms. Many of these farmers simply don't have access to sufficient capital to invest in new equipment, and continue to rely on older machines and human labor.

For them, the vast promise of the digital revolution to increase the efficiency of agricultural operations — typically lumped together as smart farming or precision agriculture — has long remained just out of reach.

But change is in the air. Over the past few years, the popularization of the internet of things (IoT) and its underlying technologies has led to the development of a new and more affordable generation of precision farming solutions.

These solutions are giving smallholdings tools to increase the quantity and the quality of their production. Combining satellite-based positioning, wireless connectivity and visual sensing with advanced algorithms including machine learning (ML) and artificial intelligence, these solutions promise to help farmers produce more for less, putting them on more equal footing with their larger commercial competitors.

In this article, we take stock of key trends driving the democratization of precision agriculture. We zoom in on some of the concrete applications transforming the operations of smaller farms the world over. We start by exploring the core enabling technologies, the applications they enable, and where they are headed.

## Technological evolution on all fronts

Sensor-fusion platforms

At their heart, precision agriculture solutions are sensor fusion platforms, taking in data points from a variety of sensors, using algorithms to make sense of them, and extracting insights on which their users — machine or human — can act. As they mature, these sensor fusion platforms are becoming increasingly complex, crunching more and more types of sensor data with algorithms of growing sophistication to gain ever deeper and higher value insights.

These insights are often generated using AI and ML models that run at the edge of the network near the sensors — on the tractors, sprayers, or other devices themselves — rather than in the cloud. Equipment manufacturers looking to integrate AI/ML at the edge are weighing their options in terms of adding application processors and hardware

accelerators capable of running advanced ML models needed to fuse camera and sensor inputs to make real-time decisions. To simplify the adoption of AI/ML at the edge, many vendors are starting to integrate AI accelerators into their modules and systems-on-chip (SoCs), lowering the barrier to entry.

Original equipment manufacturers (OEMs), for their part, are choosing to integrate these SoCs even if their software capabilities are still behind. For them, building solutions with future-proof hardware is a potentially lucrative strategy for generating recurring revenues through firmware updates that provide advanced functions down the road.

Despite the abundance of evaluation kits from major vendors, scaling from prototypes to production with these solutions can be expensive. While integrated sensor fusion platforms with, for example, pre-loaded dynamic vehicle models for auto-steering or computer vision models for plant health can accelerate development for OEMs and reduce the need for software investment, they can be too generic and may not solve use-case-specific needs. More focused AI/ML may require more investment in data collection and training models, which, due to their proprietary nature could come at a higher price.

## Camera systems

Camera systems are already widely relied on by autonomous tractors, visually monitoring the surrounding environment and feeding their data into computer-vision solutions where it is parsed. Context-rich, vision-based data can help optimize the distribution of agricultural inputs such as water, seeds, fertilizers and pesticides using real-time variable spray-rate control based on plant size and other metrics to significantly improve efficiencies and reduce overall costs.

Camera systems come with a set of challenges that need to be carefully managed. Lenses can become contaminated with water, debris, dust, and snow. Even though these issues impact all vision-based applications, including mass-market applications such as automated and autonomous driving, there are still no reliable methods of keeping them clean, aside from water-spraying nozzles (that can cause build-up on the lenses) and old-fashioned manual maintenance. Additionally, the steep price of high-resolution cameras can drive up the cost of end solutions, as can data storage and communication when the visual data is processed in the cloud.

## Global navigation satellite systems

Satellite-based positioning has also become a staple in precision agriculture solutions. Autonomous and guided tractors use the technology to drive vehicles along precise paths to increase pass-to-pass efficiency and reduce overlapping rows. Crop monitoring drones use GNSS technology to patrol predefined flight paths. And fully autonomous guided vehicles such as robotic lawnmowers use it to avoid restricted no-go zones. The latter three applications typically require centimeter-level positioning accuracies.

Centimeter-level GNSS technology has been available for well over a decade, with farmers subscribing to relatively costly GNSS correction services tailored to each user. However, it was only with the advent of affordable RTK services with availability in rural areas, as well as the dramatic decrease in cost for farmers to deploy their own RTK base stations using low-cost modules, that the price point of high precision positioning has come down far enough to make the service affordable to all but the least lucrative operations.

High precision GNSS technology brings the benefits of improved pass-to-pass efficiency – a general reduction of all agricultural inputs with all the financial, environmental, and health benefits that this entails. At the same time, it requires solutions to deal with signal delays and the resulting inaccuracies of multipath effects, caused when signals bounce off buildings, mountains, or other solid structures on their way to the GNSS receiver.

When delivered via the internet, the GNSS augmentation data stream requires an IP connection to the provider's server. This poses challenges for farms that lack infrastructures such as Wi-Fi base stations, sub-GHz RF systems, or cellular network coverage.

## Wireless connectivity

In some way or another, all advanced precision ag use cases depend on wireless connectivity. Environmental sensors and inspection drones need it to relay data to the cloud backend. Additionally, tractors, drones, and other farm robots depend on it to upload telematics data, report their status, enable predictive maintenance tools to reduce downtime, and receive GNSS augmentation data for high precision positioning.

Read full @ https://bit.ly/3qZzEBo

Source : gpsworld.com

## Agro-PV

# GAUGING INDIA'S AGRIVOLTAICS POTENTIAL

According to the 2011 national census, agricultural and related sector activities employ 54.6% of the total workforce and contribute to 17.8% of the nation's Gross Value Added (GVA). These stats show that despite the digital transformation that has taken place in the country, India is fundamentally an agrarian economy.

Under its Mission 500GW, India has planned nearly 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by the year 2030, with renewable energy making up 50% of all energy requirements. The next goal is India's Net Zero goal, which is a significant advancement in the worldwide fight to combat climate change.

After the US, it's India which has the second-highest area of arable land, cultivating close to 60% of its land. India sees nearly 300 clear and bright days each year, and the quantity of solar energy that is accessible in a single year surpasses the total power generation of all the country's fossil fuel energy sources. But an achilles heel for solar proliferation is the vast amount of acreage needed for solar energy production.

The one solution that could help India achieve solar and land optimization is Agrivoltaics.

### Agrivoltaics: Synergizing Solar and Agriculture

Agrivoltaics is the practice of using land for both solar energy production and agriculture at the same time. Crops are typically grown beneath or in between the rows of solar panels in a conventional Agrivoltaics solar system, which consists of ground-mounted solar arrays. The panels can be mounted on structures that are tall enough for farming machinery to pass underneath.

The IEEFA (Institute for Energy Economics and Financial Analysis), in their 2021 report Agrivoltaics in India: Fertile Ground? points out the potential this innovation has in meeting India's energy demands. The study states, India is a good fit for Agrivoltaics, especially given that agriculture now takes up 60.43% of the nation's total land area. Additionally, it makes up around 18.8% of the overall GVA. Thus, Agrivoltaics is a perfect answer for India because a substantial section of the nation is engaged in agriculture. Using this technique, farmers may grow food on rich soil while solar panels provide electricity.

### How India Stands to Win with Agrivoltaics

Another key study, titled Agrivoltaics in India, executed by National Solar Energy Federation of India (NSEFI) in association with the Indo-German Energy Forum (IGEF) asserted the immense value Agrivoltaics can offer to India's agriculture and renewable energy needs. The study hypothetically draws conclusion from what would happen if 5.5 acres of land, which can support 1 MW of agrivoltaics, were used for the technology. This would result in a total potential of 629.69 GW being realised from net area sown (agricultural) lands alone. For fallow areas and other uncultivated lands, the potential for Agrivoltaics is 49.50 GW and 56.6 GW, respectively.

Raman Bhatia
Founder & Managing Director
Servotech Power Systems Limited

Beyond these numbers, there are also a host of other gains that it offers:

### Augmented Crop Effectiveness and Produce

Once plants reach what is called the light saturation point, too much sunlight is not advantageous to them. Instead, it may result in increased water use and possibly stunted growth. Crops planted under solar panels are not only protected from high temperatures, but their yield also increases considerably. Solar panels can also be adjusted to get the ideal quantity of sunlight.

Some crops grow more well with solar panels than they do in more traditional environments. For instance, an APV system in a tea plantation farm in Assam can massively profit from being shaded under panels.

### Reduced Water Usage

In addition to assisting in temperature control, solar panels' shadow also helps to significantly reduce water evaporation. As a result, it aids in increasing soil moisture, enabling farmers to keep crops at the ideal water level. A "light saturation point" is a feature common to all plants. When a plant reaches this stage, sunlight no longer promotes growth but instead raises stress and

water needs. You can keep crops from reaching their light saturation threshold and experiencing stress by developing an agrivoltaic system.

The plants' requirement for extra water is reduced by the low-stress environment provided beneath the solar panels. Additionally, the solar panels' shade keeps soil-based moisture from evaporating. Farmers won't need to irrigate as frequently because the plants will need less water and more water will be retained in the soil.

### Peripheral System for Harvesting Rainwater

Agrivoltaics with a rainwater collection system together is a unique idea. In order to use it later for irrigation and PV cleaning, farmers can collect rainwater from solar panel arrays and store it in storage tanks. Studies show that it enables farmers to capture a substantial amount of rainwater that falls on the panels, offering a workable remedy for the water shortage brought on by climate change.

### Increased Revenue for Farmers

Some farmers might earn more money without putting in more labour by installing solar. Aside from their crops, farmers can earn money through programmes including virtual net metering and solar renewable energy credits (SRECs). Large factory farms, erratic global trade policy, and shifting climatic circumstances all pose daily threats to small farms. The extra cash generated by adding solar helps keep many farms viable when they otherwise wouldn't be able to.

### The Way Ahead

Agrivoltaic systems have the potential to increase agricultural land's adaptability to climate change, particularly in dryland environments where farmers already face challenges from rising temperatures and water scarcity. Agriculture can be supported while also producing more clean energy thanks to agrivoltaics.

Though there are obstacles, it is possible that using the land for both food production and energy production would yield twice as many outcomes. Not all crops can be cultivated under the panels, and in climates without significant seasonal changes, the panels' ability to regulate temperature is less effective. Despite this, there is no doubt that the dual-use of land would stabilise the rising demand for solar energy and allow farmers access to a new source of income. More potential to combine more agricultural activities with PV systems will be made possible by advancements in the usage of tracking systems and transparent PV modules.

Source : saurenergy.com

# Why John Deere invested in Africa's Hello Tractor

American ag machinery behemoth Deere & Company — more commonly known as John Deere, recently invested in Hello Tractor, a Nigeria-headquartered marketplace and fleet management technology for African farmers to rent tractors.

The startup was one of the first participants in John Deere's Startup Collaborator program, which launched in 2019 to help the company engage with tech startups and trial their innovations with customers without a formal partnership. Another early participant was Bear Flag Robotics, which was acquired by John Deere earlier this year. [Disclosure: AgFunder, AFN's parent company, was an investor in Bear Flag Robotics.]

John Deere's director of Ag & Turf Sales & Marketing in Africa and Asia Jason Brantley, told AFN that Hello Tractor aligns with the business's "Leaps Ambition" which aims to see 100% of small ag equipment connectivity enabled by 2026. He said the deal also presents an opportunity for Deere "to learn from Hello Tractor about how it connects with customers and helps solve problems in Deere's Region 1 markets of Africa and Asia."

"Sustainable food security in these regions will require new solutions to persistent problems in agriculture, but at the scales and costs that match the market and the mechanization levels of the farmer's production system. It's exciting to see the energy and efforts that new startups are directing towards production agriculture and we think this will increase as more connectivity is established," he said.

He added that the partnership with Hello Tractor is really aimed squarely at increasing access to affordable mechanization for small farmers and to help mechanization contractors run more efficiently and profitably. "As contractors and customers become more connected, we are most interested in innovative ways to help the small farmer increase yields and reduce inputs in their production systems. This is challenging because most small farmers haven't yet mechanized every step of their production system, which means many existing precision ag approaches aren't applicable."

"This is going to require new technologies and approaches and that's exactly what we hope our drive towards connectivity will inspire," Brantley added.

### Closing the mechanization gap in African agriculture

Agricultural mechanization generally has two profound effects for farmers. One is that farmers can cut costs on hiring laborers, which ultimately saves on time and increases output. It also helps to produce higher crop yields and greater efficiency, which should increase their incomes.

Read full @ https://bit.ly/3UxozVx
Source : agfundernews.com

# USING THE SUN TO KEEP AGRICULTURAL PRODUCE COOL?

## How Ghana's farmers are benefiting from solar-powered cold storage


- **Farmers in Ghana are using solar powered cold storage to keep freshly harvested fruit and vegetables cool.**
- **AkoFresh, the company behind the innovation, says countries in Sub-Saharan Africa can lose more than a third of their harvested food, mostly because of inefficient supply chains.**
- **The solar cold stores will boost seasonal income for farmers by more than $10 million and cut greenhouse gas emissions by 15%, AkoFresh says.**

Finding ways to store freshly harvested fruit and vegetables is a big problem for smallholder farmers in Ghana in West Africa. Produce can rot quickly in outdoor temperatures, and transporting it to market isn't an option for many small-scale farmers Almost 90% of smallholder farmers in Ghana sell their produce at the farm gate, news site Business Ghana reports.

### Solar powered cold storage

Now a company called AkoFresh is providing solar-powered refrigerated storage that it says extends the shelf life of perishable crops from about 5 days to 21 days. Farmers can rent a space in the cold store for a daily fee of $0.30 per 20 kilogram crate of produce, or take up a weekly subscription. They can also pay for the cold storage with crops instead of cash.

To help farmers reduce food losses and sell their produce at competitive prices, the solar powered cold storage service also includes a mobile app that connects them to food aggregators. These are organizations that consolidate and distribute agricultural products, explains Ghana state-owned food company NAFCO.

### Food waste is a risk in Africa and globally

AkoFresh says it wants to halve the volume of crops lost after harvest across 10 communities in Ghana over the next 5-10 years. This will boost seasonal income for farmers by more than $10 million, as well as reduce greenhouse gas emissions by 15%, it says.About a third of all food produced globally – around 1.3 billion tonnes – is wasted, estimates the United Nations Food and Agriculture Organization, a specialist agency that works to eliminate hunger, food insecurity and malnutrition.

In Sub-Saharan Africa, countries can lose more than a third of their harvested food, AkoFresh says. More than 90% of these losses are linked to inefficient supply chains, it adds. These food losses are a threat to the food security, financial stability and environmental protection of farming communities in Africa and globally, AkoFresh says.

### How solar powered cold storage works

The company's solar powered cold storage unit includes cold room panels, sensors, a condensing unit, and an evaporator. Using solar power means the refrigerated unit doesn't need to be connected to an electricity grid and is "net positive to the environment".

"Every solar cold room we set up is reducing up to 16.5 tonnes of $CO_2$ emissions each month," AkoFresh says. As well as keeping crops cool, the solar powered cold storage unit can be used to store fresh fish and medical materials, including vaccines.

Read full @ https://bit.ly/3R7VWuY

Source : World Economic Forum

# Could blockchain help track outbreaks like e. coli in spinach?

- Retailers such as Walmart have been promoting blockchain as a way of tracing perishable foods as they travel through the supply chain.
- Blockchain's ability to capture data along the supply chain makes it a fast and efficient way to pinpoint where contamination or other safety issues may have originated.
- However, new research suggests there are concerns around how the technology could be used to maximize profitability at the expense of farmers, leading to more supply chain problems.

Food contamination outbreaks are regular occurrences in the United States food system and can be costly. In 2006, for example, 276 consumer illnesses and three deaths were attributed to an E. coli outbreak in California, during which spinach disappeared from supermarket shelves nationwide for two weeks and the state's farmers incurred losses of $74 million. To protect themselves and their customers, retailers such as Walmart have been promoting blockchain as a novel method for tracing perishable foods such as leafy greens as they travel through the supply chain.

But what is the impact of such traceability technology, particularly on the strategic behaviors of stakeholders within the supply chain, and does it make good on its promises to increase safety and reduce waste? The answer, Fasheng Xu, professor of supply chain, operations, and technology at Syracuse University and his colleagues found in their theoretical model, is complex and depends on the configuration of the supply chain. The greatest benefit of blockchain in this context is immediately apparent: Its ability to capture, maintain, and grant access to data along the supply chain makes it fast and efficient to pinpoint where contaminated spinach or other produce came from, allowing the continued sale of unaffected products. (The researchers call this the "pure traceability effect.")

Considering the different stakeholders within the supply chain—retailers, suppliers, and farmers—complicates the picture. "They're self-interested, and playing games with one another to try and maximize their profit," Xu explains. "Their strategic actions may backfire and may not lead to win-win-win but to a triple loss." (This is termed the "strategic-pricing effect.")

For example, Walmart may strategically reduce the wholesale price for spinach, leading distributors to offer a lower procurement price to farmers. "The direct result is that the farmers are going to put less effort into improving supply chain safety, so as a result contamination risks will become higher after this technology adoption," Xu says. The system and its individual supply chain members, including the retailer, end up worse off.

Read full article @ https://bit.ly/3BCSXVO

Source : weforum.org

# This young leader is helping farmers connect technology with agriculture

- Mariana Vasconcelos is the CEO and co-founder of Brazil-based AgroSmart
- AgroSmart is the largest agricultural data network in Latin America.
- The company acquired the largest platform for agricultural producers in South America, BoosterArgo, in 2021.

Mariana's interest in business started at a young age at her family bakery. She subsequently studied at the Federal University of Itajubá, the University of California, Los Angeles, and Singularity University. The first business course she joined was STEM-based and created to foster technology entrepreneurship. This inspired her to establish a cloud computing start-up. Although the start-up was unsuccessful, it led her to apply for a trainee programme at Bosch in Germany, where the company's innovation ecosystem cultivated her knowledge of start-up development and the evolution of technologies. Mariana's second venture focused on the Internet of Things (IoT) and artificial intelligence (AI) for the industrial revolution, which soon presented the company with an opportunity to apply that knowledge to the agricultural industry – one of the main pillars of Brazil's economy.

**What motivated you to start AgroSmart and what has your experience been?**

Growing up in an agricultural family and handling food from farm to table, I developed a passion for food systems. It translated into the creation of Agrosmart and in turn allowed me to reconnect with my roots and find my place in the transition of food systems. My daily duties include interacting with the market, investors, corporate clients, entrepreneurs, and stakeholders, by which I constantly update my knowledge and build upon our vision and strategy. I also actively participate in entrepreneurial, climate, agricultural and food ecosystems, advocating for our impact commitments and helping to create an environment where we can flourish. Moreover, I engage with my leadership team weekly to monitor our progress on key projects and make the necessary adjustments in line with our company goals.

Read full article @ https://bit.ly/3xO4iRX

Source : World Economic Forum

Question

# Q&A

Answer

## OPTIONS FOR POND

**pareshtiwari:** *Hi, Can anybody suggest, what commercial activities possible in fresh water pond other than Fish Farming. If possible with some examples and references. Thanks*

***Answer 1 -- maitys:*** All you need to innovate and explore yourself …that's all about "ATMA NIRBHAR BHARAT" instead of taking reference from virtual landscape and implement ….some referral info .

1. Intensive Duck farming or Integrated Duck-Fish Farming
2. Shell Fish Culture (Shrimp, crayfish, crab, lobster, clams, scallops, oysters, and mussels etc. )
3. Aquatic plant crops cultivation for Human and Livestock consumption ( Lotus , Water chestnut , Water cress , Water Spinich , Makhana , Wasabi , Bog Cranberry , Water Celery , Lemon Bacopa , Pennywort , Aquatic Mint , Duckweed , Azolla etc. )
4. Pearl Oyster farming
5. Spirulina / Algae Culture and many more ...

***Answer 2 -- garao56?:*** IF the size of the tank is large fisheries activity is profitable , Depending up on the quality of water fresh water or brakish water fishes/prawns/crabs rearing can be taken up. Other aquatic plants cultivation may not be economical

*pareshtiwari: Thank you Mr Maitys for taking time to reply, shall explore vegetation options, if you have references of people doing it please share. It shall help me.*
*Thanks again*

*pareshtiwari: Thank you Mr Rao for your valuable inputs*

***Answer 3 -- kafijc :*** I have good information about fresh water pond cultivation. Not fisheries sir.

***Answer 4 -- swami13569:*** I have Pearl farming ideas' anybody wants to please contact .

## AGARWOOD PLANTATION

***setri1:*** *Has anyone planted Agarwood plantation in telangana and andhra pradesh states. I want to know the procedure to plant, life time and income opportunities and clarify other doubts.*

***Answer 1 -- karthi_rg:*** Please contact. We are Agarwood Plants supplier all over India.

***Answer 2 -- janrdhanan:*** 1. Select plant. (Aquilara Malaccensis.)
2. Buy from a verified supplier.
3. Prepare the site
4. Dig pit 2ft sq. @8ft distance.
5. Put cowdung/ compost +dolomite keep it for 10 to 15 days.
6. Plant the trees.
7. Irrigation is required for the first 2 to 3 years.

***Answer 3 -- setri1:*** Are you farming agarwood ? or had knowledge about ? kindly share your number so I can contact for clarifications.

## INTER CROP WITH MANGO

***vermaaditya:*** *Dear All, I have about 80 Alphanso mango plants. What all can I do along with that as intercrop? possoible to do black pepper etc? what else could give me regular income.*
*My orchard is in Konkan area with heavy rainfall*

***Answer 1 -- garao56:*** Inter Cropping or Fillers:
Usually mangoes are planted wide apart and have juvenile period of 4-5 years. Hence, the interspaces can profitably be utilized for growing of crops.
Select the intercrop very carefully. For the proper development of root system and canopy of the young plants, aeration and moisture is very necessary.
It will be beneficial to remove weeds from the basins periodically. Intercrop should not interfere with the mango plants for nutrition, light and moisture. Intercrops can be grown for the first 4-5 years of age of the plants.
Wheat can be sown by providing separate irrigation system to the mango plants. Pulses like grams and massar should be preferred. In Khariff season Moong or Arhar should be grown. Vegetable growing can be useful than intercrops. In Uttar Pradesh Sugarcane and poplar are being grown as intercrops.
Fillers are a good alternative to intercrops. Fruit plants like Plums, Peaches and Papaya can be planted as filler in mango plantations. Mango is a slow growing fruit crop. Hence, mango itself can be used a filler, which should be removed when it starts interfering with the main plants.

## IS SPRINKLER IRRIGATION/ RAINGUN METHOD SUITABLE TO COCONUT, GUAVA AND LEMON PLANTATIONS

***marsorganic*** *: Is sprinkler irrigation/ raingun method suitable to coconut, guava and lemon plantations since inceptions. Is it better than drip irrigation assuming that there is no water scarcity in the farm, it's available sufficiently.*

***Answer 1 -- pradeeppotturi2fly --*** For horticulture crops rain guns are not suitable. For better irrigation purpose 2-4 rows drip laterals it will work effectively.

***Answer 2 -- garao56*** : Please go for drip Irrigation for orchard crops

***Answer 3 -- padmanabhan_ganesan*** : Unless you are doing intercrops in between the coconut, guava, lemon, drip irrigation is best. Otherwise, raingun/sprinkler would be advisable if there are inter crops.

## 05 RAW MILK HANDLING

***ahamedqc:*** *Dear frnd, I have planning to open small scale milk industry*

*Anyone have knowledge for raw milk handling, plz give details. I will contact you or please post your suggestions*

***Answer 1 -- garao56:*** Dear sir, Raw milk can be stored in bulk milk coolers overnight and can be supplied to private or co-operative dairies.

IF milk is procured by you in small quantities also can be processed with latest equipment like Tool Tech Company equipment and pack it and sell in the market.

G. Anandarao

***Answer 2 -- stevifarm:*** Go for stevia or medicinal rops. If you need further assistance we can provide.

***Answer 3 -- garao56 :*** If export potential for stevia is not available difficult in marketing of the produce

***Answer 4 -- martandwa :*** I have more than 20acres of land in Palghar, Maharashtra, India with irrigation availability. Please guide me for details. We are happy to do corporate farming also with contract.

***Answer 5 -- garao56:*** Please take up orchard crops like mango, pomegranate , taiwan gua etc for profitability. Please utilise the subsidy from National Horitculture Board . For any clarifications and project reports please consult us

***Answer 6 -- stevifarm:*** you can go for stevia as an inter-crop with our buy-back agreement. Stevia is 5 years crop, first harvest starts from 5 months and subsequently every 3.5 months for 5 years, an approximate of 1.5 ton per acre per year yield is expected in inter-crop. Please contact us .

***Answer 7 -- achaldate:*** Hello Vermaaditya, Nice to you know that you have a good parcel of land. You can start fish farming, which will help you get good income, also, black pepper and small plants like ginger, garlic, etc. can be intercropped. I can help you in all of the above. If interested please reply .

## 06 START DAIRY FARM

***s7885001i:*** *I am planning to start Dairy Farm with 50 COWs in Tamilnadu in the Tittakudi area. Please guide me with below details to increase my knowledge.*

*1) GOVT. Subsidy if any.*
*2) Project cost for 20Cows.*
*3) Market strength / best buyer daily basis.*
*4) Best cow available with 30 to 35 ltr milk/day from each cow.*
*5) Milking period of cows.*
*7) Land requirement*
*6) Is it a really profitable business?*

*I may take your consultancy for the entire project so please give me best & honest guidance. Thanks, Visvanathan*

***Answer 1 -- mythiwh:*** 1) In Tamil nadu, there is no state government subsidy for dairy farming. However, you may get interest subvention and subsidy under Dairy Enterprenuer Development Program of NABARD

2)Project cost for 50 cows depends on your level of mechanisation

3)If you are able to approach the end consumer, You would get around 60 Rs per litre, but the farm gate price would be around 30 Rs

4) This is an unrealistic expectation. You may aim at 20-25 ltr per day , that too after a year of experience

5) You may take the milking period as 290-305 days. Depends on your herd management, land requirement would be around 15 acres with adequate water resources

6) yes, depending on your attention and management.

Please send me a private message to take things forward

***Answer 2 -- garao56:*** Dear Sir,

1) GOVT. Subsidy if any. -- 25% subsidy ( for APL - above poverty line) and 33% subsidy for SC/ST category under DED scheme of NABARD - Rs.17500/- subsidy for 10 Animals only. If more than 10 animals general dairy loan has to be availed from Banks.

2) Project cost for 20Cows. - Project cost be around 15-20 Lakhs depending up on the quality of shed and equipment . Your margin will be Rs.5.00 Lakhs and loan will be Rs.15.00 Lakhs

3) Market strength / best buyer daily basis.-

Local Milk collection centre of milk dairy unit, Private hotels, Hostels or flat dwellers

4) Best cow available with 30 to 35 ltr milk/day from each cow.

Around 15-20 litres yielding cows may be available such as Jersy and HF

5) Milking period of cows. -- 290 days

7) Land requirement - At least 5 acres

## 07 NEED CONSULTANCY FOR ORGANIC CULTIVATION

***senkuma72:*** *Need organic cultivation advise in Pudukkottai District , Tamilnadu*

***Answer 1 -- padmanabhan_ganesan:*** What type of advise are you looking for? What crop and how much acreage?

***Answer 2 -- garao56:*** Please consult us for guidance and inform types of crops to be taken up on the farm

Question

# Q&A

Answer

***Answer 3 -- jkantharaj:*** Mr. Senkumar, Kindly send your mail address, for me to send " Organic Cultivation advise " for your farm, at Pudhukkottai. I am also a Tamilian, & residing in Bangalore.

## 08 ALTERNATE CROPS IN WATER SENSITIVE AREAS

***prasna:*** *Good morning! I would like to know what crop I can grow within a coconut farm, that doesn't affect coconut productivity. Also, the area is slightly water scarce during summers.*

***Answer 1 -- achaldate:*** You can grow black pepper, and / or intercrop with crops like papaya, drumstick, Normally coconut trees are planted with about 15 to 20 feet apart depending on the species. If you have such spacing between your plants, you can do multiple activities such as fish farming, etc. If you need any help, you can write.

*prasna:Thank you for getting back. Fish farming won't be suitable here as I've mentioned in my post about water scarcity during the summer months.*

## 09 ESSENTIAL OIL PRODUCTION

**makbalar:***I aspire to set up manufacturing plant of essential oils in Gujarat and supply it to Aroma, pharma and cosmetic industry in bulk. Can anyone guide me with its manufacturing and marketing process?*

***Answer 1 - brij07 :*** Hello Sir, I can help you with your query. I have 9+ years of experience in FMCG, Agri-Business, Food Processing Industry. I can help you not only with the manufacturing but also the complete establishment of your business. Contact me .

***Answer 2 - avantagro :*** 1) Frist step the products you wish to make Essential oil
2) you should have a distillation Plant , Packing unit etc
3) Depend on products we can assist you in marketing

***Answer 3 - regina :*** Please contact .

***Answer 4 - dhayaagrowers :*** One of my client is interested in making perfumes from fiji Islands I can join him in your project

***Answer 5 - garao56:*** Please consult us for project reports

***Answer 6 - warsha19 :*** I am sure I can be of a good use to you in essential oils ground.

***Answer 7 - garao56:*** Apart from traditional distillation processes, the following are the modern distillation methods for extraction of essential oils.

Modern (Non-traditional) Methods of Extraction of Essential Oils Traditional methods of extraction of essential oils have been discussed and these are the methods most widely used on commercial scale. However, with technological advancement, new techniques have been developed which may not necessarily be widely used for commercial production of essential oils but are considered valuable in certain situations, such as the production of costly essential oils in a natural state without any alteration of their thermosensitive components or the extraction of essential oils for micro-analysis. These techniques are as follows:

- Headspace trapping techniques
- Static headspace technique
- Vacuum headspace technique
- Dynamic headspace technique
- Solid phase micro-extraction (SPME)
- Supercritical fluid extraction (SFE)
- Phytosol (phytol) extraction
- Protoplast technique
- Simultaneous distillation extraction (SDE)
- Microwave distillation
- Controlled instantaneous decomposition (CID)
- Thermomicrodistillation
- Microdistillation
- Molecular spinning band distillation
- Membrane extraction

***Answer 8 - empero :*** I am manufacturers of essential oil plant cost Rs5.75 lacs capacity-100 ltrs.I will provide you indenting agent to sell your entire products in bulk.

## CUMIN PROCESSING UNIT

***javeduk:****How I start Cumin Processing Unit in Gujarat? What type of machinery required?*

***Answer 1 -- shahatul :*** Please feel free to discuss further
atul shah

***Answer 2 - garao56 :*** Cumin is an essential spice used by human beings from time immemorial.
The peppery flavors of Cumin add to its value as a culinary spice as well as its function for helping ease digestive complaints.
The property of this flavor known as a carminative is to help dispel gas from the digestive tract.
There are some studies almost exclusively done in vitro, indicating some promise for the essential oil extract of Cumin seeds as an antibacterial agent
The processing involves 1. Cleaning for whole cumin used as spice, seed purpose etc
2. Cumin Powder
3. Cumin oil
What type processing you going to take up so that necessary machinery can be procured for setting of the processing unit .

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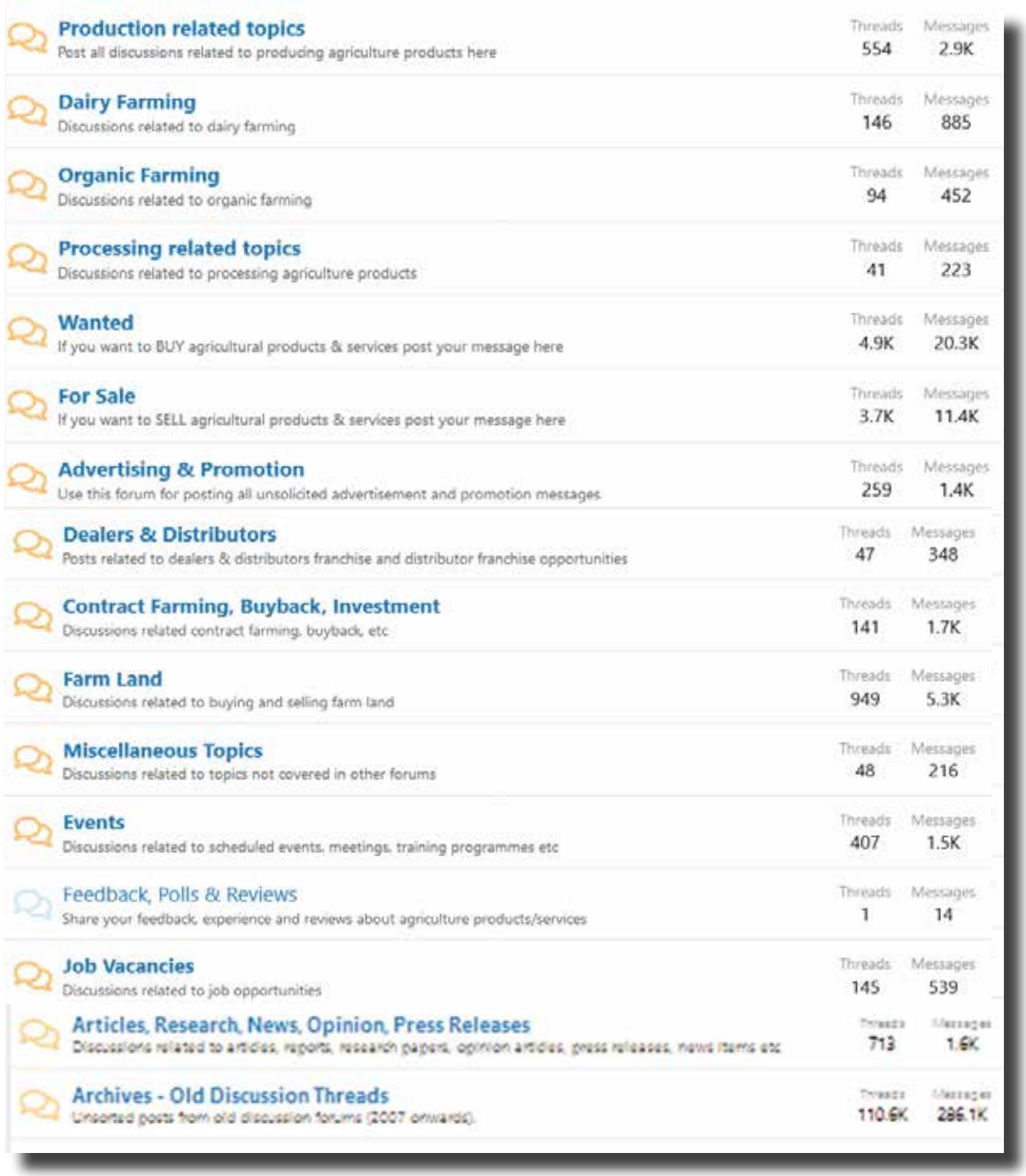

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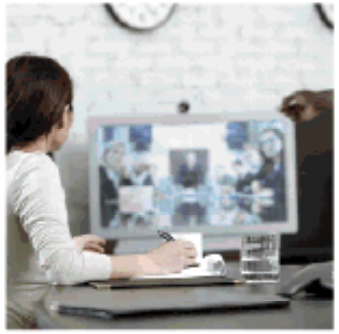

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