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A Resonance in Agriculture

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AGRI STARTUPS FEATURED ON SHARK TANK

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From the Editor's Desk

Dear Readers,

India is one of the emerging countries in the world from a business perspective. In this context, the agriculture sector, often considered the soul of India, is witnessing the rise of cutting-edge startups that are playing a crucial role in transforming both the direction and condition of agriculture and the lives of farmers. As the startup ecosystem develops, several funding sources have also emerged, one of the most prominent being Shark Tank India.

Dear readers, in this edition of Times of Agriculture Magazine, we have featured agri-startups that have secured funding through Shark Tank India. This issue also provides valuable insights into the success stories and operational models of various agricultural startups, offering you a comprehensive understanding of the prospects of Indian agriculture.

As you all know, the Government of India is implementing several programs focused on entrepreneurship and enterprise development. Through these initiatives, individuals can launch agriculture-related startups based on their ideas and establish a national or even international identity. Notable agri-startups like BharatAgri, Fasal, DeHaat, Ninjacart, and CropIn have already made significant contributions and established their presence across the country as pioneering ventures.

With the support of such startups, we can collectively strengthen India's agricultural framework. These ventures not only help increase production levels but also minimize post-harvest losses, thereby contributing to a significant rise in farmers' incomes.

So, let us read this issue of Times of Agriculture Magazine attentively, just like every previous edition, expand our knowledge, and don't forget to share your valuable feedback with us.

Thank you very much, and enjoy reading!

Editor-In-Chief

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AGRICULTURE UPDATES

India Launches Genome-Edited Rice Varieties 'Kamala' and 'Pusa DST Rice 1' to Boost Yields and Tackle Climate Stress

In a significant breakthrough for Indian agriculture and a global first, India has officially released two genome-edited rice varieties—'Kamala' (DRR Dhan-100) and 'Pusa DST Rice 1'—aimed at boosting crop yields by up to 30% and reducing maturation time by 15 to 20 days. The announcement was made by Union Agriculture Minister Shivraj Singh Chouhan.

Developed by ICAR scientists using advanced CRISPR-Cas technology, these new varieties promise enhanced yield, water efficiency, and greater resilience to climate stresses, marking a new chapter in sustainable farming practices.

Key Features of the New Varieties:

- **'Kamala' (DRR Dhan-100)** targets the *Gn1a* gene, which plays a crucial role in increasing grain yield. It showed a 19% yield increase over its parent variety Samba Mahsuri, reaching an average of 5.37 tonnes per hectare while retaining the fine grain quality preferred by consumers.
- **'Pusa DST Rice 1'** enhances drought and salt tolerance, making it suitable for cultivation in adverse environmental conditions. It achieved 9–30% higher yields depending on soil conditions during rigorous field trials conducted in 2023 and 2024.

The varieties were developed by genome editing two popular Indian rice types: Samba Mahsuri (BPT5204), known for fine grain quality but limited resilience and long maturation, and MTU1010 (Cottondora Sannalu), which matures early but is sensitive to climate stresses. Genome editing retained their strengths while improving yield and stress tolerance.

Unlike genetically modified (GM) crops, gene-edited plants do not contain foreign genes. This difference has made gene-edited crops more acceptable and allowed India to exempt SDN1 and SDN2 gene-edited plants from stringent GM regulations, expediting their development and deployment. The genome-edited varieties are now classified as equivalent to conventionally bred crops, facilitating faster approvals and wider adoption.

India Launches 5th Marine Fisheries Census

The 5th Marine Fisheries Census (MFC) began on April 28, 2025, aiming to document every marine fisher family, fisher village, fishing craft, gear, and associated infrastructure across India's coastal states and Union Territories. Covering approximately 1.2 million fisher households in around 3,500 fishing villages, the census is a crucial effort to gather comprehensive data on marine fishing communities.

A landmark feature of this census is its digital transformation. For the first time, data collection will be conducted through a geo-referenced, app-based system enabling real-time validation. The Indian Council of Agricultural Research-Central Marine Fisheries Research Institute (ICAR-CMFRI), the nodal agency implementing the census, developed the mobile application called **'VyAS-NAV'**. This app allows supervisors to verify data directly from fishing villages, landing centres, and fishing harbours, enhancing the accuracy, efficiency, and transparency of the census.

The Union Ministry of Fisheries, Animal Husbandry & Dairying officially launched the census and the VyAS-NAV app at the Coastal State Fisheries Meet 2025 held in Mumbai. The census will record detailed information, including demographic profiles, socio-economic conditions, fishing practices, and access to government schemes. This is the fifth such exercise conducted every five years since 2005, with the previous census in 2016 documenting 3,477 fishing villages across 13 coastal states and Union Territories.

Alongside the census, the government has introduced India's first **aquaculture insurance scheme** under the **Pradhan Mantri Matsya Kisan Samridhi Sah-Yojana (PM-MKSSY)**. This scheme provides financial protection to marginalized aquafarmers through two types of insurance coverage—basic and comprehensive. Together, the digital census and insurance scheme reflect the government's commitment to strengthening the fisheries sector through data-driven planning and social security.

‘Viksit Krishi Sankalp Abhiyan’ to Empower Over 1 Crore Farmers Across India

The Government of India is launching a nationwide agricultural campaign titled ‘Viksit Krishi Sankalp Abhiyan’, scheduled to run from May 29 to June 12, 2025. Timed to coincide with the kharif sowing season, the initiative aims to educate and assist **1 to 1.5 crore farmers** across **700 districts** in the country.

The campaign’s primary objective is to raise awareness among farmers about modern agricultural technologies, including new seed varieties, to enhance the productivity and production of major crops. The programme plans to reach farmers directly through a series of interactive meetings and educational sessions.

A total of **2,000 teams**—comprising **farm scientists, government officials, and progressive farmers**—will be formed to spearhead the initiative. Each team is expected to conduct **three meetings per day** at the district level, targeting outreach to **10 to 12 lakh farmers daily** during the campaign period.

The campaign will cover several key areas, including:

- Climate-resilient seed varieties
- Fertilizer availability
- Monsoon forecasts
- Awareness of government schemes

A strong emphasis will be placed on the practical application of agricultural research and technologies to improve farm outcomes.

To further safeguard farmers' interests, the government is also considering amendments to the Seeds Act of 1966. These proposed changes aim to curb the sale of spurious seeds and ensure farmers' access to quality and certified seeds. In addition, the campaign will promote seed traceability to improve accountability within the supply chain. This initiative reflects a significant step toward building a self-reliant and technologically advanced agricultural sector in India.

India's First Biochar Centre of Excellence Launched to Boost Rural Entrepreneurship

On May 5, 2025, Shri Nitin Gadkari, Minister of Road Transport and Highways, inaugurated the **Biochar Centre of Excellence for Promoting Rural Entrepreneurship** at Kanha Shanti Vanam, the headquarters of the Heartfulness Institute located on the outskirts of Hyderabad. Kanha Shanti Vanam is renowned for housing the world's largest meditation centre, making it a fitting venue for this groundbreaking initiative. The event was also attended by Shri Kamesh Patel (Daaji), President, Founder & Guide of the Heartfulness Institute, and Shri Nath Parameshwaran, Senior Director at PayPal, marking a significant collaboration between the spiritual organization and the global fintech giant to promote sustainable rural development.

The Centre of Excellence has been established with a clear focus on empowering rural entrepreneurs, especially women and youth, by providing them with the skills and knowledge necessary to produce and market biochar. Biochar, a carbon-rich product derived from biomass, is known for its ability to enhance soil fertility, improve crop productivity, and aid forest regeneration. Through hands-on training and comprehensive exposure to the entire biochar production process, participants will learn not only the technical aspects but also the commercial potential of biochar. The initiative aims to create a scalable rural business model where these entrepreneurs can supply biochar to local farmers, driving sustainable agriculture and economic growth at the grassroots level.

Beyond skill development, the Biochar Centre represents a visionary approach to tackling environmental and economic challenges simultaneously. By encouraging the widespread adoption of biochar as a carbon-sequestering agent, the initiative supports India's efforts towards climate resilience and afforestation. It aspires to establish biochar units in villages across the country, helping to improve soil health, increase agricultural resilience, and generate livelihoods in rural areas. This innovative model is set to transform the agriculture sector by making it more sustainable and profitable, while also creating new avenues for rural entrepreneurship, contributing to India's broader goals of green growth and inclusive development.

Centre Hikes Rice Allocation for Ethanol Production to 52 Lakh Tonnes

The Central Government has approved an additional **28 lakh tonnes of rice for ethanol** production over the earlier allocation of 24 lakh tonnes, bringing the total allocation to **52 lakh tonnes for the Ethanol Supply Year (ESY) 2024–25**, which started in November 2024. The rice is being issued at a fixed price of ₹22.50 per kg, despite the estimated economic cost of rice being ₹41.73 per kg for 2025–26. This decision aims to support the government's ambitious Ethanol Blended Petrol (EBP) programme, designed to increase ethanol production and promote cleaner fuel alternatives. However, while the Food Corporation of India (FCI) has allocated the entire 24 lakh tonnes of rice to distilleries, ethanol producers have so far lifted less than 10 lakh tonnes.

Based on a conversion rate of 470 litres of ethanol per tonne of rice, the 52 lakh tonne allocation could produce nearly 245 crore litres of ethanol. This increased supply is expected to help India meet and potentially exceed its ethanol blending targets of 18% for the current ESY (ending October 31, 2025) and 20% for ESY 2025–26. The government estimates a subsidy of nearly ₹10,000 crore on this allocation, as the subsidy per kg of rice stands at ₹19.23, reflecting the difference between the fixed issue price and the economic cost. Distilleries are expected to pay ₹11,700 crore to the FCI for lifting the entire rice quota and generate approximately ₹14,300 crore in revenue by selling ethanol to oil marketing companies at the fixed price of ₹58.50 per litre.

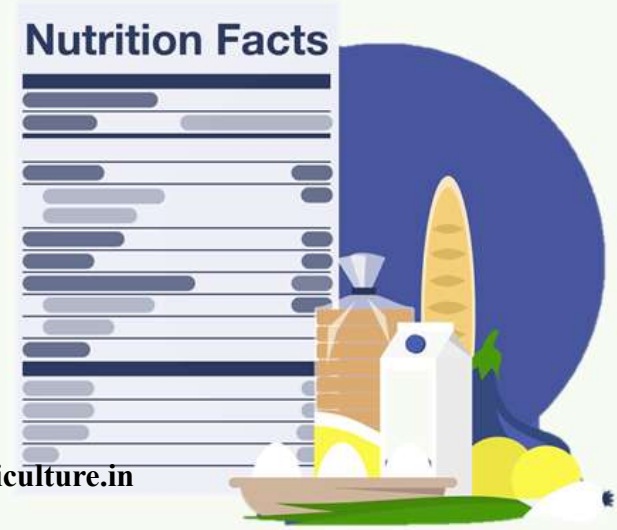
In an official memorandum issued last week, the Food Minister confirmed the competent authority's **approval of rice allocation to distilleries at the fixed price of ₹22.50 per kg for a total of 52 lakh tonnes during ESY 2024–25.** This move was taken after assessing the availability of feed stocks and the government's goal to boost domestic ethanol production. With blending rates already exceeding 18.5% between November 2024 and April 2025, the enhanced rice allocation is a strategic step toward reducing India's dependence on imported fossil fuels while supporting rural economies and sustainable energy goals.

FSSAI Empowers Consumers to Report Misleading Food Labels via App

In a major step towards enhancing food transparency and consumer empowerment, the **Food Safety and Standards Authority of India (FSSAI)** has introduced a **new feature in its digital platforms** that enables consumers to **report false or misleading claims on packaged food labels**. This feature is now integrated into the **Food Safety Connect mobile app** and the **Food Safety Compliance System (FoSCoS)** portal, making it easier for citizens to alert authorities to any violations observed on food packaging.

With this update, consumers can now upload clear images of the front and back of food packages, highlighting misleading claims, ingredient lists, and nutritional details. They can also submit vital product information such as the brand owner's name, FSSAI license or registration number, and e-commerce links, if the product is available online. Additionally, users may upload up to three extra supporting images to strengthen their complaint. This feature aims to help regulatory bodies respond more swiftly and accurately to non-compliant food businesses through evidence-based action.

This initiative aligns with FSSAI's broader objective to promote **truthful food labelling**, **strengthen food safety enforcement**, and **protect consumer rights**. Launched in October 2021, the Food Safety Connect app initially supported small vendors, hawkers, and startups with FSSAI registration, licensing guidance, and food safety compliance. Over time, it evolved into a consumer-friendly platform offering features like license verification, grievance redressal, and now, label reporting. The new tool marks a significant milestone in making food businesses more accountable while enabling consumers to play an active role in ensuring food safety across India.



Punjab Offers 33% Subsidy on PAU-Recommended Bt Cotton Seeds

In a decisive push toward crop diversification, the Punjab government has rolled out a **₹20-crore subsidy scheme that will reimburse 33 % of the cost of Bt cotton hybrid seeds** recommended by **Punjab Agricultural University (PAU), Ludhiana.** Announcing the initiative, Agriculture Minister Gurmeet Singh Khuddian said the goal is to ease the financial burden on growers, discourage the purchase of unapproved varieties, and **reclaim up to 1.25 lakh hectares for cotton in 2025's kharif season**. By expanding access to high-yielding, pest-resistant hybrids, the administration hopes to steer farmers away from water-intensive paddy and toward a crop that is both profitable and more sustainable for Punjab's semi-arid southwest.

Cotton already anchors the rural economy of districts such as Bathinda, Mansa, Muktsar, and Fazilka, yet acreage has slipped in recent years under the twin pressures of whitefly outbreaks and the assured procurement enjoyed by rice. Minister Khuddian framed the new subsidy as part of a broader revival strategy: improved varietal purity, timely extension advice, and targeted price support are all intended to restore cotton's competitiveness and bolster farm incomes. He urged cultivators to "make environmentally sound choices" by selecting PAU-recommended Bt hybrids, noting that these lines combine superior yields with in-built resistance to bollworm complexes, thereby cutting pesticide bills and boosting net returns.

The scheme's operating rules cap each beneficiary at ten 475-gram seed packets—enough for roughly five acres—to ensure equitable distribution. Administrative secretary Dr. Basant Garg added that the Agriculture Department has ordered seed dealers to furnish original GST invoices and tasked field officers with random checks to block the influx of counterfeit seed from neighboring states. By pairing financial assistance with stricter market surveillance, the government aims to protect farmers from fraud, underpin stable cotton productivity, and advance Punjab's larger mission of water conservation, agro-ecological balance, and farmer prosperity.

COVER STORY

AGRI STARTUPS FEATURED ON SHARK TANK INDIA

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The biggest risk is not taking any risk. In a world that's changing really quickly, the only strategy that is guaranteed to fail is not taking risks.", this statement was said by Mark Zuckerberg in the context of entrepreneurs who are willing to pull out all the stops.

This era is all about entrepreneurs and their innovative ideas, and entrepreneurship is about their risk-taking abilities. But the subtle game of entrepreneurship is not limited to profit-making; it has expanded its path towards societal benefits and sustainability. To fuel such aspiring entrepreneurs in India, the first season of the legendary TV show, 'Shark Tank' was aired in December 2021 by Sony Entertainment Television (SET). The panel of 'Sharks' included well-known entrepreneurs and investors of the country. It was a major hit due to the insightful thought-sharing process, youth engagement, and incredible learning.

When businesses across various sectors are thriving, how can we overlook the rise of agripreneurs?

Agri-startups in India are crucial for enhancing productivity, sustainability, and farmer welfare. They bring innovation, reduce post-harvest losses, improve supply chains, and promote eco-friendly practices. With challenges like climate change, fragmented markets, and low farmer incomes, agri-tech solutions can boost efficiency, ensure fair pricing, and empower rural economies. Here, I will introduce you to the Agri-startups featured in Shark Tank India, who have earned fame and stolen great deals from the sharks to date.

Agri Startups Featured in Shark Tank.

From 2021 to 2025 there are multiple Agri Startups who tried to lock the deals with Sharks. Some of those got featured and a few gained huge attention from the audience. The struggle with agri startups is real, where positive results take time and customer trust is hard to earn, amidst the challenges these startups set an example and taught the important tactics of the right business.

1-Meatyour

MEATYOUR, a startup selling odorless, free-range eggs, appeared on Shark Tank India in episode 10, Season 1, and secured a deal with Sharks Aman Gupta, Anupam Mittal, and Peyush Bansal. Saisharan Gandhi and Arnav Gandhi are the founders of this unique startup, which is known for its "100% Happy Egg Farming Concept", where chickens are left to freely move and feed properly. This **method is ethical, and the product is more nutritious**. Initially, they pitched ₹30 Lakhs for 5% Equity at a valuation of ₹6 crores. At first, the Sharks were skeptical about the startup being profitable and demanded a co-founder and merging of B2C and B2B services. Finally, Anupam Mittal and Aman Gupta closed the deal for ₹30 lakh for 20% equity.

Although many businesses got explicit opportunities through the show, not all of them were sustained. Unfortunately, MEATYOUR business went out in 2023, and their social media has been inactive since then.

2-KG Agrotech

Kamlesh Nanasaheb Ghumare, the founder of KG Agrotech has become a social media sensation by the name 'Kamlesh Jugadu' after getting featured in Shark Tank. Being the son of a farmer he was well aware of the **arduous task of harmful pesticide spray in the field by carrying the tank on the back**. So, he designed a multipurpose bicycle for pesticidal spray, luggage carrying, and seeding. His idea was humanitarian and inspiring, but sharks expressed their concerns regarding valuation, scalability, product differentiation, and market size in this business.

Initially, he asked for ₹30 lakhs for 10% Equity but ended with a deal of ₹10 lakhs for 40% Equity & ₹20 lakhs Debt with 0% interest, offered by Peyush Bansal. He accepted the offer under the Shark's mentorship, and today, KG Agrotech's net worth has soared to around Rs 1 crore as of 2023; his startup is flourishing and getting lots of love from aspiring youth.

3-Brainwired

The Agri-Startup, also known by the name WeStock, Introduces IoT-based livestock health monitoring and tracking systems to assist farmers in managing their livestock effectively. It helped in providing job opportunities in the IT sector, livestock stores, etc. The company pitched ₹75 Lakh for 10%, to which Sharks countered by ₹60 Lakh for 10%,; the company agreed to it and profited well afterward

The company was founded by Sreeshankar S Nair and Romeo P Jerard, who wanted to develop a solution to help their grandparents with their dairy farm and realized the **importance of modern agricultural practices in the livestock sector**. Later, they confessed that featuring in Shark Tank was their marketing strategy to attract customers, just after the show, they got 1.5 lakh more customers on their website.

4-Humpy A2

Humpy A2 offers organic milk products, focusing on A2 protein-rich milk from indigenous cow breeds. In addition to milk, they also provide a range of organic products, including cold-pressed oils, honey, dals, flours, masalas, spices, rice, and millet. Their milk quality qualifies for the 120 parameters of organic milk certification. The startup has made a huge step towards conserving local breeds with a humanitarian mindset.

Vishal Chaudhari, Malvika Gaekwad, and Jaywant Patil are the founders of this Agri-Startup. Initially, they pitched for ₹75 lakhs for 4% equity, but the sharks settled the deal with ₹1 Crore for 15% Equity. Currently, they have more than 4,000 regular customers, but they only provide services in Pune.

5- Better Nutrition

The founder couple of Greenday and Better Nutrition, Prateek and Aishwarya were one of the best entrepreneurs on the show. Prateek is an MBA graduate from IIM Ahmedabad. He married Aishwarya through Shadi.com and convinced her to live in a village for two years, where they closely observed the agriculture sector and produced nutrient-rich grain. **Their incomparable bond and dedication towards sustainability l**ed to a revenue generation from 18 lakhs to 14 crores in a year.

Before featuring in Shark Tank in Season 4, they already had Olympic gold medalist, 'PV Sindhu', as their brand ambassador and Masterchef Pankaj Bhadouria as their adorner. The entrepreneurs agreed to the deal to receive ₹60 lakhs from Namita Thapar for 1% equity and 0.5% royalty until the investment was returned. They eventually gained a lot of attention from other brands, too, their teamwork was an inspiration to every entrepreneur out there who is struggling to find the best investors for their business.

6-RBD Machine Tools

RBD Machine Tools, an agri-machinery startup founded by brothers Devendra and Bhupendra Tailor, aims to empower farmers with innovative and affordable tools. They pitched for ₹1 crore at a ₹100 crore valuation and made a deal with

Namita Thapar and Ritesh Agarwal offering ₹50 lakh for 1% equity and ₹50 lakh as debt at 9% interest, even after showing concerns regarding the certification of equipment. They have seen impressive growth, generating ₹14.37 crore in sales for FY 2023-24.

The brothers highlighted their **success in marketing their products through social media,** including viral YouTube videos and free PAN India Delivery. Their motto is "**Ab bachega kisan ka samay aur paisa dono**" (Saving farmers' time and money). The founder, Devender Kumar, has tattooed the company logo on his left hand, indicating his undeniable passion for his business.

7-XMachines

As we are incorporating all of our tasks with AI, these days, Trivikram Kumar Dogga saw it as an opportunity to bring AI and Robotics into the Agriculture sector. XMachines, pitched their technology on Shark Tank India Season 3, **aiming to promote sustainable and affordable farming practices by automation of various agricultural tasks like seeding, weeding, spraying, and planting.**

XMachines' products are currently gaining momentum in India and attracting attention from international markets in Europe, Australia, Canada, and the USA. **The Director General of ICRISAT, Dr. Jacqueline d'Arros Hughes, congratulated all parties of XMachines on the significant milestone**; this way, it got support and recognition from this prestigious institution. While featuring on Shark Tank, their product design was compared with Tesla's cyber truck; in the end, the deal was closed by Ritesh Agarwal and Namita Thapar offering him Rs 72 lakhs for 4% equity, which was the original ask.

8-F2DF – Kisaan Ki Online Dukaan

F2DF observed the **loopholes in the agri-produce supply chain** and aimed directly to revolutionize the whole chain and developed an **online marketplace that connects farmers directly with manufacturers, eliminating middlemen and ensuring fair pricing.** F2DF was founded by Ishwar Sinhmar, Rahul Dhingra, Neeraj Kumar, and Monika Sinhmar. They pitched ₹50 lakhs For 1% equity at the valuation of ₹50 Cr in season 4. The deal was settled with Aman Gupta at the rate of ₹50 lakhs for 2% equity and another ₹45 lakhs as debt with a two-year, 10% interest rate. This way F2DF provided a whole new market to the farmers with better connectivity and provided them a chance to do business directly.

9-Naara Aaba Wine Company

Naara Aaba Wine Company produces India's first organic kiwi wine, utilizing locally grown, organic kiwis from Arunachal Pradesh. It is also the first start-up to be featured in Shark Tank from North-East India in season 2. Entrepreneur Tage Rita from Arunachal Pradesh is the founder of this wine company. He utilized the wasted kiw i fruit in Hong Village, Ziro Valley, Arunachal Pradesh, and bought more fruits from nearby villages to prepare the kiwi wine. This way he reduced the post-harvest losses of the fruit,

generated employment, and provided fair prices to the farmers.

Sharks, Vineeta Singh, and Vikas D. Nahar fixed the deal with an offer of Rs. 50 lakhs for 5% equity and Rs. 25 lakhs in loan at 10% interest, totaling Rs. 75 lakhs in finance. Today, they have broadened their selection to add other fruits like plums, wild apples, and pears.

10-GROWiT India

GROWiT India was established by brothers Akshay and Saurabh Agarwal from Gujarat, it focuses on protective farming solutions that enhance crop yield while increasing resource use efficiency. Their products, including mulch films and shade nets, help farmers decrease water usage, fertilizers, and pesticides, ultimately increasing income by 50% to 100%. They have assisted over 15,000 farmers all across the country in 2023. On Shark Tank India, they secured the deal with ₹50 lakh for 1% equity and ₹50 lakh debt at 10% interest from Namita Thapar and Peyush Bansal, valuing the company at ₹50 crore in s eason 2. Their sales have surged by 70% and they have achieved positive EBITA for the first time after appearing on Shark Tank.

11-Kiwi Kisan Window

Kiwi Kisan Window was founded by Nupur Agarwal and Abhinav Ahluwalia in Dehradun, it offers a range of organic and sustainable food products so urced directly from Indian farmers. Their product line includes pulses, pickles,

dehydrated coconut chips, and traditional Indian snacks. They are committed to quality and ethical sourcing and ensure unadulterated products to consumers. Kiwi Kisan Window operates through both in-person experiences (retail stores) and online sales (omni-channels). With the motto 'Bharat ki Khoj Khane se,' they are trying to provide authentic, traditional snacks from different parts of the country in a single place. In the future, they want to open 300 more outlets to serve their custom

12-Dorje Teas

Dorje Teas offers premium, high-quality, organic, Darjeeling teas straight from the hills of Selim Hill in Assam. The founders of Dorje Teas are Debasis Dey, Ishaan Kanoria, and Sparsh Agarwal, who started this venture in the hope of reviving this industry by serving this tea to PAN India at an affordable price. They use a subscription model to ensure that tea gardens benefit directly from their sales, rather than relying on traditional middlemen. They secured a ₹30 lakh investment for 15% equity from Anupam Mittal, Vineeta Singh, and Peyush Bansal, valuing the company at ₹2 crore and

experienced 84% revenue growth in FY24 with a profit of ₹44.37 lakh. Now they are also expanding the varieties by including camomile tea and Kashmiri Kahwa Tea. Their products are available in most of the popular online markets.

However, their journey on Shark Tank was not that smooth. They got sued by Sony Entertainment Television (SET) on copyright for using their pitch clips on their social media account. But their business is still thriving.

13-Raheja Solar Food Production.

Raheja Solar Food Production was founded by the mother-son duo Varun and Babita Raheja; this Indore-based startup offers affordable solar dehydrators that preserve farm p roduce by retaining natural colors, taste, nutrition, and fragrance for up to a year without added sugar or preservatives. Their mission is to reduce food wastage and provide financial stability to farmers. To reach out to the struggling farmers across the nation, they have partnered with Reliance Foundation and the Tata Group

On Shark Tank India, they secured a deal of ₹1.25 crore for 3.13% equity, along with 1.88% advisory equity to Kunal Bahl and additional ₹50 lakhs for 1.25% equity, plus 0.75% advisory equity to Peyush Bansal and Vineeta Singh, settling at a valuation of ₹40 crore.

Conclusion

What we have seen so far is that most of the startups have emerged after recognizing the problems and challenges in society with customer interest. And most of the problems are associated with the bottom of the societal pyramid, where the agriculture sector lies. With the development of Agri-startups, many such problems have vanished from society.

But being an entrepreneur is not easy; it takes passion, knowledge, hard work, leading abilities, a heart of risk-takers, great partners, and Genuine teammates. Through ‘ Shark Tank’ we could experience the dubious world of Startups with unlimited opportunities. However, intelligence and research are a must while negotiating with these tactful minds. These are not the only agri startups who came for a deal in this show, but their presentations and offers can teach you how to crack one.

For business enthusiasts like yourself, I hope this article would have caught your interest, read more to keep reaching out to such content.

■■■

THE ROLE OF PHOSPHATES IN THE FERTILIZER INDUSTRY AND SUSTAINABLE FARMING

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In today's world, feeding a growing global population is becoming more challenging. With shrinking farmland, unpredictable climate changes and the urgent need for healthier soils, farmers face mounting pressure to grow more food sustainably. Fertilizers play a key role in this effort by boosting crop yields and among them, phosphate fertilizers are especially important. They supply phosphorus, an essential nutrient that plants need to grow strong and healthy.

But there is growing concern about the future of phosphate. Natural sources of phosphorus are limited and unevenly distributed across the world. At the same time, using too much or applying it poorly can harm the environment by polluting waterways and damaging ecosystems. With rising food demands and increasing environmental challenges, the fertilizer industry faces a tough balancing act: finding smarter, more sustainable ways to use phosphate without sacrificing productivity.

This article explores why phosphate is crucial in farming, how it works in fertilizers, the challenges of managing it and what the future might hold for phosphate use in agriculture.

Phosphate helps plants grow

People often use the words 'phosphorus' and 'phosphate' interchangeably, they are not exactly the same. Phosphorus refers to the chemical element, while phosphate is the form plants actually take in from the soil. Plants absorb phosphorus from the soil in a form called phosphate. Inside the plant, this phosphate is turned into important compounds like ATP and ADP, which work like tiny batteries storing and carrying energy. Phosphate is also used to build DNA, cell membranes and other vital parts of the plant, helping it grow and adapt.

Farmers apply phosphate fertilizers to boost crop growth, especially in soils that lack enough natural phosphorus. But there is a catch when too much phosphate is used, or when it is not absorbed by plants, it can build up in the soil or wash into rivers and lakes. This causes a serious problem known as eutrophication, where excessive nutrients in water lead to overgrowth of algae and harm to fish and aquatic life.

The way phosphate sticks to soil (called adsorption) or gets released from it (desorption) is key. If phosphate sticks too much, plants can not access it. But if it's released too easily, it washes away and pollutes the environment.

In many Chinese farmlands, for example, the soil holds onto phosphate very tightly. As a result, only 10–25% of the fertilizer is used

by plants in one growing season. The rest gets locked up in the soil, often bound with iron, aluminum or calcium, making it harder for plants to access. This challenge highlights why understanding soil-phosphate interactions is crucial for both crop production and environmental protection.

Understanding soil's role in phosphate absorption

The availability of phosphate in soil depends on many factors. One key factor is soil pH. Phosphate is easiest for plants to absorb when the soil's pH is between 6.0 and 7.0. If the soil is too acidic, phosphate binds to aluminum or iron; if it's too alkaline, it binds to calcium either way, plants cannot use it well.

The type of soil also plays a role. Older, heavily weathered soils tend to lock up phosphate, while less weathered or organic-rich soils make it more available. Clay content matters too: soils with more clay have more surface area for phosphate to stick to, reducing availability. However, organic matter in soil can help release phosphate, making it easier for plants to absorb.

Other substances in the soil like bicarbonate, carbonate, silicate, sulfate or molybdate can compete with phosphate for space on the soil particles, limiting how much phosphate plants can take up. Climate and soil conditions such as temperature, moisture, air levels and salinity also influence how quickly phosphate becomes available from organic materials in the soil.

Phosphate from farms pollutes water

Farms are one of the main sources of phosphate pollution in rivers, lakes and ponds. When too much phosphate runs off fields, it adds excess nutrients to the water, causing algae to grow out of control and harming aquatic life. This process, called eutrophication, is worsened by fertilizers and animal manures that increase phosphate levels in the soil.

Phosphate can enter water in three main ways: through surface runoff (when rainwater washes it off fields), subsurface flow (when water moves underground) and vertical flow (when it sinks deeper into the soil). Both the properties of the soil and how water moves across the land affect how much phosphate ends up in waterways.

To reduce this pollution, farmers can adopt practices that help soil soak up water better, reducing phosphate runoff. The risk of pollution increases during heavy rains or when fertilizers with lots of water-soluble phosphate are used. Animal manures, especially poultry manure, can also contribute by leaking phosphate into the soil and water.

Challenges of low phosphate use efficiency

One of the big problems with phosphate fertilizers is their low use efficiency. Studies show that only a small portion of the phosphate applied to crops is actually absorbed and used by the plants. Much of it remains in the soil, unused.

This inefficiency has several consequences. Environmentally, the unused phosphate can leak into waterways, polluting them and harming aquatic ecosystems. Economically, it means farmers need to apply more fertilizer to get the same crop yields, increasing their costs. Over time, the buildup of phosphate in the soil can also contribute to soil degradation.

Many factors contribute to this low efficiency, including the soil's properties, how the fertilizers are applied and even the plant's genetics. Understanding and addressing these factors is key to improving fertilizer use while protecting the environment.

A future with smarter phosphate use

Looking ahead, the fertilizer industry is under pressure to make phosphate use more sustainable. Researchers are exploring ways to improve phosphate fertilizers so plants can absorb more of it, reducing waste and pollution. Some solutions include developing fertilizers that release phosphate more slowly, using soil treatments that make phosphate more available, or breeding crops that use phosphate more efficiently.

There's also growing interest in recycling phosphate from waste materials like animal manure, food waste, or wastewater. By reusing phosphate, we can reduce the pressure on natural phosphate reserves and move towards a more circular, sustainable system.

Balancing productivity and sustainability

Phosphate plays a vital role in growing the food the world needs, but its use comes with challenges. From low uptake by plants to pollution of waterways, managing phosphate requires careful balance. As the global demand for food continues to rise, the fertilizer industry and farmers must work together to use phosphate more wisely and efficiently.

Through smarter fertilizers, better soil management and recycling efforts, we can ensure that phosphate continues to support global food production, while protecting the environment for future generations.■

AGRI-WOMEN ENTREPRENEURS
REDEFINING EMPOWERMENT

About Author

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Women are the foundation of creation. From households to nation-building, they leave their mark in every sphere. While they are central to families, they also play a vital role in societal and national development. But do all women enjoy the same economic freedom and social respect? Do homemakers get the same recognition as working professionals?

Today, women largely fall into two categories—those engaged in formal employment, and those involved in household and farming work. While working women enjoy financial independence, women contributing through domestic work or agriculture often remain invisible in economic terms.

From homemaker to entrepreneur

To bring women into the mainstream, we must first acknowledge their work-both socially and economically. Nearly 65% of Indian women are engaged in agriculture and domestic chores, yet they rarely receive direct economic benefits. It's time to break the mindset that a woman's world ends at the doorstep. Even if she's involved in agriculture or household duties, her work can be transformed into entrepreneurship. Take the inspiring example of Rahibai Pokhre, who, without formal education, preserved indigenous seeds and built her own "Gene Bank"—earning the Padma Shri award. With the right guidance and resources, women can not only improve their own livelihoods but also enrich their communities.

Empowering women in agriculture

Though women play a crucial role in farming, their contributions are often overlooked. Here are some key strategies to truly empower them in agriculture:

1. Krishi Saheli programs

Trained "Krishi Sahelis" (Farm Sisters) in villages can guide female farmers on modern techniques, organic farming, and government schemes.

2. Support for Self-Help Groups

Encouraging women in areas like mushroom cultivation, beekeeping, organic farming, dairy, goatry, and fishery can make them economically independent.

3. Involvement in millets (Shree Anna)

Women can play a leading role in producing and processing millets like jowar, bajra, ragi, and kodo. Government-backed training in value addition and marketing can

open doors to the food processing industry. These climate-resilient, nutritious crops are a gateway to new opportunities.

4. Promoting Agri-innovation & startups

Women must be connected to modern technologies like hydroponics, aquaponics, and aeroponics, and benefit from schemes like Startup India and Skill India.

5. Single window platforms

Provide agricultural information, subsidies, and market linkages in one place to make access easier for women.

6. Women-centric training

Organize exclusive training through Krishi Vigyan Kendras (KVKs) and agricultural universities to teach advanced techniques.

7. Tech integration

Introduce women to drones, smart irrigation, and millet-processing machines to enhance productivity.

8. Cooperatives & financial aid

Establish women-only cooperatives and link them with schemes like MUDRA, NABARD, and crop insurance programs.

9. Food processing & value addition

Train women to create millet-based products like cookies, flakes, powders, and instant mixes helping them tap into agri-industries.

10. Official recognition as farmers

Legal recognition of women as 'farmers' is crucial to ensure their access to loans, subsidies, and government benefits.

The road to self-reliance

To build a developed India, every village and every woman must be empowered. True empowerment happens when a woman sees her hard-earned income as her right, not a favor.

"Only when women are empowered will society progress. Only when women are self-reliant will the nation prosper." It's time we stop merely worshipping women as goddesses and start enabling them as entrepreneurs. When every village produces a self-reliant woman, India's transformation from developing to developed will be inevitable.

■■■

Top 15 Most Profitable Farming in India

TINY HEROES: GREATER WAX

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Plastic is everywhere. We use it in bags, bottles, straws, and even our clothes. It makes life easy, but it also creates a big problem. Plastic is useful but causes serious problems when thrown away. It stays in the environment for hundreds of years, harming animals and polluting land and water. Sea creatures often eat plastic by mistake, which can kill them. On land, it clogs drains and pollutes our surroundings. Burning plastic is also harmful as it releases toxic gases. So do we really have a good solution for it..?

However, a surprising discovery has shown that a small insect, the greater wax moth (*Galleria mellonella*), may offer a natural solution to this growing problem. The saliva of wax moth larvae is capable of breaking down the most common type of plastic, polyethylene.

They identified two enzymes that can break apart the plastic's long polymers into smaller chains Greater wax moth (GWM), *Galleria mellonella* (Lepidoptera: Pyralidae), is a destructive pest of honeybee hives. They lay eggs in the bee hives; and the hatched larvae feed on beeswax.

These insects are common pests of apiaries and feed voraciously on honeycomb. Interestingly, they also voluntarily feed on polyethylene, a type of plastic commonly used in shopping bags. Because their natural diet of honeycomb is chemically similar to polyethylene, the waxworm may have evolved the necessary biochemical adaptations to degrade plastic wastes

The discovery

In 2017, researchers from the University of Cambridge made a breakthrough while studying wax worms, the larvae of the greater wax moth. These worms are typically

known for feeding on beeswax in beehives. During an experiment, scientists noticed that the larvae could chew through plastic bags made of polyethylene, leaving behind holes in just a few hours.

How it works

The wax worm's ability to degrade plastic is believed to come from enzymes in its saliva or gut, which can break the strong chemical bonds in polyethylene. A study suggested that either the larvae themselves or the bacteria in their digestive system could be responsible for this process. These enzymes effectively break the plastic down into smaller, non-toxic compounds

Scientists identified two enzymes, named Demetra and Ceres that can break down the plastic at room temperature and a neutral pH conditions that are much more practical compared to industrial recycling methods.

Why it matters

This discovery is significant because most plastics are resistant to natural degradation. If scientists can isolate and understand the enzymes used by wax worms, they could potentially develop biotechnological methods to degrade plastic waste on a large scale. This could help reduce the environmental impact of plastic and create more sustainable waste management systems. Current plastic recycling methods are expensive, energy-intensive, and not always effective. The enzymes found in wax moth larvae work at room temperature and normal pH, making them a greener and cheaper option for breaking down plastic without harming the environment.

Challenges and future potential

While the findings are promising, there is still a long way to go. Wax worms are not a practical large-scale solution by themselves-raising millions of insects just to eat plastic is not feasible. However, identifying and reproducing the plastic-degrading enzymes in labs could lead to industrial applications in the future.

Conclusion

While reducing, reusing, and recycling remain essential, nature might be offering us unexpected help. The discovery that wax moth larvae can break down plastic is a ground breaking step toward a more sustainable future. Although we can't rely on these insects alone, their enzymes could inspire new, eco-friendly technologies to manage plastic waste more effectively. With further research and innovation, this tiny pest might just help solve one of the world's largest problems.

■■■

SMART SOLUTIONS TO STOP FOOD WASTE

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Food waste is one of the world's most overlooked problems yet it's happening all around us. From uneaten meals in restaurants to spoiled fruits at home, perfectly edible food ends up in landfills every day. But here's the good news: technology is stepping in with clever, practical solutions that are easy to use and already. making a huge impact. Whether it's an app. AI, or a natural coating, some of the smartest minds are turning the tide on food waste. Let's explore four powerful innovations that are reshaping the future of food.

1. Too Good To Go- Turning leftover into lucky finds

An app that helps you buy surplus food from local shops and restaurants at low prices. You order a "surprise bag" from a nearby café or store, pick it up at the end of the day, and enjoy good food that would've been tossed out. It reduces waste, saves money and supports local businesses. Instead of throwing away unsold croissant a bakery sells them in a surprise bag for a third of the price. More people need to download the app, and more food businesses can sign up to offer leftovers instead of wasting them.

2. Winnow Solutions- Smart kitchens that learn

A smart system for commercial kitchens that uses Al to track and cut down food waste. Cameras and sensors. track what food is thrown away, analyze it, and give chefs feedback to plan better and waste less.It helps restaurants and hotels save money while being more sustainable. A hotel kitchen sees they're throwing away too much rice. They adjust their portions, saving thousands each year. More restaurants can adopt this system, and kitchens can train staff to use data to make smarter cooking choices.

3) IBM Food Trust- Trust through transparency

A blockchain system that tracks food from farm to fork. Every step of a product's journey is recorded and shared.. That means you can trace where your lettuce came from, how it was handled, and when it was delivered. It helps prevent waste by quickly identifying issues and improves trust between producers and consumers. If a batch of spinach is recalled, stores can track exactly where it went and remove only the affected products avoiding mass waste. Encourage more food companies to adopt transparent tracking systems and share data across the chain.

4. Apeel Sciences- A natural shield for freshness

A plant-based coating that keeps fruits and veggies fresh longer. Apeel is made from natural food materials and acts like a second skin to slow down spoilage by keeping moisture in and oxygen out. It reduces the amount of food that spoils before it reaches our plate.

An Apeel-coated avocado stays ripe for twice as long, giving you more time to enjoy it. Expand its use in more countries and on more types of produce, especially in places without strong cold storage systems.

Conclusion

Solving the global issue of food waste doesn't always require massive overhauls it often begins with simple. Smart solutions powered by technology. From apps that rescue meals to Al in kitchens and invisible coatings that keep produce fresh, these innovations are quietly but. Powerfully transforming the way we handle food. They prove that change is not only possible it's already underway. The next step Is in our hands. Whether you're a consumer, a business owner, or just someone who cares about the planet, you can be part of the solution. Download an app, support foodsaving tech, spread awareness, and make conscious choices every day. Because when we waste less, we feed more, save resources, and build a future where food nourishes people not landfills. Together, smart choices can create a smarter, more sustainable world.■

Previous Issues

Website Statistics (April 2025)

183K	63K	3.3M
Monthly Pageview	Monthly Visitor	Monthly Impression

Social Stats

6.5K	5.7K	9K	1.7K	2K

THE MANTRAS FOR PROFITABLE AND SUSTAINABLE START-UP

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In the era of competitiveness, keeping a nation economically developed, well infrastructure, investment hub food, and nutritional security of million plates is challenging. The practice of a conventional form of business strategy will not work anymore. In the dynamic landscape of modern business, startups stand out as vibrant hubs of innovation and entrepreneurship, playing a pivotal role in shaping economies and societies worldwide. Over the past decade, India has become the third-largest startup ecosystem globally, fostering innovation, creating jobs, and boosting economic growth. Government initiatives like Startup India and Make in India have further accelerated the rise of startups, making them key drivers of the nation's progress. As of December 2023, India is home to a total of 112 unicorns with a total valuation of ~ INR 30L Cr. Whereas, there are more than 150 million Startups worldwide, of which a maximum are in the United States (77,927 startups). 1,361 startups globally hold the unicorn badge. The United State has 645+ and China has 302+ Unicorns.

Maharashtra has the highest number of startups followed by Karnataka, Delhi, and Uttar Pradesh. However, the North Eastern states of India are the least recognized start-ups.

Importance of Start-up

Engines of economic growth:

Startups contribute significantly to India's Gross Domestic Product (GDP) by introducing innovative business models and creating new markets. They attract foreign direct investment (FDI), leading to economic expansion. Sectors like fin-tech, e-commerce, health tech, and edtech have witnessed exponential growth, increasing India's global economic footprint.

Employment generation:

Startups generate millions of jobs across various sectors. Unlike traditional industries, they offer diverse job roles, including flexible work opportunities for freelancers and gig workers. With India having one of the largest youth populations, startups play a crucial role in reducing unemployment and enhancing workforce skills.

Table 1.1: Recognized startups under Startup India

Highest		Lowest	
Maharashtra	8353	Meghalaya	9
Karnataka	5999	Arunachal Pradesh	4
Delhi	5587	Mizoram	4
Uttar Pradesh	3880	Sikkim	4
Gujarat	2622	Ladakh (UT)	1

Innovation and technological advancement:

Startups drive technological innovations in areas such as artificial intelligence (AI), blockchain, machine learning, and digital payments. Many Indian startups have developed disruptive technologies that enhance business efficiency and improve everyday life. For instance, fintech startups like PhonePe and Paytm have transformed the digital payment landscape.

Strengthening MSMEs and local businesses:

Startups often collaborate with micro, small, and medium enterprises (MSMEs) to provide digital solutions, financial support, and market expansion strategies. E-commerce startups like Meesho have empowered small businesses by giving them access to online marketplaces, increasing their reach and profitability.

Social impact and sustainable development:

Many startups focus on solving social and environmental challenges, such as clean energy, affordable healthcare, and financial inclusion. Companies like Ather Energy (electric vehicles) and Practo (health-tech) are addressing critical issues while promoting sustainable development.

In spite of this fact, Indian startups are facing challenging times, with 2,404 of them shutting down in the Financial Year 2022 alone, according to data from Tracxn Technology Limited. Even in terms of funding received in 2023 was 5-year lowest with only $7 billion in 2023, down 73% from 2022. According to a study conducted by IBM Institute for Business Value– 91% of startups fail within the first five years. Some of the reasons are listed below:

Figure 1: Social Impact

- **Lack of financing or investors:**

47 percent of the start-ups shut down in 2022 due to limited financial resources, making it challenging to hire talent, invest in technology, or scale operations. Eg. TaxiForSure was a competitor of Ola and Uber could not raise funding and was ultimately acquired by Ola. HotelsAroundYou weren‟t capable of raising more money and had to shut down.

- **Lack of innovation:**

Innovation is the most important factor in deciding the success or failure of Indian startups. Most startups failing in India lack an adequate level of innovation and over-dependence on foreign countries like China for manufacturing as well as copy-paste the existing one. Eg. PepperTap startup failed because of poor innovation. Poor IPR Between 2016-17 and 2022-23, only 11% of the total patent applications filed by startups were granted.

- **Broken business model:**

Well business model as well as backup plan is key for a successful start-up. Around 17% of startups fail due to a lack of a clear business model. Eg. Zoomo was a Bengaluru-based startup that wanted to build a trusted marketplace for used cars in India. The buy-and-sell vehicle market was relatively young in India and therefore startup failed.

- **Market competition:**

Seven percent of startups face intense competition from both established companies and other startups. Eg. Dazo, a food tech startup failed due to competition.

- **User-Friendly Product Development and Diversification:**

Developing a viable product or service that meets customer needs and stands out in the market can be challenging. SchoolGennie failed due to a product-market misfit.

- **Disharmony among team members/investors:**

Disagreements, lack of alignment, or interpersonal conflicts can hinder progress and morale, making it essential to cultivate a positive and collaborative culture. According to Noam Wasserman, author of The Founder's Dilemmas, 65% of startups fail because of founder conflict.

- **Poor marketing and pricing:**

12 percent of start-ups failed due to poor marketing and customer un-friendly product pricing. The customer wants delivery on time, and quality of the product at an affordable price. However, most of the start-ups failed to provide and satisfy the customer's needs.

- **Uncertain regulatory environment:**

Startups often operate in industries that are subject to complex and evolving regulations. Navigating this regulatory landscape can be challenging and costly, requiring legal expertise and compliance efforts. According to PRS, 42

ministries/departments/bodies are overseeing the implementation of various schemes and initiatives related to startups. There are as many as 1,536 laws that directly or indirectly govern doing business in India leading to issues of Regulatory Cholesterol.

Mantras for viable and sustainable start-up

There is no foolproof methodology or technique that claims 100 percent success after adopting the mantras, but from the case studies, it is evident that 90 percent of the start-ups excel in their production, increase market value, minimize risk, and make profit-oriented and sustainable ventures. The success mantras are as follows;

Mantra 1; Bootstrapping/Self-financing:

Bootstrapping a startup means growing the business with little or no venture capital or outside investment. It means relying on your savings and revenue to operate and expand. Nagavara Ramarao Narayana Murthy, age 78, is an Indian entrepreneur who co-founded IT giant Infosys (INFY) with an initial investment of 10,000 rupees or about $250.

Mantra 2: Borrow from friends & family:

This is also a commonly utilized channel of funding by entrepreneurs still in the early stages. For example, Mahindra began as a steel trading company, Mahindra & Mohammed, in 1945 by brothers JC and KC Mahindra, along with Malik Ghulam Muhammad. They initially traded steel with the US and UK during World War II. The company was renamed Mahindra & Mahindra in 1947 after Ghulam Muhammad's departure. In 1947, they started assembling Willys Jeeps, which was a significant milestone.

Mantra 3; Innovative business idea generation for grants support:

This is the prize money/ grants/ financial benefits that are provided by institutes or organizations that conduct business plan competitions and challenges. Even though the quantum of money is not generally large, it is usually enough at the idea stage. E.g. SharkTank.

Mantra 4; Incubation:

Aspiring entrepreneurs must be incubated under some Incubators are organizations set up with the specific goal of assisting entrepreneurs with building and launching their startups. Incubators also provide a lot of value-added services (office space, utilities, admin & legal assistance, etc.) along with grants/debt/equity investments. E.g. Atal Incubation Centre**.**

Mantra 5: Approach for government-sponsored loan schemes:

The government has initiated a few loan schemes to provide collateral-free debt to aspiring entrepreneurs and help them gain access to low-cost capital such as the Startup India Seed Fund Scheme, SIDBI Fund of Funds, PM-FME, AgriSure, PMEGP, etc.

Mantra 6: Market fit product development:

Product diversification based on the affordability of the customer without compromising quality is a master stroke for a successful enterprise. However, most of the new enterprises failed to satisfy the needs of the customers and faced challenges to survive.

Mantra 7; Dynamic team member:

A versatile team member is the nerve of any start-up**.** If the team members diversified, more risk-bearing ability, decision-making, technology integration, and financial security led to a successful enterprise.

Mantra 8; Market Research:

Continuous research on market trends, the needs of the customer, and government policies are required to grow with time and always remain in the market. E.g. Nokia, once a dominant brand in the mobile phone market, struggled to adapt as smartphones became more popular and ultimately lost market share to competitors such as Apple and Samsung.

Conclusion

India's massive population presents a significant market opportunity for startups. Nearly 70% of India's GDP is driven by domestic private consumption. The country remains the world's sixth-largest consumer market. India has educated youth labour force, advanced science and technology such as artificial intelligence, block-chain, machine learning, cloud computing and government supports through various schemes makes climate setting for entrepreneurship development. The aspiring entrepreneurs or newly formed enterprises must follows these mantra's as mentioned above for profitable and sustainable business.

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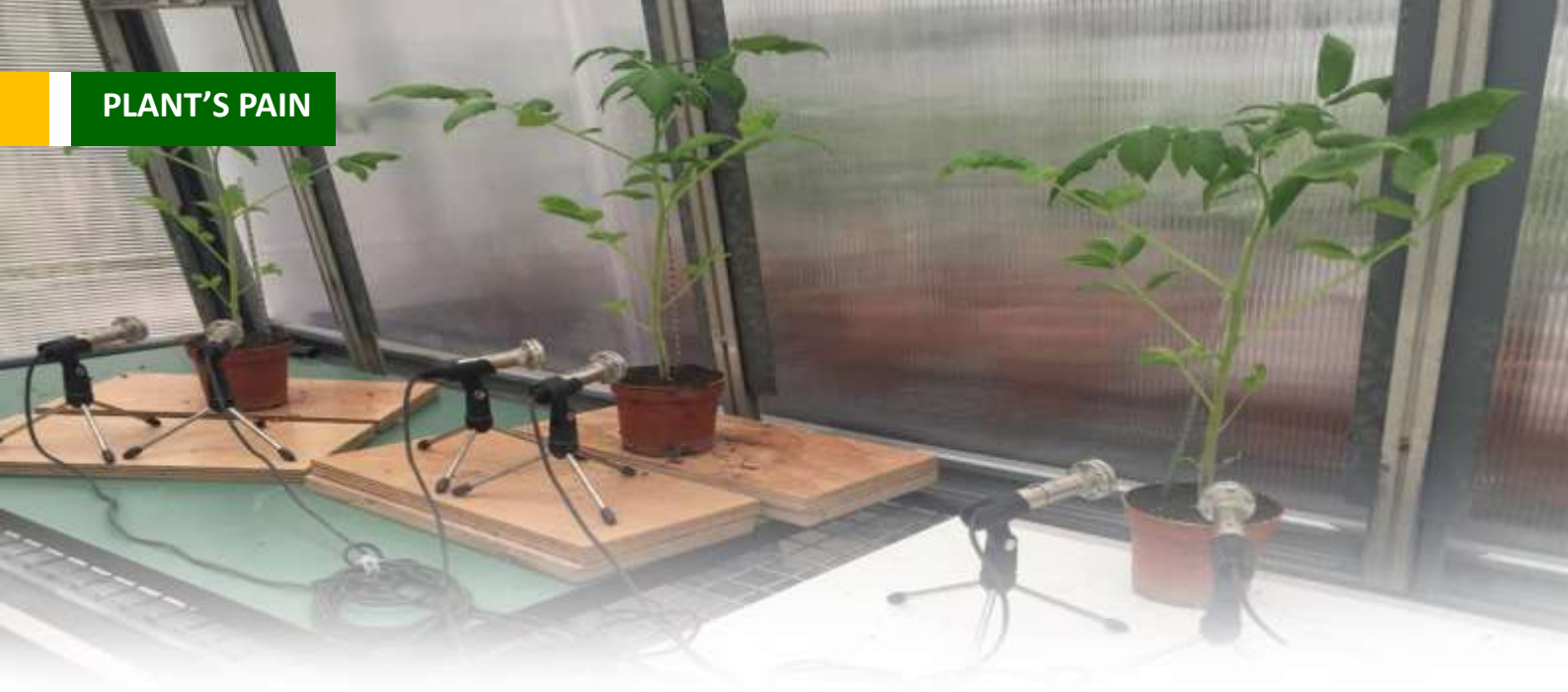

WHISPERING GREENS

HOW STRESSED PLANTS CRY OUT IN SILENCE

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For decades, plants were seen as passive, silent lifeforms—rooted, reactive, and without a voice. But what if they've been trying to communicate all along, and we simply weren't listening?

Groundbreaking research published in *Cell* by scientists from Tel Aviv University and collaborators in the U.S. has revealed something astonishing: plants emit sounds when they are under stress. These sounds, though inaudible to the human ear, can be picked up from several meters away and interpreted using advanced machine learning models. The study focused on tomato and tobacco plants, showing that they produced distinct noises when injured or dehydrated-up to 35 clicks per hour compared to fewer than one in healthy specimens.

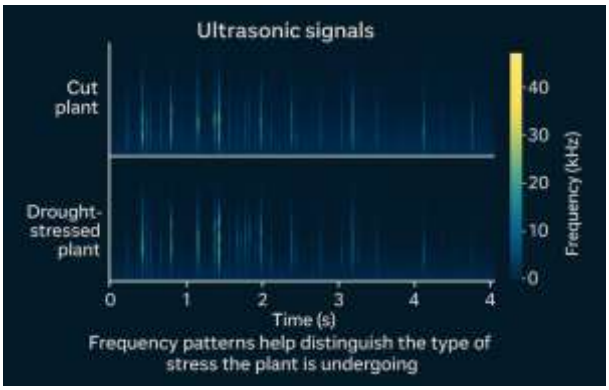
These ultrasonic pops, believed to be caused by the bursting of bubbles in the plant's xylem (a process called cavitation), offer clues not only about a plant's condition but also open up fascinating questions about ecological communication. Could insects like moths hear these signals and avoid laying eggs on a stressed plant? Could farmers use these sounds to better monitor crop health and optimize irrigation?

This discovery reframes our relationship with plants—from caretakers to potential listeners—and highlights the hidden complexity of the botanical world. As this field of research grows, so too does our understanding that perhaps plants have been "talking" all along. We just needed the right ears to hear them.

Stress Signals in the Air

Two common plants, tomato and tobacco, were used in the study.

When water-deprived or physically cut, they produced distinct sound patterns, with stressed plants emitting significantly more clicks—up to 35 per hour—compared to well-watered, healthy ones.



Even more fascinating, machine learning algorithms were trained to classify the type of plant and the stress condition, solely based on the recorded sounds.

Why does this matter?

This research revolutionizes how we perceive plant life. While we've known for years that plants communicate chemically (e.g., through root secretions or leaf volatiles), this is among the first pieces of evidence of airborne sound-based communication.

Here's why this matters:

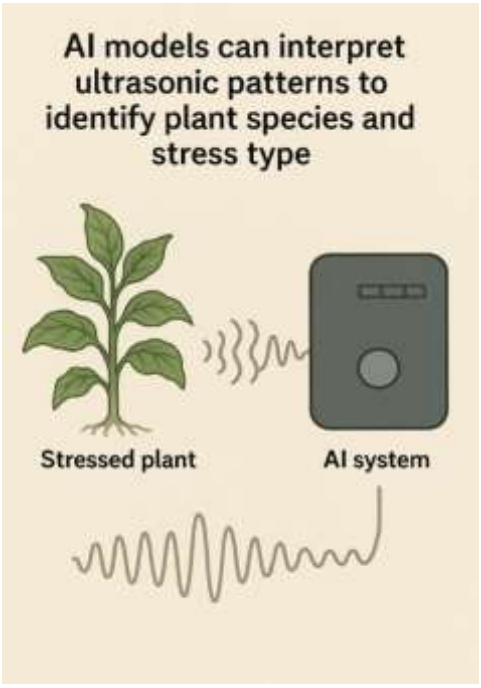
Smart farming: Farmers could soon use sensors to detect plant distress in real time, improving precision agriculture and reducing water waste.

Ecological connections: Some animals, like moths and bats, can hear ultrasonic sounds. Could they be responding to plant cries? This opens a fascinating avenue for further research.

Inter-plant communication: It's possible that other plants respond to these sounds-perhaps by closing stomata or activating internal defense pathways.

Future horizons

This discovery paves the way for non-invasive plant monitoring systems. Imagine



greenhouses where each crop's "voice" is continuously monitored, triggering irrigation or pest-control only when needed. Such applications could boost crop yield and sustainability while conserving precious resources like water.

Final thoughts

The idea that plants "speak" when in pain adds depth to our understanding of the natural world. Though we can't hear their cries, this research teaches us to pay closer attention and perhaps, in the near future, we will be able to listen to our plants and care for them more compassionately and efficiently.

Let us continue to nurture not only our crops, but our curiosity-because sometimes, even the quietest beings have the loudest stories to tell.■

KADAVANCHI WATERSHED

SUCCESS STORY OF TWO AND HALF DECADES

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Watershed Development (WSD) in India has been a part of the national approach to improve agricultural production and alleviate poverty in rainfed regions since the 1970s. Watershed Development programs aim to restore degraded watersheds in rainfed regions to increase their capacity to capture and store rainwater, reduce soil erosion, and improve soil nutrient and carbon content so they can produce greater agricultural yields and other benefits. As the majority of India's rural poor live in these regions and are dependent on natural resources for their livelihoods and sustenance, improvements in agricultural yields improve human welfare while simultaneously improving national food security.

Kadavanchi watershed is located in the Jalna district of the Marathwada region of Maharashtra State. It is 15 km from Jalna. In the case of Kadavanchi, villagers say that until 1995, women here used to walk long distances to collect water in the scorching sun. The villagers here had to rely heavily on tankers for drinking water. Many of the labourers here used to migrate to other parts of the state in search of employment, as well as for sugarcane harvesting work. The land in the village had also become barren. There was scarcity of water for crop irrigation. The river in the village had also dried up. The groundwater source had also dried up. Even though the drains started flowing during the monsoon, the surface water would not seep into the ground and instead flow away due to the slope of the land.

Vijay Anna Borade, Secretary of the Marathwada Agriculture Support Board in Aurangabad, visited the village on this occasion. He gave examples of watersheds in other districts of the state where watershed works have been successful. In that meeting, he assured that soil and water conservation works and watershed management would be done by Krishi Vigyan Kendra, Kharpudi, Jalna through the Indo-German Watershed Project to overcome the water shortage in Kadavanchi village. The villagers were also ready to work. The villagers agreed to contribute their labour to build various location specific and useful soil and water conservation measures. Due to the positive response and actiove peoples participation, Kadavanchi became successful in watershed

management. All the Scientists and Subject Matter Specialists work in in the Krishi Vigyan Kendra, Kharpudi, Jalna run by the Marathwada Sheti Sahayya Mandal also contributed greatly to this work.

In the year 1995, the Jalna Krishi Vigyan Kendra received funds to carry out soil and water conservation works in the selectedvillages of Jalna district under the Indo-German Watershed Development Programme. The Kadavanchi watershed was also included in it. Initially, bamboo, teak, sesam trees were planted on the fallow land under non-irrigated areas. During the period of five years (1995-1996 to 2000-2001), various SWC measures were constructed by adopting integrated watershed management, which reflected in increase in the area under crop cultivation from 1365 hectares to 1517 hectares. The area under perennial irrigation also increased from 174 hectares to 617 hectares. Now, there are more than 500 lined farm ponds in the Kadvanchi watershed. Also, the area under grape cultivation reached to 600 hectares.

During the period 1995-96 to 2000-2001, continuous contour trenching along with tree plantation work on 408 hectares area have been done at Kadavanchi watershed, bunding have been built on 1408 hectare, 19 cement dams, 9 gabion dams have been constructed. The groundwater level in the watershed has risen by an average of 2 meters. As a result, the villagers here are enjoying the fruits of their efforts. There was a time for the village of Kadavanchi, when the villagers used to migrate elsewhere in search of employment, but today the situation is such that not a single villager of the village of Kadavanchi goes elsewhere for employment, but about 500 labourers from various parts of the country and neighbouring villages come to Kadavanchi village for work every year. It would not be an exaggeration to say that the villagers of Kadavanchi have not only brought about their own prosperity but have also set a great example for other villages.

Keeping in mind the water budget, the farmers of Kadavanchi abandoned crops that required more water. Instead, they started growing grapes, pomegranates, citrus fruits, guava, lemons and soybean and pigeon pea using drip and sprinkler irrigation systems. As a result, their economic situation gradually improved. In the year 2012, Jalna district received only 198 mm of annual rainfall, yet the farmers here managed to keep their grape gardens alive with great courage and by making careful and adequate use of the available water. As a result, their grape production has not decreased at all. Even today, the farmers here collectively plan to export grapes. It has been observed that the annual income of Kadavanchi village has increased by 100 times 25 years after completion of SWC works in the watershed. The local farmers were convinced. This made them start making efforts. This resulted in improving their socio-economic status. It can be said that the prosperity came due to soil and water conservation, water budgeting, water storage in lined farm ponds and its careful use for crop irrigation in the Kadavanchi watershed.

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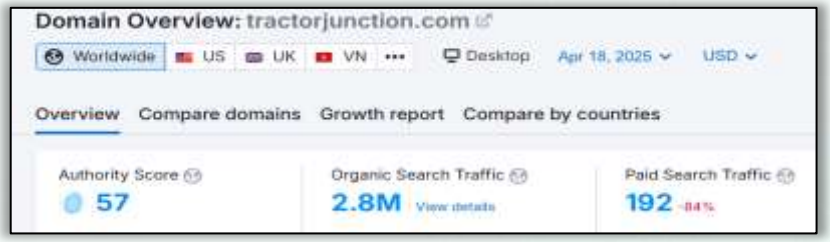
India’s Most Visited Agri-Websites

A quick comparison of the top-performing agriculture websites based on monthly organic search traffic.

Tractor Junction



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