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A Resonance in Agriculture
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June-2024

The Bitter Truth of

MANGO

Insecticides & our Health



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Times of Agriculture

A Resonance in Agriculture

From the Editor's Desk

Dear Readers,

The June issue of **Times of Agriculture magazine** is dedicated to your favorite fruit, the Mango, also known as the "**King of Fruits**". In this issue, we covered chemicals spraying in mangoes and their harmful effects. India is a major producer and exporter of mangoes. Mangoes are a primary fruit consumed during the summer season, loved by children, adults, and the elderly alike. However, did you know how many chemicals are sprayed on the mangoes you consume daily, which dissolve in your body and make you susceptible to numerous diseases?

Typically, 4 to 5 chemicals are sprayed on mangoes during a single season to protect them from pests and diseases. The use of chemicals doesn't stop there; after harvesting, farmers use various chemicals to ripen the fruit. Some of these chemicals are even banned, but due to their low cost, farmers opt for them to ripen their fruits quickly and fetch good prices from the market. However, the chemically treated fruits we consume today have severe harmful effects. There is a significant difference between naturally ripened fruits and those ripened using chemicals. This difference is not limited to taste but also affects their nutritional value. In this issue, we have covered in depth about chemicals used in mango crops and the effects. Apart from this, we have included other articles related to agriculture that will help enhance your knowledge. We hope you enjoy this issue and share it with your friends. Your feedback inspires us to work better, so please feel free to point out any errors or provide suggestions.

Thank you very much, and enjoy reading!

Editor-In-Chief

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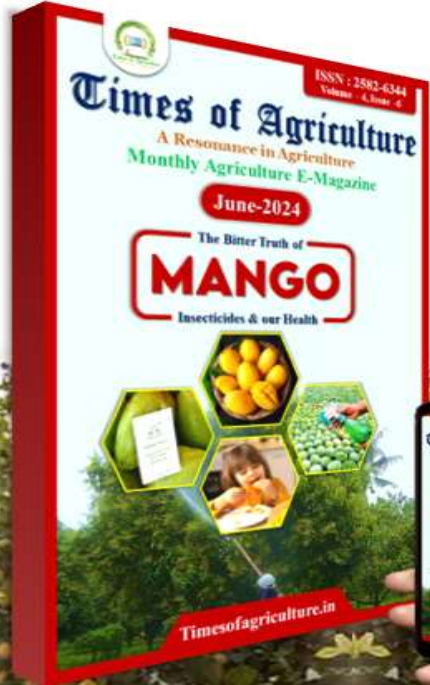
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The Bitter Truth of MANGO

Insecticides & our Health



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AGRICULTURE UPDATES



Cabinet approves MSP for Kharif 2024-25

The Union Cabinet chaired by Prime Minister Shri Narendra Modi approved the increase in the Minimum Support Prices (MSP) for all mandated Kharif Crops for Marketing Season 2024-25. Government has increased the MSP of Kharif Crops for Marketing Season 2024-25, to ensure remunerative prices to the growers for their produce. The highest absolute increase in MSP over the previous year has been recommended for oilseeds and pulses viz. niger seed (Rs.983/- per quintal) followed by sesamum (Rs.632/- per quintal) and tur/arhar (Rs.550/- per quintal).

Crops	MSP 2024-25	MSP 2023-24	MSP Increase in 2024-25 over 2023-24
Paddy	2300	2183	117
Maize	2225	2090	135
Tur /Arhar	7550	7000	550
Moong	8682	8558	124
Groundnut	6783	6377	406
Sunflower Seed	7280	6760	520
Cotton	7121	6620	501
Sesamum	9267	8635	632

Rs. per quintal



Shivraj Singh Chauhan appointed new Union Agriculture Minister

Union Minister Shri Shivraj Singh Chouhan took charge of the Ministry of Agriculture and Farmers Welfare. He said the Prime Minister has resolved to double the income of farmers and the government will take every possible step for the welfare of farmers. The Minister also added that the NDA government has been committed for farmer's welfare for past ten years and his Ministry will continue to work for achieving the goals.

After taking over charge, the Minister visited various offices in the Ministry and interacted with staff at various levels including cleanliness workers. He exhorted them to work as a team for achieving the government vision for welfare of farmers and work in cooperation with each other. He also visited Krishi integrated command and control center in the Ministry and saw facilities to review the agriculture scenario within the country including crop production and drought preparedness.

Apart from him **Rajiv Ranjan Singh** takes charge of Ministry of Fisheries, Animal Husbandry & Dairying and Ministry of Panchayati Raj. After taking the charge the Union Minister were briefed on the schemes and initiatives undertaken by the Ministry of Panchayati Raj. The Union Ministers also closely reviewed the current status of implementation of all the schemes and discussed in detail the future action plan. Union Minister Shri Rajiv Ranjan Singh alias Lalan Singh also provided instructions and suggestions regarding the implementation of all Schemes within a definite timeframe.



Total Food Grain Production in 2023-24 has decreased compared to previous year

The Ministry of Agriculture and Farmers Welfare has released 3rd Advance Estimates of Major Agricultural Crops for the year 2023-24. From the last agricultural year, the summer season has been segregated from Rabi season and incorporated in the Third Advance Estimates. Hence, this Advance Estimates of area, production and yield includes Kharif, Rabi & Summer season.

Total foodgrain production is estimated at 3288.52 LMT, which is slightly lower than foodgrain production of 2022-23 while higher by 211.00 LMT from average foodgrain production of last 5 years (2018-19 to 2022-23) of 3077.52 LMT.

Total Food grains	3288.52 LMT
Rice	1367.00 LMT
Wheat	1129.25 LMT
Maize	356.73 LMT
Total Oilseeds– 395.93 LMT	
Soybean	130.54 LMT
Rapeseed & Mustard	131.61 LMT
Sugarcane – 4425.22 LMT	
Cotton	– 325.22 Lakh Bales (170 Kgs. each)
Jute	– 92.59 Lakh Bales (180 Kgs. each)



Doordarshan Kisan Introduced 2 New AI News Anchors

Doordarshan Kisan is set to achieve another milestone. Channel is introducing a new look and style starting May 26. The most exciting feature of this revamp is the introduction of two AI anchors, named **AI Krish** and **AI Bhoomi**.

These AI anchors making Doordarshan Kisan the first government TV channel in India to employ artificial intelligence in this way. The AI anchors are designed to look and function just like human presenters, capable of delivering news 24/7 without breaks.

Farmers across India, from Kashmir to Tamil Nadu and from Gujarat to Arunachal Pradesh, will benefit from the information provided by these AI anchors. They will cover topics such as agricultural research, market trends, weather updates, and government schemes. Impressively, these AI anchors can communicate in fifty different languages, catering to a diverse audience both domestically and internationally.

Doordarshan Kisan, established on May 26, 2015, by the Government of India, is the only TV channel in the country dedicated solely to farmers. The channel aims to keep farmers informed about weather changes, market conditions, and other essential information to help them make timely and informed decisions. With the launch of AI Krish and AI Bhoomi, Doordarshan Kisan is set to enhance its service to farmers, ensuring they receive accurate and timely information in an innovative and engaging manner.



eFeed launched AI-powered SaaS platform VetVantage to help convert Methane to milk

Animal nutrition technology company eFeed launched VetVantage, an AI-powered platform to help dairy companies measure and reduce methane emissions from cattle while earning carbon credits.

The software-as-a-service (SaaS) tool, MethaneTracker 2.0, uses artificial intelligence, animal nutrition data and satellite imagery to estimate a dairy firm's emissions from cattle, which account for a major share of its carbon footprint. VetVantage is a cutting-edge methane emission calculator that leverages AI, precision animal nutrition and geospatial data from satellites to provide dairy companies with accurate estimates of their Scope 3 cattle methane emissions. This tool is crucial in India, where livestock plays a vital economic role but also contributes significantly to greenhouse gas emissions.

VetVantage, as a SaaS platform, offers key value propositions centered around delivering unparalleled transparency and visibility into cattle methane emissions. The platform's unbiased models ensure that data and recommendations are free from regulatory or private/governmental biases, fostering trust within the farming & industry. VetVantage stands out by providing insightful recommendations, shedding light on the causes of methane emissions, and offering tailored feeding & management solutions. Built on a foundation of robust community data from farmers, the platform ensures reliability and trust.



Coromandel International Ltd Launched Nano Fertilizer Plant at Kakinada, Andhra Pradesh

Coromandel International Limited has unveiled a nano fertilizer plant at its Kakinada complex in Andhra Pradesh. The plant was inaugurated by Mr. Sankarasubramanian S, Executive Director, Nutrient Business, in the presence of the company's senior leadership team and key channel partners from across the country.

Coromandel's Kakinada unit produces a wide range of NPK grades with an annual capacity of 2 million t of fertilizers and caters to the needs of the farming community across India. With the commissioning of the new nano facility at its Kakinada complex, Coromandel has forayed into new generation fertilizers, which have the potential to transform Indian agriculture.

The new nano fertilizer plant is designed using energy-efficient technologies and has fully automated production line including robotic arm for bottling operations. It has capacity to produce 10 million bottles of nano fertilizers per year and can be scaled up for higher volumes besides producing multiple range of nano fertilizers. Coromandel has developed nano fertilizers like nano DAP and nano urea through its in-house research and development centre at IIT Bombay-Monash Research Academy. Coromandel International has also set up a nano technology centre at Coimbatore to focus on nano application in agriculture and to establish quality for the nano range of products.

Coromandel 



FSSAI directs food brands to remove 100% fruit juice claims from labels and ads

Food regulator FSSAI has asked food business operators to immediately remove claims of 100 percent fruit juices in advertisements as well as labels on packaged products. All the FBOs have also been instructed to exhaust all existing pre-printed packaging materials before 1st September 2024. "It has come to the attention of FSSAI that several FBOs have been inaccurately marketing various types of reconstituted fruit juices by claiming them to be 100 percent fruit juices.

Upon thorough examination, FSSAI has concluded that, according to the Food Safety and Standards (Advertising and Claims) Regulations, 2018, there is no provision for making a '100%' claim.

"Such claims are misleading, particularly under conditions where the major ingredient of the fruit juice is water and the primary ingredient, for which the claim is made, is present only in limited concentrations, or when the fruit juice is reconstituted using water and fruit concentrates or pulp.

According to the regulation, products covered by this standard have to be mandatorily labelled in line with the Food Safety and Standards (Labelling and Display) Regulations, 2020. Not only this, but, in the ingredient list, the word "reconstituted" has to be mentioned against the name of the juice that is reconstituted from the concentrate. Further, if added nutritive sweeteners go beyond the limit of 15 gm/kg, the product has to be labelled as 'Sweetened juice'.



India's spices exports at recorded \$4.46 billion in FY 24

According to the latest data by the Spices Board under the Ministry of Commerce and Industry, the export of spices/spice products from the country has been 15,39,692 tonnes valued at Rs 36,958.80 crore (\$4.46 billion) during FY 2023-24. The red chilli exports hit a record \$1.5 billion in FY24, a 15 per cent increase from the previous year's \$1.3 billion which is driven by robust demand from China and Bangladesh. According to Spices Board data, red chilli export volume increased by 15 per cent in FY24 to 6.01 lakh tonnes from 5.24 lakh tonnes the previous year. Red chilli exports, worth \$1.5 billion, comprised about 34 per cent of India's total spices exports.

China was the top importer of Indian red chillies in FY24, purchasing over 1.79 lakh tonnes valued at Rs 4,123 crore. This represents a 14 per cent increase in volume and a 21 per cent increase in value from 1.57 lakh tonnes worth Rs 3,408 crore in FY23. Chilli exports to Bangladesh jumped by 67 per cent in FY24, reaching 90,570 tonnes, up from 53,986 tonnes the previous year. "India's red chilli exports have reached unprecedented heights in FY24, fueled by escalating demand from key importing nations. The surge in exports, especially to China and Bangladesh.



The Bitter Truth of **MANGO**

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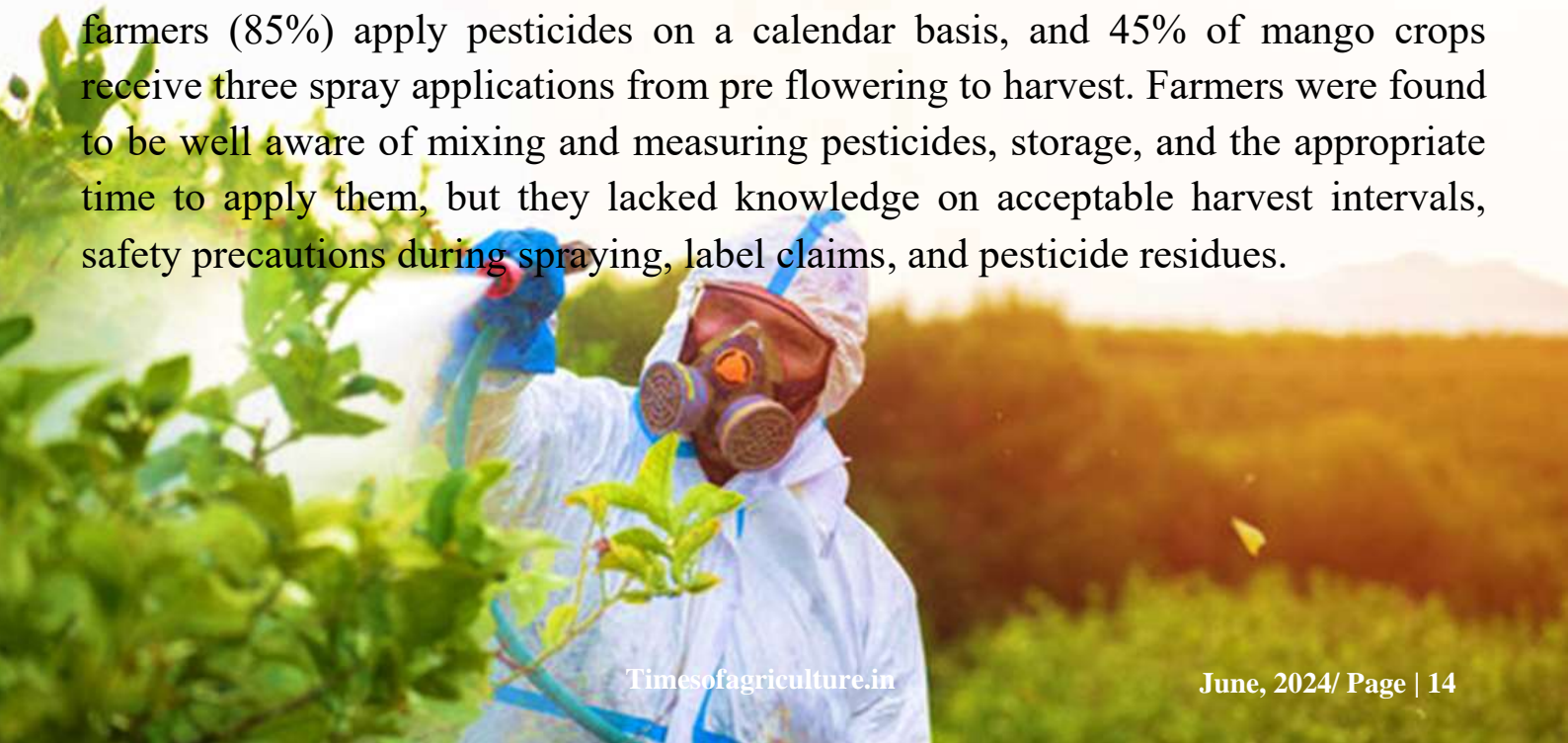


Mangoes, often referred to as the "king of fruits," enjoy immense popularity worldwide due to their sweet flavor, vibrant color, and nutritional benefits. Originating in South Asia, mangoes are now grown in tropical and subtropical regions across the globe. India, China, and Mexico are among the largest producers, with India alone contributing nearly half of the global production.

The use of insecticides in mango production is widespread to ensure high yields and market readiness. Insecticides are applied to protect mangoes from pests and diseases, but their overuse can lead to health and environmental concerns. Artificial ripening, often using ethylene gas, ensures uniform ripening and market availability. However, some methods, like the use of calcium carbide, pose significant health risks and are regulated or banned in many regions. Balancing these practices with safety and environmental sustainability is crucial for the mango industry.

Approximately 260 insect and mite pests that manifest at various phases of crop growth infest the mango crop. They launch an assault while stages of development, flowering, and fruiting that seriously hinder fruit output. Farmers often use a variety of pesticide types to control these types of insects. Insecticide application that is indiscriminate will result in pest resurgence as well as negative health consequences on consumers (residues in commodity). The industrialization of agriculture has led to an increase in the amount of chemicals on natural ecosystems, endangering both human health and the environment.

In order to find out how mango growers in Tamil Nadu's Krishnagiri and Dharmapuri districts felt about insecticide use and consumption patterns, a survey was carried out between December 2021 and January 2022. The majority of farmers (85%) apply pesticides on a calendar basis, and 45% of mango crops receive three spray applications from pre flowering to harvest. Farmers were found to be well aware of mixing and measuring pesticides, storage, and the appropriate time to apply them, but they lacked knowledge on acceptable harvest intervals, safety precautions during spraying, label claims, and pesticide residues.



Rise of Insecticides Use in Mango Cultivation

The rise in insecticide use in mango cultivation has been driven by the need to combat various pests and diseases that threaten crop yields and fruit quality. As global demand for mangoes has increased, so has the reliance on chemical insecticides to ensure consistent and abundant harvests. While these insecticides effectively protect mango crops, their increased use raises concerns about potential health risks to consumers, environmental impacts, and the development of pest resistance. This trend underscores the importance of implementing integrated pest management practices and regulatory measures to ensure the safe and sustainable production of mangoes.

Growing mangoes commercially requires meticulous care, especially regarding insect management. The need for 4-5 insecticide sprays per season to ensure fruiting and protection from insects indicates the high level of vigilance needed.

Adaptation of Insecticides

The adoption of insecticides in mango cultivation is driven by several key factors. High pest and disease pressure necessitates their use to protect crops and maximize yields. Economic incentives, such as the desire to produce high-quality, marketable fruit, also play a significant role. Technological advances in insecticide formulations and application methods make them more accessible and effective. Regulatory approvals and support programs can further encourage their use. Additionally, increased farmer awareness on insects management contribute to the widespread adoption of insecticides in mango farming.

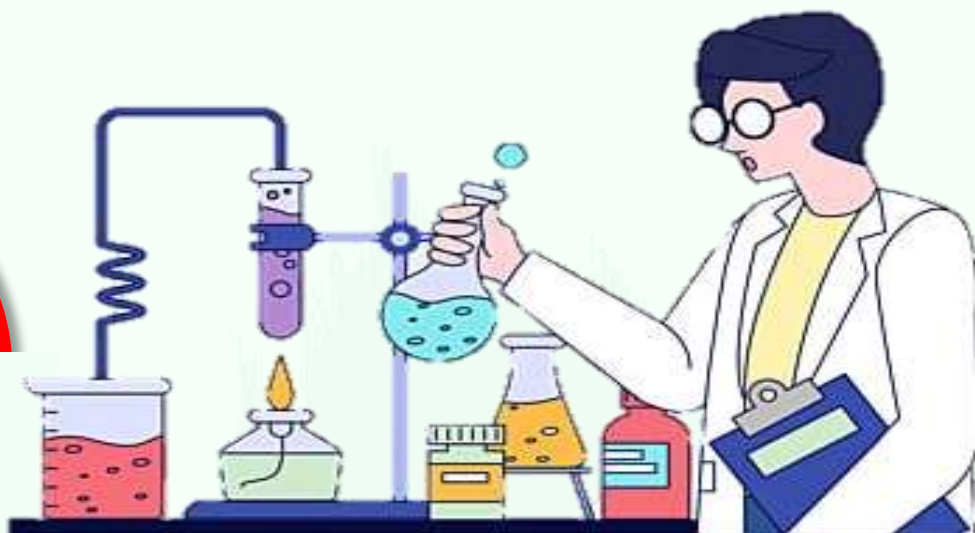
Commonly used Insecticides

Farmers utilize a variety of insecticides when growing mangoes. The cultivators of mangoes are often exposed to many pesticides, such as Carbaryl (1-naphthyl methylcarbamate), Rota (Lambda-cyhalothrin), Fencord (Cypermethrin), Imitaf (Imidacloprid), Gird (Chlorpyrifos), and Boron.

Many fungicides, including Mancozeb, Dithine M-45 (Mancojeb), Indofil M-45 (Mancojeb), Nativo (Tebuconazole + Trifloxystobin 100), Knowing (Carbendazime), Pencozeb (Mancojeb), and Power blast (Azoxitrobin+ Diphenconajol), were also sprayed by the mango growers.



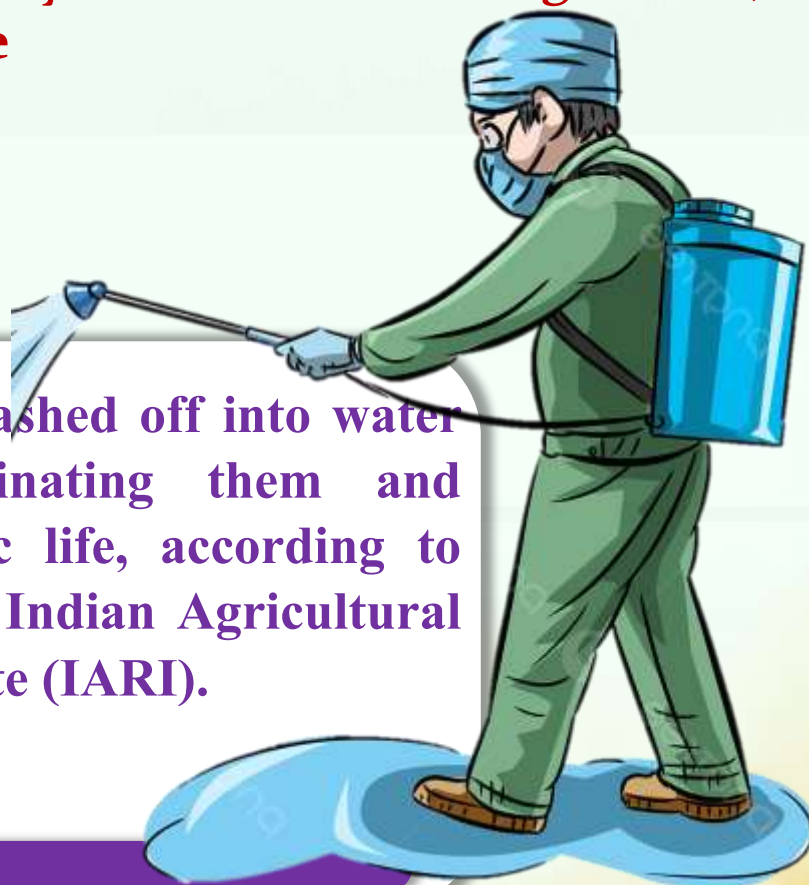
Cross Pesticide limits.



A Food Safety and Standards Authority of India (FSSAI) report-2019 found that 2.6% of food samples, especially fruits and vegetables, exceeded pesticide limits.

20-30%

Pesticides are washed off into water bodies, contaminating them and affecting aquatic life, according to research by the Indian Agricultural Research Institute (IARI).



Consequences of Insecticide Sprays

Insecticides sprays are widely used in agriculture to protect crops from insects and diseases, but they can also have significant impacts on human health and environment. The use of insecticides in agriculture, including mango cultivation, carries several consequences:

Effect on Health

Short-term exposure to high levels of insecticides can cause acute poisoning, leading to symptoms such as headaches, dizziness, nausea, vomiting, abdominal pain, and, in severe cases, respiratory distress, convulsions, or even death.

Prolonged exposure to pesticides, even at low levels, can lead to chronic health problems. These may include respiratory issues, skin conditions, neurological disorders, and endocrine disruption. There is also evidence linking long-term exposure to pesticides with cancers.

Insecticide can have adverse effects on reproductive health, potentially leading to infertility, birth defects, and developmental delays in children. Pregnant women and young children are particularly vulnerable to the harmful effects of insecticide exposure.

Certain pesticides, especially organophosphates and carbamates, are known neurotoxins. They can affect the nervous system, leading to symptoms such as memory loss, coordination problems, and other cognitive impairments.

Some pesticides act as endocrine disruptors, interfering with hormone systems. This can lead to a variety of health issues, including developmental, reproductive, neurological, and immune problems.



Effect on Environment



Insecticides, while essential for controlling agricultural insects, pose significant risks to bees, which are vital pollinators in both natural ecosystems and agriculture. Bees contribute to the pollination of about 75% of the world's food crops, making their health crucial for food security and biodiversity.



These Chemicals can harm beneficial insects, birds, and aquatic life. Insecticides can reduce populations of beneficial Predatory insects like ladybugs, lacewings, and predatory beetles, which naturally control pest populations.



Insecticides can alter the soil's microbial community, affecting soil health and fertility. They can reduce populations of beneficial soil organisms like earthworms and bacteria, which are essential for nutrient cycling and soil structure.



Insecticides dissolve into water bodies, contaminating rivers, lakes, and groundwater. This can harm aquatic ecosystems, affecting fish, amphibians, and aquatic plants. Persistent insecticides can accumulate in the food chain, leading to long-term ecological damage.



Some insecticides volatilize and become airborne, leading to air pollution. Drift from spraying can affect nearby ecosystems, harming plants and animals not targeted by the treatment.

7000

Cases of pesticide poisoning are reported in India annually in recent years according to the National Crime Records Bureau (NCRB), though the actual number is likely higher due to underreporting.

Conclusion

Insecticides are effective in managing pests and ensuring mango crop yields, their use poses significant health and environmental risks also pesticides are deadly to beneficial insects, we needed to protect the natural enemies and use of optimum dose of pesticides for pest management and maintain the agro-ecosystem. Balancing the need for pest control with the safety of consumers and the environment is essential. Adopting integrated pest management strategies, enhancing regulatory frameworks, and investing in research for safer alternatives can help mitigate these risks.

Andhra Pradesh, Bihar, Gujarat, Maharashtra and Uttar Pradesh, which together account for about two-third share in India's total mango production. Malihabad district in Uttar Pradesh's mango belt sustains its economy on the fruit. Its people even plan weddings around the harvest season in June the pursuit of innovative approaches in insect and pest management is imperative for the future. By harnessing technologies such as biological control, precision agriculture and genetic manipulation, we can enhance our ability to mitigate pest-related challenges while minimizing environmental impact and safeguarding human health. However, to fully realize the potential of these approaches, sustained investment in research, development and education is essential. With concerted efforts and a commitment to innovation, we can cultivate healthier ecosystems and foster more resilient agricultural systems, ensuring food security and sustainability for generations to come.



THE HEALTH HAZARDS OF ARTIFICIAL MANGO RIPENING

Mangoes naturally ripen through a complex process driven by the plant hormone ethylene, enhancing their color and flavor. However, this natural ripening can be slow and uneven, posing challenges for transportation and market availability. To address these issues, artificial ripening methods using chemicals like calcium carbide and ethylene gas have become common.

While these methods help meet commercial demands, they also raise safety and ethical concerns. The Indian Ministry of Agriculture recommends ethylene gas for safer ripening, but many fruits in developing countries are still ripened with hazardous chemicals. This highlights the need for increased regulation and awareness to ensure consumer health and promote sustainable fruit production.

In traditional regions to include the moisture to methods, uniform

methods, calcium carbide is commonly used in developing ripen mangoes due to its affordability, Application methods basket and heap methods, where the carbide reacts with release acetylene gas, accelerating ripening. Among modern ethylene gas is widely employed in developed countries for ripening in artificial chambers. Ethephon, a chemical ripening agent, releases ethylene when dissolved in water, while methyl jasmonate enhances ripening by stimulating ethylene production. Other modern agents include ethylene glycol, propylene, methanol, and potassium permanganate.

Innovative techniques such as gas emission systems and ethylene generators provide precise control over ethylene exposure, ensuring optimal ripening conditions. Postharvest technologies like refrigerated transport vehicles, low-temperature storage, and ethylene-induced ripening chambers further enhance the ripening process and preserve fruit quality during shipping and storage.



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Traditional Methods

Smoke Exposure : This practice relies on smoke to alter the mango's colour and taste. The smoke induces changes in the fruit's physical and biochemical properties, accelerating the ripening process. While not as precise as modern methods, it reflects the resourcefulness of generations past.

Calcium Carbide -In many regions, calcium carbide remains a prevalent choice for ripening mangoes due to its affordability. However, its use comes with significant health risks, highlighting the trade-off between cost-effectiveness and safety in traditional practices. Calcium carbide application methods include:

Basket Method: Fruits are placed in a basket made of leaves, with calcium carbide wrapped in cloth or newspaper placed at the bottom. The carbide releases acetylene gas when it reacts with moisture, which accelerates the ripening process.

Heap Method: Large heaps of fruits (1-2 tons) are placed at the corner of a room, with calcium carbide spread in several spots. The heap is then covered with craft paper, allowing the acetylene gas to permeate and ripen the fruits.

Hot Water Dipping and Dark Polyethylene Bags: Fruits are dipped into hot water and then wrapped in dark polyethylene bags. This method creates a warm, humid environment that mimics natural conditions and speeds up ripening by enhancing the production of natural ripening agents within the fruit.

Modern Methods

Ethylene Gas - Ethylene, a natural plant hormone, is widely used in many countries for ripening fruits in artificial chambers, posing no health hazards. Ethylene works by triggering the natural ripening process, leading to changes in texture, color, and flavor. Ethephon is applied in liquid form, and as it breaks down, it releases ethylene gas that triggers the ripening process.

Propylene: Propylene, a colorless gas, is used in the fruit industry for ripening purposes, particularly for tomatoes and melons. However, its effectiveness is only about 1% of that of ethylene, making it less efficient but still a viable option in certain contexts.



Traditional vs Modern Methods

Aspect	Traditional Methods	Modern Methods
Methods	Smoke Exposure, Calcium Carbide, Hot Water Dipping and Dark Polyethylene Bags.	Ethylene Gas, Ethephon, Methyl Jasmonate (MeJA), Ethylene Glycol, Propylene, Methanol, Potassium Permanganate.
Safety	Generally, less safe due to potential health risks (e.g., Calcium Carbide). Studies have shown that residues from calcium carbide can be harmful to consumers.	Generally safer, especially when using natural hormones like Ethylene. Research indicates ethylene poses no health hazards.
Cost	Generally lower cost. For example, calcium carbide is affordable and widely used in developing countries.	Can be higher due to the need for specialized equipment and chemicals. However, the investment can lead to better quality and reduced waste.
Health Risks	Higher health risks. The use of calcium carbide and other chemicals can pose significant health risks if not properly managed.	Lower health risks when properly managed. Ethylene gas is safe and widely approved for use in fruit ripening.

Naturally Ripened Mango



Naturally Ripened

✓

✗

✗

✗

- Good Aroma & Flavor
- Black spot on skin
- High Acidity
- Low TSS & Sugar

Artificially Ripened Mango



Artificially Ripened

✗

✓

✓

✓

Impact on taste and nutritional value of artificial ripening on mangoes

Artificial ripening methods can alter the taste of mangoes, often resulting in fruits with high acidity and low sugar content, and poorly developed flavor. Despite potential flavor drawbacks, artificial ripening has been associated with an increase in phytochemicals and vitamin C levels in mango fruits, potentially enhancing their nutritional value.

Ethylene, a hormone commonly used in artificial ripening, can impact the texture, acidity, and sweetness of mangoes, influencing their overall flavor profile. In contrast, natural fruit ripening involves a complex interplay of developmental and metabolic processes, resulting in mangoes with well-developed flavor, aroma, and nutritional content.

In 2007, a laboratory experiment was carried out at Sri Sankara Arts and Science College in Kanchipuram, Tamil Nadu to investigate the impact of artificial ripening, namely calcium carbide, on the biochemical components of three distinct mango varieties: Mulgoa, Neelum, and Rumani. The findings were kept track of till the ripening process was complete. Compared to the control, the fruits treated with calcium carbide had lower levels of TSS and sugar (reducing, non-reducing, and total). Ripeness decreased the alkaline pH in every mango variety evaluated. In comparison to the control group, the mango cultivars had lower levels of protein and ascorbic acid. The findings showed that artificial ripening or pseudo-ripening by calcium carbide causes a decline in mango fruit quality.

Health Effects of Chemicals Used in Artificial Ripening of Mango

- ❖ While this chemical may seem innocuous, its implications for health are far-reaching and warrant urgent attention. Let's delve into the risks associated with artificial mango ripening and explore the global concerns it raises.
- ❖ Chemicals such as calcium carbide, commonly used in artificial ripening, are carcinogenic, raising concerns about their potential to cause cancer.
- ❖ Traces of arsenic and phosphorus found in calcium carbide pose serious health risks, leading to neurological symptoms, digestive disorders, and skin ulcers upon consumption.



- ❖ Exposure to acetylene gas, generated from calcium carbide, can result in neurological effects like headaches and dizziness, as well as digestive issues such as diarrhea and vomiting.
- ❖ Prolonged exposure to these chemicals may lead to memory loss, cerebral edema, cardiovascular diseases, and liver and kidney dysfunction.
- ❖ At the heart of the issue lies calcium carbide, a highly reactive compound with carcinogenic properties. When exposed to moisture, it generates acetylene gas, which is not only flammable and explosive but also more hazardous than ethylene, the natural ripening agent. Moreover, the presence of arsenic and phosphorus hydride in calcium carbide compounds elevates its toxicity to alarming levels, posing grave risks to human health.
- ❖ The onset of arsenic and phosphorus poisoning is insidious, with symptoms ranging from gastrointestinal distress to neurological impairment. Vomiting, diarrhea (sometimes bloody), chest and abdominal discomfort, weakness, and speech difficulties are early indicators of exposure.
- ❖ Consumers who unknowingly consume artificially ripened mangoes face a host of health issues, ranging from digestive disorders to cardiovascular diseases. Despite their enticing appearance, these fruits often lack proper ripening internally, compromising taste and texture.

Artificially ripening mangoes with chemicals like calcium carbide can be risky, potentially harming our health with carcinogens and neurological problems. To keep people safe, we need better rules and more awareness about safer ripening methods. The "Prohibition of use of Calcium Carbide in ripening of fruits" is covered under sub-regulation 2.3.5 of the Food Safety and Standards (Prohibition and Restriction on Sales) Regulations, 2011, a person who sells, offers, exposes for sale, or keeps fruits that have been artificially ripened by the use of acetylene gas, also known as carbide gas, on his property for the purpose of selling is prohibited by this subregulation.



Previous Issues



Website Statistics (May 2024)

161K

Monthly
Pageview

72K

Monthly
Visitor

1.8M

Monthly
Impression

Social Stats



6.5K



5.1K



6.1K



1.7K



2K



UNLOCKING OPPORTUNITIES

HOW STUDENTS CAN SUCCESSFULLY APPLY TO AGRICULTURAL SCIENCES MASTER'S AND PH.D. PROGRAMS ABROAD



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Aspirations and passion propel us towards our goals. For international students aiming for advanced degrees in Agricultural Sciences, the journey is both exciting and challenging. The recent Open Doors 2023 Report reveals a significant surge in international students in the U.S., with 467,027 enrolling in graduate programs in 2022/2023. This represents the strong global interest in U.S. higher education. For those studying agriculture, the U.S. offers invaluable access to advanced agricultural technologies and methods, preparing them to tackle global food challenges and promote sustainability. With careful planning, strategic searching, and smart approaches, every student can successfully navigate their way to studying at overseas universities.

In the pursuit of doctoral programs, these elements become paramount to compete on a global scale. From selecting the right program and preparing for standardized tests to tackling visa applications and financial arrangements, the process may initially seem daunting. However, it's important to recognize that with dedication and guidance, it's entirely manageable. Whether your interests lie in

Agricultural Extension, International Agriculture, Agricultural Economics, Agribusiness, sustainable farming, plant breeding, entomology, crop science, or agricultural technology, understanding the essential steps empowers you to transform your educational aspirations into reality.

This comprehensive guide aims to boost your confidence and equip you with the knowledge needed to pursue your dream universities abroad. By following these steps, you'll gain clarity and insight into the process, setting you on the path to success.

1. Research and preparation

Every program is uniquely structured, and each university abroad has its own set of rules and admission culture. Conducting thorough background research and adopting a strategic approach can significantly aid in defining your career trajectory and ultimate goals.

Identify programs and universities

First and foremost, it is essential to understand the universities, the programs they offer, and the research culture in the countries where you wish to pursue your degree. This step is



crucial and requires significant patience and determination, typically involving at least six months of consistent planning. A strategic approach is vital during this phase. Start by listing the countries and universities that are your top priorities. Each university's website provides clear information about their programs, including contact details for professors and program coordinators, tuition costs, career opportunities, and more. This is the time to bookmark the websites of programs you are interested in and record the relevant contact and program information by university and country. It's important to note that universities are generally divided into public and private categories. The main distinction between these two types lies in their acceptance rate and financial costs. Beyond this, the operational aspects of both types of institutions are quite similar.

Research Programs: Master's and Doctoral programs in Agricultural Sciences.

Master's and Doctoral degrees, both categorized as graduate programs, generally follow similar approaches and requirements across most universities. However, the key distinction between them lies in the nature of funding and academic expectations. Doctoral programs are typically funded, demanding significant research experience, excellent academic performance, and they involve intense competition. In contrast, Master's programs are usually not funded and admit a larger number of students.

Regarding the financial aspects, the cost of graduate studies in agriculture can vary widely. Generally, students might expect to pay tuition ranging from \$20,000 to \$40,000 per year at public universities. Costs at private institutions can be significantly higher, sometimes exceeding \$50,000 annually. To help manage these expenses, many students seek financial aid, scholarships, or assistantship positions that offer stipends or

cover part of the tuition in exchange for research or teaching duties.

Program Requirements: Check the specific requirements for each program

The most reliable approach is to conduct your own research. University websites provide original and trustworthy information, ensuring no risk of fraud. These websites offer clear details about programs and accurate contact information. Confidence is key—if you find a program that interests you, promptly email professors or academic coordinators to inquire further. Most universities respond within a week, helping you advance in the admission process and gain valuable insights into your desired program.

Standardized Tests: GRE & IELTS/TOEFL tests

Alongside researching and gaining awareness about universities, it's crucial to focus on the required examinations for admission. Most universities outside India require proof of English proficiency, as English is not the first language in India. The commonly accepted exams for this purpose are the IELTS or TOEFL. Achieving a score above 6.5 on these tests is essential for most of the programs, and also each university has its own score requirements. Additionally, many programs in the USA and some other countries require the GRE (Graduate Record



Examination). This exam is more challenging and typically requires about a year of preparation for an average student. These examination

requirements apply to both master's and doctoral programs abroad, so it's important to set score goals based on the specific demands of the programs you're interested in.

2. Application process

The application process is crucial and involves numerous steps that must be completed before the approaching deadlines of the selected universities and programs. Typically, each university has five essential requirements: transcripts, English standardized test results, letters of recommendation, a statement of purpose, and a resume or curriculum vitae. Additionally, there may be other



requirements that vary by program.

These requirements are generally the same for both master's and doctoral programs. However, for doctoral programs, additional critical requirements include obtaining email acceptance from a professor to proceed with your admission, as well as demonstrating outstanding research abilities. This includes having research papers, conference presentations, and exceptional academic performance. Most importantly, the first step is to contact professors conducting research in your area of interest by sending a clear and concise email along with your resume, requesting their approval. This proactive approach is essential for moving forward in the doctoral application process.

Prepare Application Materials: transcripts, LOR's, SOP, CV, and others

As previously discussed, maintaining strong academic transcripts is crucial, whether you're an undergraduate aiming for a master's





degree or a master's student eyeing a doctoral program. Consistently performing well academically is imperative. Typically, a minimum GPA of 3 out of 4 is expected for master's programs, while doctoral programs often require a GPA of 3.5 or higher, though these standards can vary depending on the institution and program. Getting your transcripts in order well in advance of starting the admission process is essential for a smoother journey. Most universities will request transcripts as a primary step, followed by English proficiency test results (such as IELTS or TOEFL) and GRE scores.

Additionally, crafting a compelling Statement of Purpose (SOP) is vital. Your SOP serves as a reflection of your academic and professional journey, detailing your research interests and career aspirations. It should be meticulously written to stand out in the competitive selection process.

Letters of Recommendation (LOR) are also integral components. Most universities specify the number of recommendations required, typically ranging from 2 to 3 for master's programs and 3 to 5 for doctoral programs. These letters should be obtained from professors who can attest to your academic abilities, and they must be handled professionally, as each recommender will be contacted, and their endorsements verified.

Furthermore, preparing a comprehensive Curriculum Vitae (CV) is essential, particularly for doctoral programs, where research experience

and academic achievements are heavily weighed. Your CV should highlight your academic accomplishments, research experience, and relevant work history. Ensuring that all required research materials are in order is also crucial for doctoral program applications.

Submit Applications: You're free to apply to multiple universities

Each university sets its own deadlines and procedures for completing admission forms, often utilizing various platforms. It's crucial to gather all necessary documents beforehand and diligently complete the online application forms for each institution. There's no limitation on the number of universities you can apply to. You're free to apply to multiple universities, giving you the flexibility to select from various options if accepted. Typically, applying to 5-6 universities for a master's degree and 2-3 for a doctoral program is sufficient. However, for doctoral programs, it's important to note that approval from professors may be required before initiating the admission process. Once you've filled out your application forms and progressed to the final stages, you'll likely encounter an application fee, the amount of which varies among universities and programs. It's essential to exercise caution when selecting the universities to which you apply, considering factors such as program suitability, faculty expertise, and financial considerations.

Interviews: Some programs may require an interview

This is an added requirement after the admission selection is

approved. This is mostly conducted for a doctoral program as a final step of their admission process. Some programs may require an interview mostly a videocall. In this interview call, they mainly focus asking about you and your research interests, performances, and experiences. How effective and confident your vocals will be is the point of achievement.

Acceptance: Once accepted, you will receive an admission letter

Within a month, you can expect to receive the results of your admission. Upon acceptance, you'll receive an official admission letter. Many programs offer funding opportunities to help alleviate tuition costs or provide part-time work options. Typically, for doctoral programs, acceptance involves a professor taking you under their wing, granting a full tuition waiver and often an assistantship offer like GRA (Graduate Research assistantship) or GTA (Graduate Teaching Assistant), which serves as a stipend of about 1000-2500\$ (USA) throughout your PhD journey. While some universities may have additional processes for securing assistantships, it's crucial to contact your prospective professor about funding opportunities, ideally in your initial email. This proactive approach is key to securing full funding.

However, it's worth noting that funding opportunities aren't exclusive to doctoral students. Exceptional master's students can also pursue scholarships or assistantships by reaching out to professors. With strong academic performance, master's students may also





have the chance to attain full funding similar to doctoral candidates.

3. Financial planning

Scholarships and Funding: Research about scholarships or assistantships offered by the university.

Another clever step often overlooked is to explore scholarship opportunities both within and outside the university. Many institutions offer internal and external scholarships upto 1000 – 3000\$ (USA) or an in-state tuition waiver that can significantly offset tuition costs. It's wise to start researching and applying for these scholarships soon after receiving your admissions offer.



In India, there are organizations that also provide scholarships for studying abroad, which you can investigate while still in your home country. For master's programs, it's crucial to start planning for securing loans to cover tuition fees. Many banks offer student loans at favorable interest rates, making it feasible to fund your education. Taking the initiative to apply

for both university funding options and external scholarships demonstrates a proactive approach to financing your education and can ultimately alleviate financial burdens during your academic journey.

4. Visa process

Visa Application: I20, SEVIS Fee, passport, Visa interview and travel

This final step requires careful attention. Beforehand, the university requests the completion of an I20 Application form to verify funding and international travel feasibility without issues. This document is crucial for students traveling abroad on an F1 Visa, which is granted to those pursuing educational endeavors overseas. The student must demonstrate one year's worth of tuition fees in their bank account to ensure financial stability throughout their academic journey. Upon submission, the university will provide the I20 form, essential for the visa interview and immigration process.

Following this, the next step involves preparing necessary documents for the visa interview. This includes paying the SEVIS (Student and Exchange Visitor Information System) fee, which allows booking an

appointment for the interview. Prior to this, applicants must fill out the visa application form (e.g., DS-160 for the U.S.).

On the interview day, applicants must present all required documents, including passport, I-20 form, SEVIS fee receipt, admission letter, financial proof, and visa application confirmation. If the interview is successful, the passport will be retained for approximately one week before being returned with the printed visa. Once the visa is obtained, it's time to prepare for travel. Booking a flight ticket, packing luggage, and connecting with university student groups for living arrangements are essential steps before departure.

In conclusion, this guide not only provides a detailed roadmap for aspiring international students but also recognises the importance of resilience and thorough preparation. With the right resources, guidance, and an unwavering commitment to their educational and professional goals, students can transcend boundaries and transform their aspirations into tangible achievements, fostering significant personal and academic growth in the realm of Agricultural Sciences.

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EMPOWERING KARNATAKA'S AGRICULTURE EDUCATION FUTURE THROUGH ENGINEERING INNOVATION



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Revolutionizing the agricultural landscape, agricultural engineering emerges as the cornerstone for Karnataka's prosperity, tackling productivity woes and empowering farmers with transformative technology. Tracing its roots back to the early 20th century, agricultural engineering in Karnataka has evolved into a dynamic field integrating

advancements in technology and environmental sciences, driving sustainable farming solutions and economic development.

The journey of agricultural engineering education in Karnataka began with the establishment of the Agricultural Engineering Institute (AEI) in Raichur in 1969. What started as a diploma program has transformed into a network of nine colleges across six universities, offering B. Tech degrees. Additionally, an exclusive College of Horticultural Engineering and Food Technology has been operational in Ranebennur, Haveri District since 2016. These institutions admit approximately 300 students annually and collaborate with educators and private institutions to enrich academic offerings and align with national standards.

Renowned Indian agricultural engineer, Dr. A.M. Michel, underscores the pivotal role of agricultural engineering in economic progress, emphasizing its interdisciplinary nature. Despite its significance, enrollment in agricultural programs remains disproportionately low. The NEP-2020 has paved the way for significant changes in the higher agricultural

education system, introducing multiple exit and entry points to enhance the Gross Enrollment Ratio (GER). This comprehensive policy overhaul is intricately linked to Indian agriculture, aiming to bolster agricultural education while addressing the challenges and aspirations of the farming community.

Agricultural engineering holds immense promise, not only in enhancing farm productivity but also in shaping the future of sustainable agriculture. From precision farming to robotic automation, the discipline continues to push boundaries, attracting individuals with a passion for innovation and a commitment to addressing the challenges of the agricultural sector. As Karnataka remains at the forefront of agricultural advancements, the journey of agricultural engineering unfolds as a beacon of hope for a greener, more prosperous future.

In today's era of climate change and technological advancement, the role of agricultural engineering education has become indispensable. With a focus on developing resilient farming methods and harnessing technology like robotics and artificial intelligence, this field addresses the pressing need for



sustainable agricultural solutions. As Indian agriculture undergoes transformation, agricultural engineers play a pivotal role in driving mechanization and innovation to ensure food security and environmental sustainability.

In terms of career opportunities, agricultural engineering offers a diverse array of paths, ranging from research and farm management to environmental conservation and machinery manufacturing. Encouraging students to explore agricultural engineering not only promises a rewarding career but also fosters a sense of responsibility towards building a better world through sustainable agricultural practices.

Despite the significance of agricultural engineering to India's economy and livelihoods, the country lags in mechanization compared to peers like China and Brazil. The Standing Committee on Agriculture has highlighted the urgent need to enhance mechanization, especially for small farms, through initiatives like expanding the Directorate of Agricultural Engineering and developing farmer-centric mobile apps. Bridging the knowledge gap and facilitating technology adoption are essential for advancing mechanization and improving agricultural practices nationwide.

For a future outlook, India aims for self-reliance in agricultural technology, and graduates in Agricultural Engineering are poised for significant opportunities in both public and private sectors. With upcoming policies favoring indigenous manufacturing and entrepreneurship, the demand for technical experts to drive innovation and technology adoption will only increase. The role of agricultural engineers as catalysts for change in the agricultural landscape is crucial, paving the way for a sustainable and prosperous future for Indian agriculture. Despite challenges like land fragmentation, Indian agriculture has a bright future with the integration of tiny robots and

artificial intelligence. The proposal for a National Institute of Agricultural Robotics and AI, under the SGoS-8 Vision India-2047 initiative, highlights India's proactive approach to agricultural innovation and technology.

Higher education is crucial for personal growth and is considered a basic human right, boosting the economy by providing advanced skills and creating more job opportunities. Recent trends in Karnataka highlight this importance, with a record 375,399 candidates registering for KCET 2024, as reported by the Karnataka Examinations Authority (KEA). Despite agricultural universities making up about 9% of all universities, enrollment in agriculture and allied sciences is under 1% of total higher education enrollment. Graduates in Agricultural Engineering excel in academic and professional roles across Central and State public services, technocrat positions in agriculture and allied departments, and sectors such as irrigation, IT, food processing, farm machinery, dairy companies, and financial organizations. Additionally, they can leverage entrepreneurial opportunities supported by the Atmanirbhar initiative.

The report of the Standing Committee on Agriculture, Animal Husbandry, and Food Processing on 'Research and Development in Farm Mechanization for Small and Marginal Farmers in the Country' in 2023 and has made 16 recommendations on the holistic upliftment of the sector. The committee proposes to appoint agricultural engineers at block and district levels, along with the creation of state-level Directorates of Agricultural Engineering, heralding a promising future for graduates in this field. These initiatives aim to fill gaps in machinery support and expertise, enabling graduates to drive agricultural innovation. With a growing emphasis on

mechanization and technological advancements, aspiring engineers have exciting opportunities to transform the agricultural landscape and build rewarding careers. It also recommends an advanced Agricultural Research Service (ARS) and the introduction of "Electronics and Instrumentation" as a new discipline, highlighting the government's commitment on par with other agriculture disciplines. The development of the Agriculture Information Management System (AIMS) by the National Informatics Centre (NIC) into a robust platform for smart farming solutions highlights the crucial role of technologists. These professionals integrate agricultural expertise with technology to create customized solutions that address the specific needs of farmers and the agricultural sector.

As the demand for agricultural engineers continues to soar, reflecting a projected 6% employment growth from 2022 to 2032, the future of agricultural engineering education is brighter than ever. With automation and AI revolutionizing farming practices, agricultural engineering programs and professionals play a pivotal role in equipping farmers with essential tools and knowledge for success in a digitized agricultural era. As we embrace the future, agricultural engineering education emerges as a beacon of innovation, offering endless opportunities to shape a sustainable and prosperous agricultural landscape.

The imperative to foster the expansion of higher educational disciplines and programs in Karnataka is undeniable. It calls for concerted efforts to raise awareness and provide educational opportunities at every level. Edu-Summit programs hold immense potential as catalysts for promoting and advancing this cause.

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**Karnataka's Agricultural Education Movement:
Cultivating Tomorrow's Food Leaders.**





TRICHODERMA

AN EFFICIENT TOOL FOR DISEASE MANAGEMENT IN SUSTAINABLE AGRICULTURE



About Author



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Agriculture is crucial for food security, poverty reduction, and natural resource sustainability. However, pests like weeds, insects, and bacteria affect crop quality and yield. Monocropping has led to soil-borne diseases, pollution, and resistance. Sustainable agriculture requires biological disease control. As of present day, several bio-control agents are recognized and accessible as bacterial agents such as *Bacillus subtilis*, *B. cereus*, *Pseudomonas fluorescens*, *Agrobacterium radiobacter*, and *Aspergillus niger*, as well as fungal agents such as *Trichoderma* spp., *Gliocladium virens*, *G. roseum*, *Aspergillus niger*, *A. flavus*, *Chaetomium globosum*, *Ampelomyces* spp., *Candida* spp., and *Coniothyrium* spp. It has been found to function well as an antagonist both in vivo and in vitro against a variety of fungal plant diseases. *Trichoderma* spp. is one of these biocontrol agents that is most useful and

has been used for a long time to manage plant pathogenic fungi.

Trichoderma and its occurrence:

Trichoderma, a soil inhabitant, asexually reproduced, green filamentous fungus, was first described by C.H. Persoon in 1794. The term *Trichoderma* has been derived from two words: thrix means hair means thread-like and derma means skin. Its antifungal properties were discovered in the 1930s by Welding and Fawcett, and have since been widely used in plant disease management. *Trichoderma*, an avirulent fungus, is a potent biocontrol agent used in soil amendments, biopesticides, and plant growth enhancers. Its effectiveness is influenced by various abiotic factors like soil pH and heavy metals. There are more than 80 species of the genus *Trichoderma* that are useful for controlling phytopathogenic fungi. The most promising biocontrol agents among them are thought to be *T. virens*, *T. viride*, *T. virens*, *T. lignorum*, *T. reesei*,



T. longibrachiatum, *T. virens*, *T. deliquescens*, *T. aureoviride*, *T. koningii*, *T. virens*, *T. virens*, and *T. aureoviride*.

Mechanism:

Trichoderma mostly kills or inhibits the spread of the infection through the following mechanisms.

Competition:

In this case, one organism (the target disease) is suppressed while the two species compete for limited amounts of nutrition, oxygen, and other resources.

Antibiosis:

Release of compounds that resemble antibiotics or other chemical metabolites by the antagonistic fungus, such as viridin, trichodermin, and so forth, which are toxic to the pathogen and either inhibit or destroy its growth.

Mycoparasitism:

Interactions between pathogens and organisms involve hyphae coiling, penetration, haustoria formation, and hyphae lysis through lytic enzymes, breaking down the pathogen's cell wall.

Induced resistance:

Trichoderma strains colonize plant root tissue, causing morphological and biological changes that serve as defense mechanisms and eventually establish induced systemic resistance.

Methods of application:

Seed treatment: Use 50 ml of water and 8–10 g of *Trichoderma* spp. powder formulation (2x10⁶ cfu/g) for larger seeds; use 6–8 g for smaller seeds to treat one kg of seed before sowing. In case of liquid formulation use *Trichoderma* spp. @ 5-10ml/liter of cow dung slurry for treating 1kg of seeds like cereals, pulses, and oil seeds. After that let the treated seeds dry in the shade for 20 to 30 minutes before planting. This is a highly effective method against seed and soil-borne diseases.

Seed material treatment: For seed material such as sugarcane setts, banana suckers, turmeric, ginger rhizomes, and potato tubers, treat @ 8–10 grams of *Trichoderma* powder with one liter of water for 30 minutes before sowing. It is

very important to let the seeds dry in the shade for 20 to 30 minutes before planting.

Soil application: A mixture of farm yard manure (FYM) (25–50 kg) and *Trichoderma* spp. Powder (1-2 kg) or liquid (500–1000 ml) is mixed, covered with paddy straw or jute bag, and stored in the shade for 2-3 weeks for optimal multiplication. Applying FYM 15 days after 15 days of sowing is recommended

Soil drenching: 1-2 kg of *Trichoderma* formulation mix in 200 liters of water and drench soil in 1-acre area, or 8 to 10 grams/liter of water in the soil in the nurseries, should be applied periodically.

Nursery bed treatment: 500 grams of powdered *Trichoderma* spp. should be mixed with 10 to 15 kg of well-decomposed FYM, compost, or vermicompost. The mixture should be spread out across an acre in the evening and under the proper moisture conditions. For soil drenching, 5–10 ml/liter of liquid *Trichoderma* spp. formulation is enough.

Cutting or seedling root dip treatment: A liter of water is used to dissolve 5–10 ml of liquid formulation or *Trichoderma* spp. powder formulation for approximately 30 minutes. After dipping the cuttings and seedling roots into this prepared liquid for 30 minutes, transplant the plants right away. Root dipping works well to prevent infections spread by the soil.

Foliar application: Apply a liquid formulation of *Trichoderma* spp. (3-5 ml/litre) or a powder formulation of 8–10 g/litre to infected plants during cooler hours, every 10–12 days.

Advantages of using Trichoderma:

- It performs well with both biofertilizers and organic manures, such as phosphorus-solubilizing bacteria, *Rhizobium*, *Bacillus subtilis*, *Mycorrhizae*, *Azospirillum*, and other bio-agents.
- It helps to solubilize phosphates that the crop is unable to absorb.

- It encourages the crop to absorb the macro and micronutrients that it needs.

- It is safe for consumers and farming communities, ecologically friendly, and helpful to the environment.
- It decomposes organic matter, increases soil fertility, increases absorption of soil nutrients by plants, and improves soil health and soil eco-system.

Limitations of use of Trichoderma:

- Keep seeds treated with *Trichoderma* out of direct sunlight.
- Use of *Trichoderma* formulation requires a mixture of organic manure or slurry.
- Avoid using chemical fungicides for four to five days following the application of the *Trichoderma* mixture.
- *Trichoderma* requires moisture for development and survival; avoid using it in dry soil.
- Avoid keeping the treated FYM for an extended period.

Conclusion:

One of the most significant fungi in agriculture is *Trichoderma*. It has proven to have numerous uses as both biofungicides and biofertilizers. It has also demonstrated its sustainability and different nutrient-supply methods for the crop. Furthermore, it has an advantage over other phytopathogen control strategies because it provides a variety of control mechanisms for different plant infections. As a result, farmers have the alternative to employ it for sustainable farming, which will raise produce yields and quality.





TRANSFORMING AGRICULTURE

INSPIRING ENTREPRENEURIAL VENTURES AND EMERGING SECTORS

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Entrepreneurship is the driving force behind innovation, economic growth, and job creation. It's about identifying opportunities, taking risks, and starting something new. Agricultural entrepreneurship is the application of entrepreneurial thinking and risk-taking to the agricultural sector. It involves identifying and pursuing new opportunities in farming, production, processing, and marketing of agricultural products. Agricultural entrepreneurs are

helping to revolutionize the agricultural industry by developing innovative solutions to the challenges facing the sector, such as climate change, resource scarcity, and food security. They are also creating new markets for agricultural products and increasing the profitability of farms.

Success stories of enterprises in agriculture

1. Ms Shahnaz Anis Manniker: Roti making women

Ms Shahnaz Anis Manniker is a Food Processing Entrepreneur from North Karnataka. She started her roti-making business upon her husband's business was closed due to sudden lockdown. Initially, she thought of making rotis manually but then found out about the Solar Powered Roti Rolling Intervention through SELCO Foundation, which helped her in financing the machine. Now, she makes about 1500 rotis daily and markets it locally. She has also employed 3 women from the neighbourhood for supporting the food processing business. She acts as a true inspiration to many aspiring

entrepreneurs who can integrate clean energy-driven solutions in the small food processing sector.

2. Cropway ensures sustainable Agtech supply chains

Agri input market place situated in Raipur, an Indian startup that makes an integrated AgTech platform that offers technology-enabled, sustainability-focused supply chain solutions. It features geospatial crop advisory and farm intelligence tools that use AI-powered algorithms to provide real-time price forecasting and pest or disease detection. Besides, the platform enables fertilizer calculation and crop prediction. Its seller studio helps farmers connect with buyers, processors, and output agencies to sell their produce. Additionally, its marketplace offers doorstep delivery for agriculture-related inputs, chemicals, and commodities. This enables agribusiness stakeholders to make data-driven decisions, improve productivity, and enhance profitability.

3. Evlogia eco care Pvt Ltd.

Evlogia Eco Care is a startup company that comes up with eco-



friendly and healthy innovations meant for daily use by common people. Leafy Straws are the need of the hour quite obviously and quite from a global point of view. Made from fallen down coconut leaves that might otherwise be burnt, emitting thick fumes, these straws do not contain any chemicals that can enter the body of the end-user. The only side-effect they have is a good one; they will help the rural economy in palm rich-growing South Asian countries.

4. BigHaat

Founded by Raj Kancham, Sachin Nandwana and Sateesh Nukala in 2015, BigHaat is a farmer-centric digital marketplace, which offers technical guidance and accessibility to a wide range of high-quality inputs to farmers. It is a full-stack data-based platform, which sources data through 7-8 channels to monitor consumer behaviour, sales patterns and cropping patterns. The data helps BigHaat analyse and predict how much produce will be generated by a particular farmer and how it will be affected by other external factors such as pests and weather patterns. The startup, which counts JM Financial, Ankur Capital and BlackSoil as its investors, claims to have onboarded more than 4 Mn farmers. The startup has so far secured more than \$13.4 Mn in total funding.

5. Ninjacart

The Bengaluru-based startup procures groceries, fruits and vegetables from farmers and delivers them directly to supermarkets and other retail stores. Founded by Nagarajan, Sharath Loganathan, Sachin Jose, Kartheeswaran KK and Vasudevan Chinnathambi in 2015, Ninjacart claims to source over 1,400 tonnes of fresh produce daily from farmers hailing from over 20 states. It then supplies the produce to over 17,000 retail stores. The startup has secured more than \$396 Mn since its inception. It is backed by names like Tiger Global, Walmart, Accel India and Trifecta Capital Advisors. Ninjacart saw its operating revenue cross the INR 1,000 Cr mark in the financial year ended

March 31, 2023. The B2B agritech startup reported sales of INR 1,153.4 Cr in FY23, up 19% from INR 967.3 Cr in FY22. Despite the rise in sales, the startup's loss grew 6% to INR 326.3 Cr in FY23 from INR 307.9 Cr in FY22.

6. Farmtheory

Established in 2019 by Arpit Agarwal and Sakshi Agarwal, Farmtheory is an innovative agri-waste management startup committed to mitigating waste at its source, empowering farmers to enhance their income, mitigate food loss, and combat climate change. With a dual focus on elevating farm yields and delivering premium ingredients to commercial kitchens, Farmtheory has successfully onboarded over 3,000 partner farmers and served more than 1,500 kitchens to date. Recently, Farmtheory secured seed funding of \$1.45 Mn (around INR 12 Cr) from Merak Ventures. These funds would be deployed to scale up its operations, expand its supply arm, and enhance its tech infrastructure. It also plans to reach out to more farmers, ensuring a robust and sustainable source of produce.

7. Salam kisan

Founded in 2022 by Dhanashri Mandhani, Salam Kisan is an end-to-end agritech startup, which offers services like drone-based soil testing, procurement, and marketplace offerings to farmers. The startup primarily earns its revenues from soil testing and drone services with which it claims to have covered over 15,000 acres of land, aiding 7,500 farmers. Currently, the startup is only operational in Maharashtra across 22 districts of the state, with a user base of 58,000 farmers. It also offers a DGCI-certified drone pilot training course valued at INR 50,000 per pilot. However, in the coming financial year, Salam Kisan also plans to enter the drone manufacturing segment, targeting the production of 250 drones by the end of March. The in-house drones are expected to serve the purposes such as spraying chemicals, pesticides, and seeds. As a bootstrapped

startup, Salam Kisan commenced operations with a preliminary investment of \$2 Mn.

8. Gramophone

Founded in 2016 by Tauseef Khan, Nishant Vats, and Harshit Gupta, Gramophone is an Indore-based full-stack agritech platform. It facilitates activities ranging from sourcing raw materials to warehousing. The startup sells agri inputs like seeds, fertilisers, nutrients, pesticides and farming equipment. It also provides standalone services such as warehousing and inventory management. The startup additionally assists farmers by offering crop advisory and weather information. Simultaneously, it provides agronomic intelligence and solutions to farmers through image recognition, soil science, smart crop selection, and personalised information-led cropping systems. The startup has secured close to \$19 Mn in total funding across five rounds. It is backed by investors like Info Edge, Z3 Partners, Asha Impact and Siana Capital. Last year, Info Edge announced that it would increase its stake in the company by investing INR 9.3 Cr (\$1.1 Mn) in Gramophone's parent Agstack Technologies.

Conclusion

In conclusion, the stories of these agricultural entrepreneurs exemplify the transformative power of entrepreneurship in the agricultural sector. From addressing critical issues like access to pure milk, to developing innovative technologies for farm management, and promoting sustainable practices, these ventures are reshaping the landscape of agriculture. Their successes not only contribute to economic growth and job creation but also offer solutions to pressing challenges such as food security and environmental sustainability. With continued support and innovation, agricultural entrepreneurship will play an increasingly vital role in ensuring a resilient and prosperous future for the industry and beyond.



MOONLIGHT MAJESTY

TRANSFORMING YOUR GARDEN INTO A NOCTURNAL RETREAT

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A moon garden is a concept in landscaping and gardening that focuses on creating a serene and magical outdoor space that can be enjoyed primarily at night. Unlike traditional gardens that emphasize bright colours and vibrant blooms, moon gardens are designed to highlight plants and features that stand out in the

moonlight, creating a tranquil and ethereal atmosphere.

A moon garden offers a captivating experience that unfolds from dusk till darkness, illuminated solely by the gentle glow of the moon and garden components. It invites exploration and enjoyment through both sight and scent, as the moon's light reveals the garden's enchanting features and the fragrance of night-blooming flowers fills the air with their intoxicating perfume. This serene and magical setting allows visitors to immerse themselves in the beauty of the night, offering a unique sensory experience that transcends the boundaries of daylight. Whether taking a leisurely stroll along moon light pathways or simply sitting and soaking in the tranquil ambiance, a moon garden provides a peaceful retreat

where one can connect with nature and find solace under the celestial canopy of the night sky.

Key elements of a moon garden include:

1. White and silver plants: Moon gardens often feature plants with white or silver foliage, flowers or variegated leaves. These plants reflect moonlight beautifully, enhancing the garden's glow



White and silver plants





Jasmine



Night scented stock



Single petalled tuberose

in the evening. Examples include white roses, tuberose, moonflower vines and white lilies.

2. Fragrant flowers: Incorporating fragrant flowers adds another sensory dimension to the moon garden experience. Night-blooming flowers like jasmine, night-scented stock, tuberose and evening primrose release their intoxicating scents after dusk, filling the air with delightful aromas.

3. Reflective Surfaces: Adding reflective surfaces such as water



Reflective Surfaces

features, polished stones or metallic ornaments can amplify the moonlight in the garden, creating shimmering effects and enhancing the overall ambiance.

4. Night-blooming plants: Including plants that bloom exclusively at night adds a sense of mystery and intrigue to the moon garden. Moonflowers, angel's trumpets, jasmine, tuberose and evening primroses are popular choices for their enchanting nocturnal blooms.

5. Sensory plants: Incorporating plants with interesting textures and foliage can enhance the sensory experience of the garden, even in low light conditions. Plants like ornamental grasses and ferns provide tactile interest and visual appeal.

6. Night time lighting: While the focus of a moon garden is on natural moonlight, subtle and strategic lighting can help illuminate pathways and highlight key features without overpowering the garden's nocturnal ambiance. Soft, warm-toned lighting fixtures or solar-powered lights can be

used sparingly to guide visitors through the garden.

7. Seating areas: Providing comfortable seating areas allows visitors to relax and enjoy the serene atmosphere of the moon garden. Whether it's a water component among foliage or a seating area under a tree, seating should be strategically placed to maximize views of the garden and the night sky.

Conclusion:

Overall, creating a moon garden is about embracing the beauty of the night and designing a space that encourages relaxation, reflection, and appreciation of nature's nocturnal wonders. Whether it's a small corner of a backyard or an expansive landscape, a well-designed moon garden can provide a magical retreat for evening strolls or it will be chance escape from day time chaos.





INDIAN MULBERRY

NUTRITIONAL FRUIT

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The tropical fruit of *Morinda citrifolia* or Noni, is widely grown all over the world. An alternative name for it is 'Indian Mulberry'. Regarding its capacity to restore health, it is among the most significant sources of traditional medicine. However, in recent years, its popularity has declined because of its unpleasant odor from the ripened fruit. It

is indigenous to Australia and Southeastern Asia (Indonesia).

Noni is renowned for having a wide range of environmental tolerances. It thrives in extremely dry to extremely moist environments and may grow on infertile, acidic and alkaline soils. Noni can withstand a broad range of environmental conditions, including exposure to flooding, wind, fire and salinity. Every portion of the plant has both traditional and contemporary purposes, the roots and bark are used for dye and medicines, the trunks are used for firewood and tools, and the leaves and fruits are used for food and medicines. Many different illnesses and disorders are treated with traditional and modern medicine, albeit most of these have not yet been proven to be effective by science. Noni grows well as a monoculture in full sun or as an intercrop in conventional agro-forestry subsistence systems. It has lately

attained major commercial relevance globally through a range of health and cosmetic products derived from fruits and leaves. Fruit juices are one example of these.

Table 2. Nutritional composition of Noni Fruit (in 15 ml juice)

S. No.	Fruit composition	Amount
1.	Calorie	3.5 kcal
2.	Carbohydrate	0.9 g
3.	Total Sugars	0.9 g
4.	Na (Sodium)	1 mg
5.	Vit (Vitamin C)	1.5 mg
6.	Niacin	170 mcg
7.	Folate	0.12 mcg
8.	Ca (Calcium)	2 mg
9.	Mg (Magnesium)	800 mcg
10.	Fe (Iron)	35 mcg
11.	K (Potassium)	10 mg
12.	Zn (Zinc)	300 mcg

General uses

- Fruits are used as a famine food and also use them in local medicine (juice) by people in places like Hawaii and Australia. Ripe fruits are eaten raw with salt and unripe fruits are cooked in curries in some cultures, including Burma. On long sea trips, fruit is boiled, mixed with coconut and consumed as a stimulant.
- Terminal buds are utilized for both culinary and medicinal purposes.
- **Nut/seeds:** Foetid oil, made from nuts or seeds, is applied topically to the hair to act as an insecticide or insect repellent.
- **Leafy vegetables:** Mature leaves are wrapped around fish before cooking and served with the fish itself, whereas younger leaves are cooked as vegetables and served with rice in Java and Thailand.
- **Beverage:** Dried leaves or fruits are used to create infusions and teas for medicinal purposes.
- **Spice/Flavouring:** When cooking, fish or other meats or foods are wrapped in noni leaves.
- **Food for animals:** The fruit is fed to pigs in places like Puerto Rico, while the leaves are used as animal

fodder in places like Niue, India, and as a source of nutrition for silkworms in other places.

Medicinal benefits

● Reduce blood pressure

The presence of Scopoletin, which has been demonstrated scientifically to cause blood vessels to enlarge and reduce blood pressure. Additionally, it encourages the body to produce Nitric oxide, a substance that makes blood vessel more elastic and capable of expanding more readily.

● Cures heart disease and stroke

A healthy circulatory system is encouraged by the xeronine system. Noni contributes more magnesium into the heart cells which aids in maintaining a healthy cardiac rhythm. Both anti-inflammatory and histamine inhibiting properties of scopoletin make them great for fostering the smooth joint movement.

● Enhanced immune system

The cellular enhancing properties of noni may help to reduce the damage to the joints and other affected tissues, including joints. The immune system and pancreas both operate better as a result. This is accomplished by noni serving as an adaptagen that helps in self-healing. This may relate to diabetes

by assisting cells that are unsuccessfully attempting to utilize blood glucose or by impairing the beta cells in the pancreas.

- Helps treat inflammation and allergies, which are the root causes of asthma.
- By controlling hormones and having an effect on the liver and hormone receptors, it also helps relieve menstrual migraine headaches. Noni tea functions as an analgesic, general febrifuge and aid in the treatment of Malaria.
- Jaundice is treated with a decoction made from Noni's stem bark.
- Poultices made of leaves or fruits can also be used to treat rheumatism, sprains, deep bruises, and TB.
- It is believed that the fruits are utilized as an appetite and brain stimulant.
- Red and yellow pigments, which are used to make dyes, are found in the bark and roots, respectively. Old-fashioned noni dyes, used for centuries, are still used to color clothing and textiles.



UNVEILING THE POTENCY OF MARINE COLLAGEN IN COSMETICS AND PHARMACEUTICALS

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This article explores the remarkable applications of fish collagen in cosmetics and pharmaceuticals, highlighting its structural similarity to human collagen and high bioavailability. Fish collagen, especially Type I, is becoming more and more popular in moisturizers, anti-aging cosmetics and formulations for healing. Application diversity of collagen for skincare is increased by its capability for UV protection. Fish collagen is

extremely useful in the pharmaceutical industry for drug delivery systems, bone regeneration, wound dressings and possible joint health remedies but there are obstacles like legal compliance and sustainable sourcing. A promising future in the revolutionary transformation of cosmetics and healthcare through sustainable, creative products is offered by the ongoing research necessary to fully realize the potential of fish collagen.

Introduction

Marine collagens, obtained from fish scales, skin, and bones, have acquired crucial value in cosmetics, health, and nutrition sectors. These collagen derivatives provide several benefits over traditional sources, with their distinct amino acid profile and molecular structure which makes them appropriate for cosmetics, medicines, and functional foods. Derived from varied marine environments, their amino acid content, including glycine, proline, and hydroxyproline, required for

collagen fibre development, sets them apart.

In skincare, marine collagens are valued for promoting skin health, reducing aging symptoms, and improving moisture and softness. The cosmetic industry frequently uses marine collagen in anti-aging treatments, recognizing its potential to increase overall skin condition. In pharmaceuticals, these collagens show potential in wound healing and tissue regeneration, suitable for sophisticated healthcare products including dressings for wounds and tissue engineering scaffolds, provided their biocompatibility with the body of humans.

Expanding into functional meals, marine collagens offer a nutritional component, which is present in dietary supplements and health goods. Their bioactive peptides improve joint health, bone strength, and overall well-being. The sustainability component adds appeal, as marine collagen is produced from by-products, harmonizing with





Figure 1: Sources of collagen from fish body (Rajabimashhadi, Z., 2023)

consumer priorities for eco-friendly alternatives. This not only benefits the environment but also connects positively with business enterprises utilizing these resources. Marine collagens thus provide a dynamic relationship of research, industry, and consumer interests in the constantly evolving field of bioactive chemicals.

Sources of marine collagen

Because of its potential health and cosmetic benefits, marine collagen, a protein obtained from fish and other marine sources, has gained prominence in a number of industries.

The extraction of collagen-like proteins from algae is being investigated by several businesses. Compared to marine collagen made from animals, algae collagen is thought to be a vegetarian or vegan substitute.

absorption into the skin, making it an excellent ingredient for anti-aging creams, serums and masks. Additionally, marine collagen peptides stimulate the body's own collagen production, promoting long-term skin rejuvenation.

a. Anti-aging formulations:

Anti-aging lotions, serums, and masks frequently contain marine collagen. This collagen from marine sources improves skin softness and reduces the visibility of fine lines and wrinkles. Marine collagen's special qualities make it a valued component in skincare products meant to fight the effects of ageing, offering customers a potential remedy for skin that looks younger and feels more hydrated.

b. Moisturizers and lotions:

Marine collagen, often integrated into moisturizers and lotions, is known

it helps to create a highly smoother and shinier complexion. The addition of marine collagen in skincare formulations highlights its crucial function in stimulating not only hydration but also overall skin regeneration, offering users with a luxurious and effective solution for maintaining a healthy and radiant appearance.

c. Wound healing and scar reduction:

The regeneration power of marine collagen proves beneficial in the healing process of wounds, placing it as a widely employed material in formulations developed for treating various skin conditions such as wounds, abrasions, and scars. Its application in these formulations is strategic, intending to speed up the healing timeframe and decrease the creation of scars. Marine collagen, with its reparative characteristics, interacts synergistically with the skin's natural processes, creating a conducive environment for faster tissue regeneration. This application of marine collagen in wound-care formulations emphasises its potential to not only fast healing but also contributes to the overall improvement in the aesthetic outcome by minimising the appearance of scars.

d. UV protection:

Recent research suggests that marine collagen exhibits potential UV-protective characteristics, establishing it as a beneficial element in sunscreens and sunblock's. Its presence in formulations seeks to establish a protective barrier, effectively insulating the skin from the detrimental impact of UV rays. Marine collagen emerges as a promising element in the ongoing pursuit of total skin defence against the damaging effects of sun exposure.

e. Hair and nail care:

Marine collagen, considered for its strengthening characteristics, is a prevalent component in haircare and nail care products. Specifically selected for its ability to fortify, it aims to prevent damage and promote the

Source	Body part	Species
Fish	Skin, Scales and Bones	Cod, Salmon and Snapper
Shellfish	Carapace (Shrimp), Skin (Squid and Cuttlefish)	Crabs, Lobsters and Shrimp
Other	Skin	Sea cucumber, Sea urchin

Cosmetic applications

In cosmetics, marine collagen is prized for its ability to improve skin elasticity, hydration, and firmness. Its smaller molecular size allows for better

for its great capacity to excel in water retention. This property contributes significantly to boosting skin hydration levels, delivering a deep and enduring moisturizing effect. As the marine collagen absorbs moisture into the skin,



general health of hair strands. In nail care, marine collagen is utilized to strengthen nail strands, potentially resolving concerns like brittleness and contributing to enhanced nail health.

Pharmaceutical applications

In pharmaceuticals, marine collagen's bioactive properties extend beyond skincare. Studies suggest that collagen aids in wound healing, joint health and bone regeneration. Its unique amino acid profile, including glycine, proline and hydroxyproline, supports these functions, making it a valuable ingredient in supplements and medical treatments.

a) Wound dressings: In the application of dressings for wounds, marine collagen emerges as a suitable choice due to its biocompatibility and exceptional capacity to stimulate tissue regeneration. These advanced dressings not only lower the danger of infection but also offer an optimal environment for the natural healing process. The biocompatibility of marine collagen makes it particularly ideal for stimulating tissue regeneration, giving a new path for revolutionary wound care solutions.

b) Bone regeneration: In orthopedic and reconstructive surgery, marine collagen plays an important part in bone regeneration, using its bioactive qualities to speed bone production and optimise the overall healing process. Its applicability in various medical operations is motivated by the capacity of marine collagen to offer a supporting matrix for bone formation, helping to the regeneration of skeletal components. As a crucial component in bone regeneration techniques, marine collagen has potential in enhancing orthopedic and reconstructive surgical procedures.

c) Drug delivery systems: Collagen matrices generated from marine sources exhibit excellent efficiency as carriers for drugs

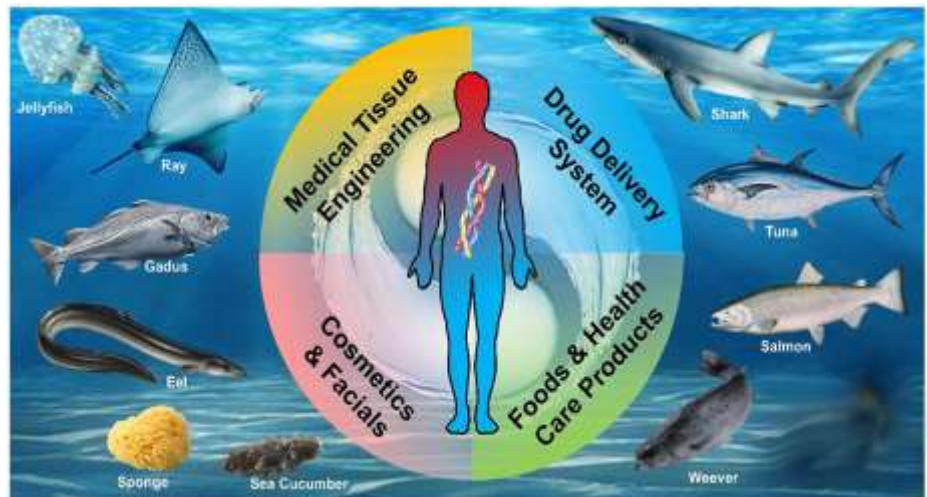


Fig 2: Marine collagens extracted from various marine biota (Xu, et al., 2021)

delivery systems. Their inherent features make them ideal for encapsulating pharmaceutical compounds, allowing for regulated and sustained release. Utilizing these marine collagen matrices boosts the effectiveness of various treatments by offering a personalised and controlled delivery route for therapeutic chemicals, thereby enhancing their influence on specific tissues or cells.

d) Joint health: Recent research reveals that marine collagen offers promise in increasing joint health, establishing it as a viable target for medications aiming at enhancing joint function, especially for disorders like osteoarthritis. The particular features of marine collagen, especially its bioactive components, make this a compelling subject for research into therapeutic approaches for joint-related disorders. This developing understanding emphasises the potential for marine collagen to contribute to the development of pharmacological solutions targeting enhanced joint health and addressing disorders defined by joint dysfunction.

e) Tissue engineering: The excellent potential of marine collagen to mimic the extracellular matrix, along with its great biocompatibility, presents it as a

viable material for scaffold creation in tissue engineering applications. Its capacity to accurately imitate the natural environment of cells provides a perfect substrate for regeneration of tissue.

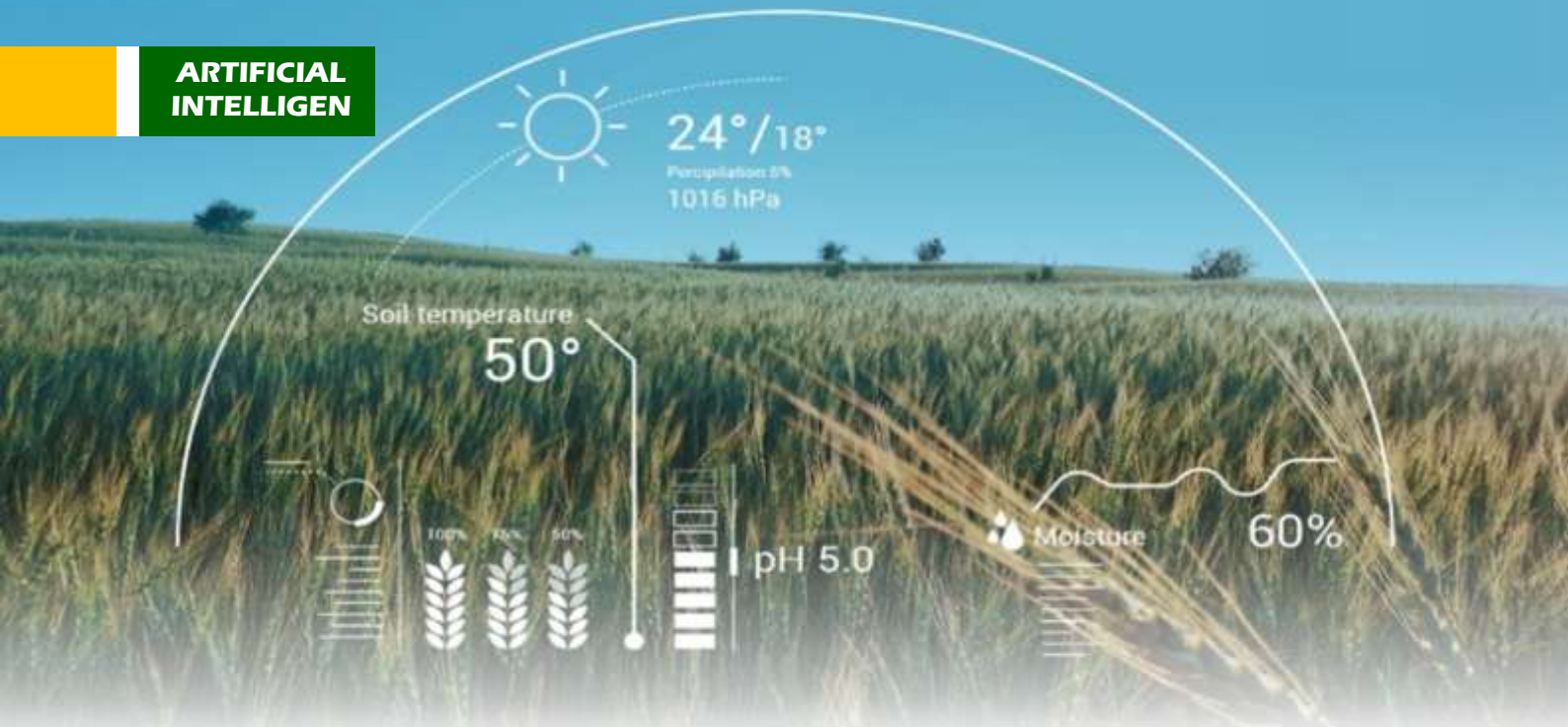
Challenges and considerations

Growing concerns regarding sustainable sourcing to avoid overfishing and preserve ecological balance have been raised by the increased demand for fish collagen. One of the biggest obstacles in the process of producing fish collagen for use in pharmaceuticals is adhering meeting regulatory standards and ensuring product safety. Purification, allergenicity and long-term impacts are among the many issues surrounding fish collagen that require further investigation before its full potential can be realised.

Conclusion:

Fish collagen is a versatile and fascinating material that has many applications in both cosmetics and medicine. Due to its special qualities, such as its high bioavailability and biocompatibility, it acts as a valuable resource in the pursuit of healthier and more resilient skin, bones and tissues. As technology advances and research progress, fish collagen may become more significant in the development of innovative products that enhance beauty and health.





ARTIFICIAL INTELLIGENCE (AI) IN AGRICULTURE IS EXPECTED TO INCREASE DRAMATICALLY

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Food waste, climate change, and other issues lead approximately one billion people to remain hungry and malnourished even though the globe produces enough food to feed everyone. And with 9.7 billion people expected to inhabit the planet by 2050, the agriculture sector is under increasing pressure to provide food with less

resource use and less environmental effect. Thankfully, the application of artificial intelligence (AI) in agriculture has promise for revolutionizing food systems and mitigating the world food issue.

AI can assist farmers in making data-driven choices, optimizing resource consumption, and minimizing environmental effect by analyzing data from several sources. According to a World Economic Forum analysis, integrating AI into agriculture might result in a 60% reduction in the use of pesticides and a 50% reduction in water usage. Market demand analysis is an essential component of contemporary agriculture. In addition to analyzing meteorological data and satellite photos, AI can assist farmers in choosing the best crop to produce or sell and offer insightful advice on when to plant and what kind of crop to grow. It is possible to forecast market demand for certain crops while optimizing profitability by examining data patterns. Farmers may reduce the likelihood of crop failures by using forecasting and predictive

analytics. This will create software applications that analyze fruits and vegetables and offer information on their quality, freshness, and size using artificial intelligence (AI) and computer vision methods. In addition to identifying flaws and illnesses in crops, these AI technologies allow farmers to take preventative action before the crops are impacted.

Artificial Intelligence (AI) can assist in the production of crops that are more weather and disease adapted by gathering data on plant growth. Scientists can use AI to find the best-performing plant kinds and crossbreed them to make even more superior hybrids. AI systems are capable of reliably estimating missing nutrients and performing chemical soil analysis. One of their products, Nutrient Scanner, gathers information from soil samples and gives farmers precise estimations of the nutrients that are lacking and the general condition of the soil. This enables farmers to optimize crop growth and minimize environmental impact by



modifying irrigation schedules and fertilizer applications.

AI can monitor the state of plants to spot and predict diseases, identify and remove weeds, and recommend effective treatment of pests. It can also suggest the most effective treatment for pests, reducing the need for broad-spectrum insecticides that can harm beneficial insects and lead to pesticide resistance. Farmers find it difficult and time-consuming to estimate crop growth and maturity, but AI can complete the work accurately and swiftly. Farmers are able to accurately forecast when crops will achieve ideal maturity by monitoring and tracking crop changes with the use of AI-powered gear, such as sensors and image recognition tools. According to studies, the accuracy rate attained by employing AI to forecast crop maturity was greater than that of human observers. Farmers may benefit from large cost savings and better revenues as a result of this improved precision. Farmers can precisely track the amount

of water and nutrients in the soil by integrating sensors and AI systems. Deploying devices that detect several factors such as temperature, pH levels, nutrient content, and soil moisture might be part of the sensor-based soil monitoring process. These sensors relay data back to AI systems, which process it, evaluate it, and advise farmers on the best ways to handle their crops in light of the soil conditions they have discovered.

AI-powered technologies can help farmers identify plant illnesses and insects faster than people can. For instance, an AI-powered system might identify an aphid infestation on a strawberry field, transmit the information back to the farmer's Smartphone, and then recommend the best course of action. Through a linked sprayer, the device could even automate the spraying of pesticides if necessary.

AI technology can be used to automate insect or weed control. Robotic weeding is supposed to be

extraordinarily accurate with the use of computer vision, saving 90% of pesticide use. These solutions use data analytics to determine how much pesticide is required for each field based on information about crop type, soil condition, and field history. In the upcoming years, artificial intelligence (AI) in agriculture is expected to increase dramatically since it has the ability to completely transform the industry by boosting efficiency, decreasing waste, and raising crop yields. The market for AI in agriculture is likely to develop rapidly, with a Compound Annual Growth Rate (CAGR) of 35.6% expected to see the market size rise from \$2.35 billion in 2020 to \$10.83 billion by 2025, according to a research by Markets and Markets. This will lead to more informed decision-making and improved crop yields, essential for addressing the global food security challenge.

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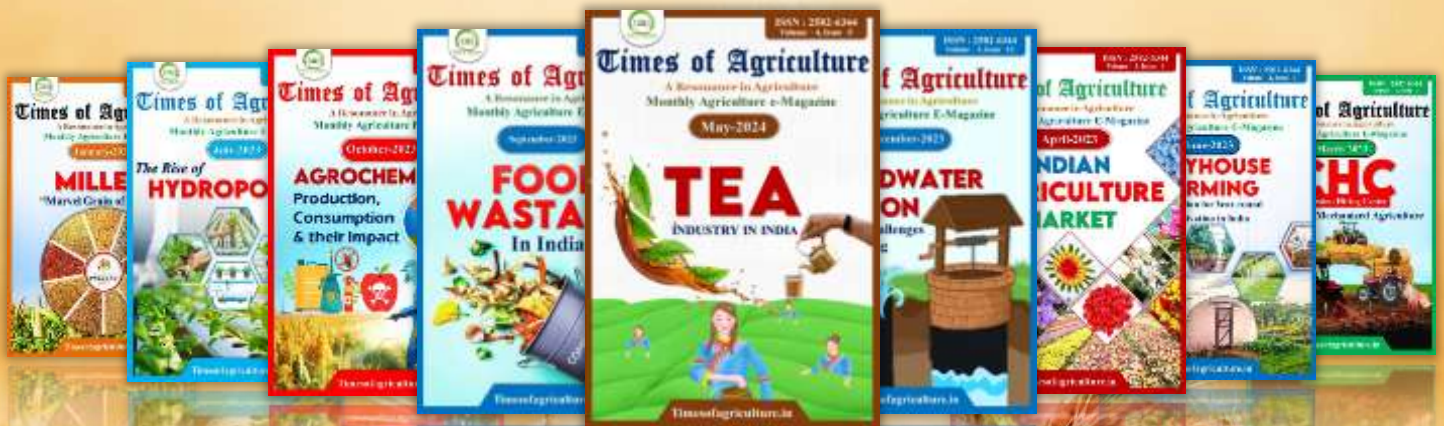


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