

## Entrepreneurial prospects for tuber crops technologies in India

The tropical tuber crops including cassava, sweet potato, yams, elephant foot yam, taro, arrowroot, and Chinese potato have played a significant role in ensuring food and nutritional security in tribal areas, but they now stand at a crossroads. The growing transition toward healthy eating and disciplined lifestyles, along with a strong political will for self-reliance, has reshaped the role of tropical tubers in the country. Among them, cassava contributes substantially to industrial production, particularly through starch and sago, while sweet potato is emerging as a healthy food that provides balanced nutrition for both children and adults. Elephant foot yam and greater yam have established themselves as commercial vegetables with stable market prices. In contrast, minor tubers such as arrowroot and Chinese potato serve niche industrial applications as well as direct consumption markets.

**Keywords:** Agri-business incubation, Export, ICAR-CTCRI, Organic tuber farming, Tuber crop entrepreneurship

From a business standpoint, India is a significant producer of tropical tuber crops, although their cultivation is concentrated in a few regions. These crops serve as vital raw materials for multiple industries. Cassava, for instance, is primarily cultivated in Tamil Nadu and Kerala, covering 154,980 ha with an annual production of 5.92 million tonnes—representing 87.07% of the country's cassava area and 93.36% of its total output. In Tamil Nadu alone, more than 90% of the cassava harvest is processed into sago and starch, which are extensively used across the food, textile, paper, and packaging industries. Sweet potato production is approximately 1.3 million tonnes annually, predominantly from Odisha, West Bengal, and Uttar Pradesh, which collectively contribute to 59.21% of the national output. Yams, elephant foot yams, and taro are cultivated in specific areas of Kerala, Andhra Pradesh, Odisha, and Bihar, and sold to meet local consumption needs.

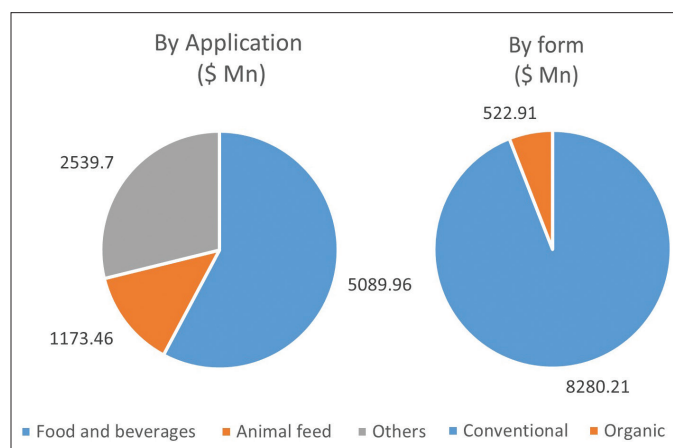
### MARKET DYNAMICS OF TUBER CROPS

Tuber crops are experiencing a steady increase in demand both for consumption and industrial production within India and abroad. The changing food habits, rising health awareness, and the preference for convenient, yet nutritious foods drive this growth in demand.

#### Domestic market

In India, the domestic market for tuber crops is shaped by both direct consumption of secondary staples and vegetables, as well as industrial utilization. According to Grand View Research (2025), the domestic demand

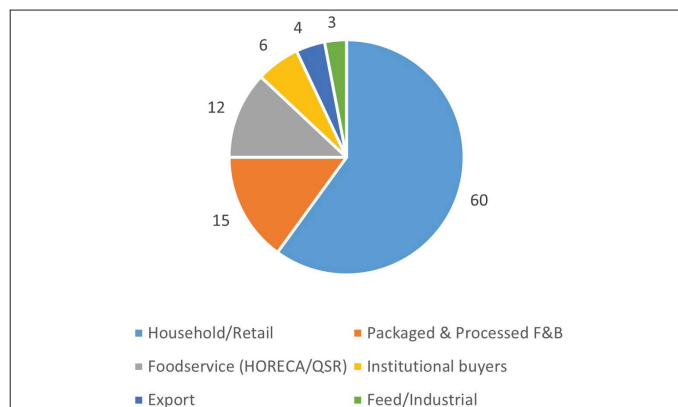
for processed tuber-based products, such as chips, snack foods, cassava flour, dried cassava, and quick-cooking cassava is on the rise. The market was valued at USD 22.5 million in 2024, and is projected to grow to USD 30.2 million by 2030, reflecting a CAGR of 5%. Cassava is used predominantly as food and for value-added food products (Kerala, Meghalaya, and Northeastern states) and as an industrial raw material to produce sago, starch, and other derivative products (Tamil Nadu and Andhra Pradesh). From a production standpoint, the cassava processing food market in India accounted for 10.71 million tonnes in 2024, and is expected to expand to 12.88 million tonnes by 2033, growing at a steady pace.



Cassava Market Size in India in 2021  
Source: Market Research Future, 2022

A key factor behind this growth of the cassava industry in India is the affordability and versatility of cassava foods, which readily adapt to diverse Indian cuisines. This flexibility, combined with their role in ensuring food and nutritional security, has significantly broadened their appeal across both rural households and urban consumers.

According to Data Bridge Market Research (2025), India's sweet potato market was valued at USD 1,837.66 billion in 2024, of which 60% sweet potatoes are consumed as food in the households.



Demand for sweet potato based on its utilization

The shift towards plant-based diets, increasing health consciousness, and the emergence of sweet potatoes as a healthier alternative to potatoes are key trends driving the growth of sweet potatoes in India.

### International market

On the export front, the demand for tubers and their products is buoyed by the large Indian diaspora, particularly the 8.88 million NRIs residing in Gulf countries as well as strong communities in Europe, where tuber-based foods remain integral to traditional diets. In 2023, India exported cassava products worth USD 17.756 million to destinations including the United Kingdom and Gulf countries. Among these exports, raw cassava accounted for the largest share (76.03%), valued at USD 13.5 million, primarily shipped to European and Middle Eastern markets. Frozen cassava has emerged as the major product in this segment, positioning India as the leading global exporter, with a contribution of 83% to the total world exports of frozen cassava, far ahead of Vietnam (11%) and China (2%).

Sweet potato is increasingly emerging as an export-friendly crop, driven by the rising global demand for

### Export of cassava products in 2023

| Product                                     | Export Value (USD Million) | Volume (tonnes) | Major Destinations                 |
|---|----------------------------|-----------------|------------------------------------|
| Raw cassava-tubers (frozen) and dried chips | 13.5                       | NA              | UK, UAE, Qatar, US, Australia      |
| Cassava (Manioc) starch                     | 3.04                       | 3,310           | US, Kuwait, Nepal, UAE, Sri Lanka. |
| Cassava flour                               | 1.22                       | 982.3           | United States, UK, Australia, etc. |

healthy foods and beverages. In 2023, India's exports of sweet potatoes (both raw and dried forms) were valued at USD 328,460, a figure that has more than doubled since 2019. The top importers of Indian sweet potatoes in 2023 were Nepal, Maldives, Bhutan, and the UAE. This reflects both improved international market access and the recognition of sweet potato as a versatile, nutrient-rich food crop.

Among the aroids, elephant foot yam stands out with remarkable export potential. According to Volza (2025), India was the largest exporter of elephant foot yam in 2023–24, accounting for 100% of the world's exports based on shipment volume. This unique position underscores India's dominance in the global trade of this niche tuber crop, presenting significant opportunities for scaling exports and developing value-added products.

### ENTREPRENEURIAL OPPORTUNITIES

Tuber crops offer diverse entrepreneurial opportunities for the aspiring youth, that spread across the value chains from seed systems, commercial farming, precision farming, eco-friendly production through food/industrial processing, and exports. With growing global demand for natural, healthy, gluten-free, and functional foods, as well as diverse industrial uses including bioethanol, bioplastics, and emerging export opportunities, aspiring entrepreneurs have a strong platform to build scalable ventures. The ICAR-Central Tuber Crops Research Institute, Thiruvananthapuram, has developed diverse technologies with high market potential to enable the entrepreneurs to create sustainable business ventures across tuber crops value chains.

### Good Agricultural Practices for Sustainable Farming

The rising demand for natural, organic, and value-added food products, combined with the increasing preference for high-quality industrial inputs among health-conscious consumers, has accelerated the adoption of Good Agricultural Practices (GAPs) in the production of tuber crops. In this context, organic farming modules and natural farming practices, when integrated with eco-friendly biopesticides such as *Nanma*, *Menma*, and *Shreya*, offer significant scope for developing Certification-based Business Models.

The adoption of organic farming packages for tuber crops has been shown to yield 10–20% higher yields and 20–40% higher profits compared to conventional production systems. The CTCRI-developed biopesticides, derived from cassava leaves—*Nanma*, *Menma*, and *Shreya*—have proven effectiveness against a broad spectrum of agricultural pests. These include borer pests (such as the banana pseudostem weevil and the red palm weevil), sucking insects (aphids, thrips, and whiteflies), and mealybugs, thereby providing a sustainable alternative to chemical pesticides.

To enable commercial-scale manufacturing, ICAR–CTCRI has licensed the extraction machinery and process to M/S Green Edge Agri Imports Pvt. Ltd., Trichy, Tamil Nadu. This technology transfer creates a pathway for entrepreneurial ventures, especially for FPOs, startups, and SMEs, to establish profitable enterprises in

eco-friendly crop protection products, while supporting sustainable agriculture and meeting global market demands for certified organic produce.

As part of the sustainable agriculture programme, ICAR-CTCRI has developed customized liquid micronutrient sprays tailored for specific tuber crops and soil types, including cassava in Tamil Nadu and Kerala, sweet potato, yams, elephant foot yam, and Chinese potato. These formulations have been commercialized by

serve the niche markets with various preferences, the ICAR-CTCRI has developed a few elite varieties which meet the location-specific needs.

The elite varieties can be commercially produced through the planting material production models developed by ICAR-CTCRI, such as seed villages (Certified seed system operating through Decentralised Seed Multiplier farmers associated with ICAR-CTCRI projects) and nutriseed villages (Specialised seed system

### Elite varieties of tuber crops released by ICAR-CTCRI

| Crop         | Varieties  | Key attributes  | Target market  |
|--------------|--|---|--|
| Cassava      | <i>Sree Athulya</i>  | High yield (39 t. ha <sup>-1</sup> ; High starch - 34.80 %                                    | Sago and starch industries – Estimated market size USD 364.9 million by 2030,            |
|              | <i>Sree Reksha</i>   | Medium starch (27-31%) and low sugar (1.10%) content, Resistant to cassava mosaic disease     | Raw material for the chip industries, starch and sago industries<br>Eri silkworm rearing |
|              | <i>Sree Jaya</i> and <i>Sree Vijaya</i>                              | Short duration and low cyanogen content (40-50 ppm)   | Human consumption and raw material for the chip industry                                 |
| Sweet potato | <i>Bhu Sona</i> and SP 95/4  | High β-Carotene content >19100 IU/100g fresh weight   | Health and wellness food industry – vacuum-fried chips and bakery products               |
|              | <i>Bhu Krishna</i> and <i>Sree Arunima</i>                           | High anthocyanin content (> 90 mg/100g)   | Health and wellness food industry - vacuum-fried chips and bakery products               |
| Taro         | <i>Muktakeshi</i>  | Excellent cooking quality and non-acrid tubers; Resistant to taro leaf blight                 | Human consumption  |
| Arrowroot    | <i>Sree Aadya</i> , <i>Sree Nakshathra</i> , and <i>Sree Karti</i> . | High tuber yield (>30.04 t. ha <sup>-1</sup> ; and starch yield (> 5.95 t. ha <sup>-1</sup> ) | High growth arrowroot starch market, estimated as USD 2.75–2.75 billion in 2024.         |

M/S Linga Chemicals, located in Madurai, Tamil Nadu. The ICAR-CTCRI foliar micronutrient technologies consistently boost yields across tropical tuber crops, with cassava and elephant foot yam showing the highest gains (20–27%). This translates into significant profit advantages (20–40%), especially when combined with organic/natural farming packages and GAP certification models.

### Seed and Planting Material Enterprises

Using high-quality planting materials as critical inputs for the commercial production of tropical tuber crops to maximize profitability. The quality planting material of improved varieties determines their yield potential, tuber size, and resistance to pests/diseases. As the tuber crops

for biofortified varieties of sweet potato and yams, managed by the Satellite Incubation Centres of ICAR-CTCRI Agri-Business Incubator). The models are proven to be effective in creating viable seed enterprises.

### Processing and value-addition from GAP-compliant tuber crops

ICAR-CTCRI has developed several value-added food products and services that cater to a wide range of consumer segments. The products range from cassava leaf-based bioformulations to healthy snacks and bakery products. To make tuber crop-based enterprises viable, the ICAR-CTCRI has developed several feasible and sustainable business models.

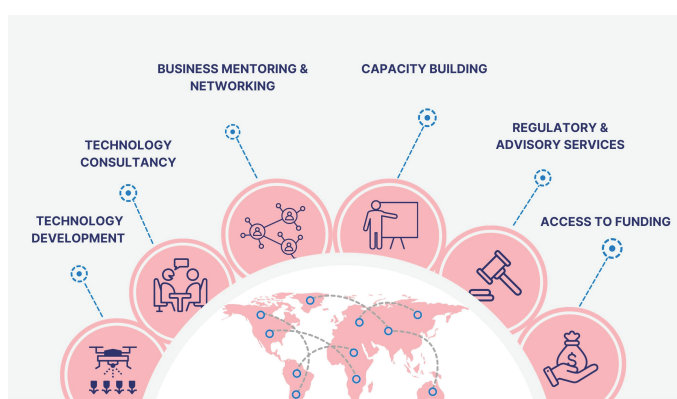
### Business models developed for tuber crop technologies

| Model  | Salient features   | Technologies   | Successful models   |
|--|--|--|---|
| Contract manufacturing model   | Granting a manufacturing license of a technology to a private agency with a buy-back arrangement                             | E-crop – A precision farming device which provides customised advisory to farmers in managing farm operations<br><br>CTCRI Bioformulations – <i>Nanma</i> , <i>Menma</i> , and <i>Shreya</i> | M/s Semilon Technologies Private Limited, Thiruvananthapuram<br><br>ICAR-CTCRI provides the bioformulation concentrate, and the KVKs prepare three variants for large-scale field testing and limited non-commercial use. |
| Business Models for Cassava-based Micro food Enterprises (Kerala and Tamil Nadu) | Cassava-based business models for assisting small-scale industries in securing Central/state government grants in Tamil Nadu | Food-grade edible cassava flour, fried chips/snack, functional pasta, bakery products  | Mithram Food Products, Moozhoor, Kottayam, Kerala   |
| Grassroot Incubation Centre model  | Grassroot processing facility for producing snack foods from locally cultivated cassava                                      | Fried cassava snacks   | Village Incubation Centre, Riha, Ukhrul District, Manipur   |

| Model  | Salient features  | Technologies  | Successful models   |
|--|---|---|---|
| e-Crop-based smart farming model                       | Precision farming agro-advisory service using an IoT device. The farmers receive data-driven decisions for irrigation, nutrient use, pest/disease management, and harvest planning.   | E-crop technology-based innovative farming system   | Demonstrated in farmers' fields in five panchayats – Anad, Aruvikkara, Vembayam, Karakulam and Panavoor – of Nedumangadu block, Thiruvananthapuram district, Kerala.          |
| Technology commercialisation for industrial processing | Granting licenses of high-value tuber crop technologies to startups and industries for commercial manufacturing   | E-crop technology<br><br>Super absorbent polymer  | M/s Tech Visit IT Pvt. Ltd., Mumbai (Domestic and International sale)<br>M/s SKR Agrotech, Wardha, Maharashtra<br>Green Edge Agri Imports Pvt. Ltd, Trichirapalli, Tamil Nadu |
| Unified Technology-to-market Showroom Model            | A centralized, branded physical marketplace where all the technologies, value-added products, farm implements, and inputs developed by research institutes of ICAR (are showcased, demonstrated, and sold/licensed under one roof.<br>Managed by an Incubatee of ICAR-CTCRI Agri-Business Incubator | CTCRI bioformulations – <i>Nanma, Menma and Shreya</i><br>Technological products of ICAR Institutions | Roots-Mart Mall, ICAR-CTCRI, Thiruvananthapuram   |

### ENTREPRENEURIAL ECOSYSTEM

The entrepreneurial ecosystem of tuber crops in India is transitioning from subsistence-level, farm-based activities to organized, technology-driven, nutrition and industry-linked enterprises. The ICAR-CTCRI anchors this ecosystem through substantial research and development (R&D), technology incubation, and technology transfer and commercialization. Equipped with two business incubators in Thiruvananthapuram—the SFAC Techno-Incubation Centre and the ICAR-CTCRI Agri-Business Incubator—and the RKVY Techno-Incubation Centre in Bhubaneswar, Odisha, ICAR-CTCRI is catalysing new businesses centered on tropical tuber crops. While the Techno-Incubation Centres primarily serve as hubs for technology development and training, the ICAR-CTCRI Agri-Business Incubator focuses on facilitating and nurturing start-ups and emerging enterprises. The range of services offered by these incubation facilities at ICAR-CTCRI is presented below.



Incubation services provided by the ABI and TIC

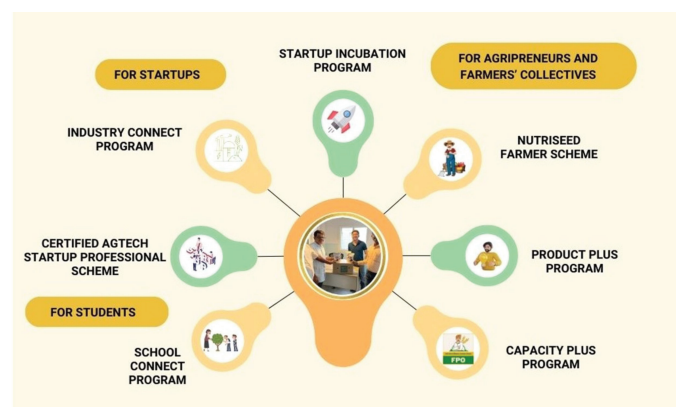
Since 2015, these incubation centres have contributed substantially to developing tuber crops entrepreneurial ecosystems for tuber crops businesses in India.

To create sustainable businesses across tuber crops value chains, the ICAR-CTCRI ABI has developed the Satellite Incubation Centre (SIC) through collaboration with local partners (FPOs, NGOs, DMF, SHG federations,

### Achievements of ICAR-CTCRI tuber crops technology and business incubation

| Aspect   | Achievements |
|--|--------------|
| New businesses created – Startups, MSME and agripreneurs | 12           |
| Entrepreneurs and farmers trained                        | 12,630       |
| New technologies developed through the PPP mode          | 17           |
| Industry meets organised                                 | 6            |
| Intellectual Property Protection                         | 12           |

Panchayats). The SICs are grassroots business incubators designed to create and nurture viable businesses across tuber crop value chains. They provide incubation support to strengthen the value chains of tuber crops. Currently, ICAR-CTCRI ABI has three active SICs at KVK, TANUVAS, Kallakurichi (Tamil Nadu); Regional Agricultural Research Station, Kerala Agricultural University, Pattambi, Kerala, and at the Regional Station of ICAR-CTCRI, Bhubaneswar, Odisha. Various incubation programmes implemented by ICAR-CTCRI Agri-Business Incubator are displayed below.



Incubation programmes of ICAR-CTCRI ABI and its Satellite Incubation Centres

### CONCLUSION

Tropical tuber crops, with their adaptability to diverse agro-climatic conditions and their ability to provide a wide

range of nutritional benefits, hold immense entrepreneurial potential in India. Their versatility extends across seed systems, food processing, biofortified functional foods, industrial starches, eco-friendly biopesticides, and farm implements, creating multiple entry points for start-ups, FPOs, SHGs, agripreneurs, and export-oriented businesses. Backed by ICAR-CTCRI's strong technology development system, its influence on programs and policies, and its proven capacity to foster sustainable entrepreneurship through business incubation, the entrepreneurial ecosystem around tuber crops is expanding rapidly. However, unlocking the full potential of tuber crops requires addressing key challenges such as post-harvest losses, seed degeneration, fragmented

markets, price volatility, and limited export promotion. By fostering cluster-based enterprises, promoting GAP and organic certification, investing in digital tools such as the E-Crop smart farming model, and strengthening market linkages, tuber crops can evolve into a profitable, sustainable, and inclusive agribusiness domain.

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## NATIONAL FARMERS' DAY, 2025

### *Kisan Diwas*

*Kisan Diwas*, or National Farmers' Day, is celebrated in India on 23 December, to honour farmers and commemorate the birth anniversary of Shri Chaudhary Charan Singh, the fifth Prime Minister and a champion of farmers' welfare. The day highlights the vital role of farmers in ensuring food security and driving rural and national development.



#### **Honours Farmers**

It is a day to appreciate the relentless efforts of farmers and their pivotal role in feeding the nation and sustaining its prosperity.

#### **Recognizes Agricultural Contributions**

*Kisan Diwas* acknowledges the indispensable contributions of farmers to the nation's progress and the rural economy.

#### **Purpose**

*Kisan Diwas* highlights the challenges in agriculture, promotes farmer welfare and sustainable growth, and honors farmers' vital contributions to India's economy and prosperity.

#### **Activities**

Celebrations often include farmers-scientist interfaces, seminars, debates, workshops, and award functions to acknowledge farmers' efforts.

#### **ICAR's Role**

Institutes under the ICAR will host events to engage with farmers and highlight achievements in agricultural research and development.