



Revitalizing Tropical Tuber Crops Cultivation in Kerala



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Executive Summary

Tropical tuber crops like cassava, elephant foot yam, yams, taro, sweet potato, Chinese potato, arrowroot and a few others are ancient, starchy crops with vital roles in food, livelihood, and climate resilience. Kerala, once a major producer-particularly of cassava-is witnessing a sharp decline in area under cultivation and production despite productivity and profit gains mainly due to technological interventions. Strategic interventions are needed to revive the sector, support smallholders, and enhance food, nutritional and livelihood security.

Key issues

1. Decreasing Area Under Cultivation: Cassava area dropped from 3.27 lakh ha (1975) to 55,713 ha (2022).
2. Seed System Gaps: Lack of a formal seed system limits access to sufficient supply of quality planting materials.
3. Underutilized Varieties and Technologies: Adoption level of improved varieties and agrotechniques need substantial increase.
4. Pests & Diseases Pressures: Emerging threats like stem and root rot, red spider mite and mealy bug of cassava, leaf and pseudostem rot of elephant foot yam and a few other pests and diseases are escalating. Attack of wild boar is a very serious issue.
5. High Production Costs: Tuber crops have higher production costs, limiting competitiveness in value added food products market.
6. Market Instability: Post-harvest perishability and price fluctuations hinder farmer income and value addition prospects.

Strategic recommendations

1. Area Expansion & Seed System Reforms
 - a. Double cassava area to 1 lakh ha and sweet potato area to 10000 ha in 5 years using a block-wise expansion model.
 - b. Establish Seed Villages (SV) and Decentralized Seed Multipliers (DSM) of cassava across 62 target blocks.
 - c. Achieve 15–20% seed replacement rate annually with improved varieties.
2. Smart Tuber Crops Clusters
 - a. Develop 50-100 Smart Tuber Crops Clusters with processing units for value-added products.
 - b. Scale up 'Rainbow Diet Campaign', a successful institutional innovation model developed by ICAR-CTCRI, for developing locally adaptable agri-food systems.
 - c. Promote β -carotene-rich sweet potato and their value added products among lactating women and pre-school as well as other children in Anganwadis to address vitamin A deficiency.
 - d. Establish smart clusters of elephant foot yam, taro and Chinese potato in selected blocks.
3. Technology Scaling
 - a. High-yielding, short-duration and climate resilient varieties.
 - b. AI, IoT and crop models based smart farming using ICAR-CTCRI developed e-Crop especially for location-specific production systems.

- c. Climate resilient agriculture practices
 - d. Precision and regenerative farming practices- organic farming
4. Inclusive Agri-business Development
 - a. Support value-added enterprises for food, feed, and industrial uses.
 - b. Partner with FPCs, Kerala State Kudumbashree Mission, and Startups to build 50-100 Smart Tuber Crops Clusters.
 - c. Encourage export-oriented entrepreneurship and technology licensing.
 5. Policy and Institutional Support
 - a. Close linkage among development department, agricultural university, ICAR institutions and KVKs for technology validation, variety development as well as for technology scaling and commercialisation.
 - b. Annual updates to the Package of Practices of Crops about varieties and production technologies.
 - c. Formal seed system of tuber crops through state seed farms.
 - d. Value chain and impact assessment of tuber crops technologies.
 6. Research Priorities
 - a. Develop high yielding, nutritionally rich, low GI, culinary varieties of cassava with higher amylose (27-30%) content. In other tuber crops, develop multiple trait specific varieties for different agro climatic zones and uses.
 - b. Invest in genome editing, speed breeding, phenomics, predictive breeding and biofortification to develop future tuber crops varieties with targeted traits.
 - c. Develop AI, IoT and sensor based smart farming for cropping / farming systems and locally adaptable climate resilient agriculture (CRA) practices for different AEUs.
 - d. Develop urban and peri-urban farming technologies such as smart nutrition gardens, soilless cultivation, hydroponics and aeroponics.
 - e. Develop machinery to ease drudgery in land preparation, planting, weeding, and harvesting with special emphasis on women-friendly tools.
 - f. Improve post-harvest shelf life to reduce food loss and enable market linkages as well as to develop value added enterprises.
 - g. Develop novel value added products such as animal feed, baby food, military food, bubble tea, dietary supplements, climate smart food products such as meat analogues, starch based industrial products such as mucoadhesive starch membranes for controlled oral drug delivery.

Conclusion

Tropical tuber crops are crucial to Kerala's food, nutritional, and climate resilience strategies. With coordinated efforts in research, extension, seed systems, and value addition, the state can reclaim its position as a tuber crops leader-ensuring farmer welfare and sustainable agri-growth.

1. Introduction

During the Megalithic period, a continuation of the Neolithic age, Kerala saw the beginnings of organized social structures, permanent settlements, and agriculture around 4,500 years ago. Historical records show that cassava, which originated in the southern Amazon forests of Brazil and was domesticated about 10,000 years ago, reached Africa in the 16th–17th centuries and eventually came to Malabar region in Kerala. It was introduced and popularised in Travancore during a famine between 1860–1880 by Sri Visakham Thirunal, brother of the then King Sri Ayilyam Thirunal and a skilled botanist who was also the successor of Sri Ayilyam Thirunal and reigned Travancore during 1880-1885.

Cassava use subsequently expanded beyond food to include animal feed and industrial products like starch, sago, alcohol, and sweeteners. Over the past 50 years, cassava cultivation spread to many countries like China, Thailand, Indonesia, Lao PDR etc. By 2023, it was grown in 114 countries, covering 32.217 million hectares, producing 333.681 million tonnes of tuber.

Tropical tuber crops include around 15 starch-rich crops like cassava, sweet potato, yams, taro, elephant foot yam, Chinese potato, arrowroot etc.—crops that have been cultivated for 5,000–10,000 years.

2. Trends in Cassava Cultivation

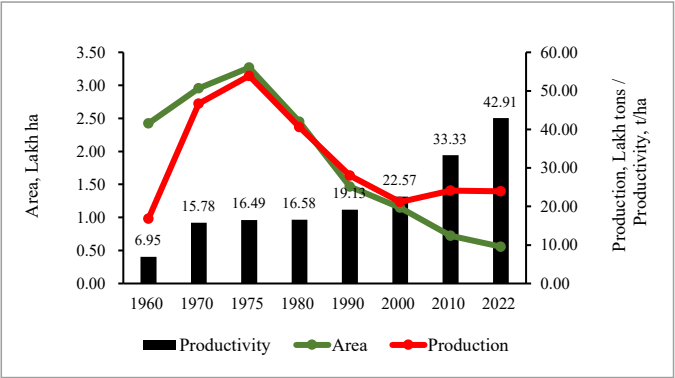


Figure 1. Trends in Cassava Cultivation in Kerala (1960–2022)

Figure 1 shows the trends in area, production and productivity of cassava in Kerala over the past 63 years. From 2.42 lakh ha cultivation in 1960, it peaked at 3.27 lakh ha in 1975, but drastically dropped to 55,713 ha in 2022. Cassava production rose to 53.90 lakh tonnes in 1975 from 16.83 lakh tonnes in 1960, but dropped to 23.90 lakh tonnes in 2022. Productivity increased from 6.95 t/ha in 1960 to 42.91 t/ha in 2022—an 8.2% annual growth rate,

a record among major crops in Kerala. This rise in productivity, despite reduced area, is mainly attributed to successful research, development, and extension efforts.

3. Area, Production and Productivity of Tuber Crops in Kerala (2022-23)

Table 1. Area, Production & Productivity of Tuber Crops in Kerala (2022–23)

Crop	Area (hectare)	Production (tonnes)	Productivity (t/ha)
Cassava	55713	2390395	42.91
Taro	5185	58024	11.19
Elephant foot yam	4486	241000	53.73
Greater yam	1236	42210	30.00
Chinese potato	848	12720	15.00
Arrowroot	345	8625	25.00
Lesser yam	171	3078	18.00
Sweet potato	150	2133	14.22
Total	68134	2758185	

Table 1 presents the area, production and productivity of tuber crops in Kerala. Tuber crops were grown in 68134 ha with a total production of 27.58 lakh tonnes and a lion's share of it is cassava (23.90 lakh tonnes).

4. Profitability Comparison

Table 2. Economics of production of tuber crops vis-à-vis other major food crops in Kerala

Crop	Production Cost (Cost A) (Rs/hectare)	Value of Produce (Rs/hectare)	Profit (Rs/hectare)
Cassava	150000	450000	300000
Elephant foot yam	1000000	1750000	750000
Rice	75000-87500	112500-125000	37500
Banana	225000-250000	625000	375000-400000
Pepper	100000	250000	150000
Pineapple	250000	425000	175000
Vegetables/Spices	100000-200000	200000-450000	100000-250000
Coconut	100000	162500-175000	62500-75000

Table 2 shows the total production cost, total income and net income from important tuber crops in comparison to a few other food crops in Kerala. Elephant foot yam and cassava are among the most remunerative crops along with a few other crops like banana and ginger. A net profit of at least Rs. 1 lakh/acre or Rs. 2.5 lakh/hectare is a minimum need and only a few crops give a net profit of above Rs. 1 lakh/acre and it is noteworthy that many tuber crops give net income more than Rs. 1 lakh/acre.

5. Key Challenges in Tuber Crops Cultivation

Despite increases in productivity for crops like cassava, elephant foot yam and yam, tuber crops cultivation in Kerala faces several serious challenges:

1. Decline in area under cultivation and total production

While productivity has improved for a few crops, the area under cultivation and total production continue to decline sharply, especially for cassava and sweet potato.

2. Low productivity in some crops

Though there has been a substantial increase in productivity of cassava and elephant foot yam over the years, crops like sweet potato, taro, and Chinese potato still have relatively low productivity. For many of these tuber crops including cassava and elephant foot yam, the potential yield is 2-4 times the current realized yield.

3. High cost of cultivation

Compared to other crops, tuber crops have higher cultivation costs, making it hard for value-added products from tubers to compete with analogous products from other crops in the market.

4. Long crop duration

Most tuber crops have long-duration (5-11 months) except for sweet potato (2.5-4.0 months), which increase their cost of cultivation and also make them vulnerable to climate variabilities.

5. Vegetative propagation constraints

Majority of tuber crops are propagated vegetatively. This limits the rapid multiplication and distribution of newly developed high-yielding varieties. Vegetative propagules are heavy, bulky and perishable, making transport and storage difficult and expensive. Vegetative parts often carry bacteria, fungi, viruses and nematodes, hence a high risk of spreading pests and diseases.

6. Lack of a formal seed system

There is no organized certification and formal seed systems in place for tropical tuber crops, which further complicate the production and distribution of quality planting material.

7. Small and fragmented land holdings

Most tuber crops farmers in Kerala are small and marginal farmers cultivating on small patches of land. Combined with the undulating topography of Kerala, this makes

mechanization and scaling of production & smart farming technologies difficult.

8. Rising pests and diseases incidence

Many tuber crops are facing serious pests and diseases threats due to change in climate. New pests and diseases are also emerging. For example, first report of infestation of cassava mealy bug, *Phenacoccus manihoti*, in India was from Thrissur, Kerala in 2020. Also in cassava, stem and root rot, a new disease reported for the first time in Kerala in 2018, has become a very serious issue during past 5 years, often completely destroying the tubers before symptoms appear aboveground. Leaf and pseudostem rot in elephant foot yam is another example.

9. Market price volatility

Significant fluctuations in market prices in alternate years are a major concern for farmers.

10. Wild animal attacks

Wildlife damages especially by wild boar has become a growing threat to tuber crops farmers in all 14 districts of Kerala. ICAR-CTCRI farm, located in Thiruvananthapuram city also faces attack by wild boar and crop damage.

11. Post-harvest storage only for a short period

Cassava deteriorates within 1-2 days after harvest (post-harvest physiological deterioration- PPD). Sweet potato cannot be stored for more than 1-2 months. This severely limits marketing, value addition, and product diversification.

6. Technological Interventions

Tuber crops research in Kerala began in 1942 and gained momentum with the establishment of ICAR-CTCRI on 01 July 1963. Since then, significant advancements have been made:

A. Development of improved varieties, production and protection technologies

In 1971, ICAR-CTCRI released India's first high-yielding hybrid cassava varieties, H-97, H-165, and H-226. Since then, 77 improved varieties of tropical tuber crops have so far been released, of which 22 are improved cassava varieties with specific desirable traits.

Notable varieties include:

1. Sree Jaya and Sree Vijaya (1998): Short-duration types suitable for paddy fields and coconut gardens.

2. Sree Sakthi, Sree Suvarna: Virus-resistant varieties introduced to combat cassava mosaic disease.
3. Sree Reksha (drought-tolerant and cassava mosaic disease resistant) and Sree Pavithra (low potassium requirement) are now widely cultivated in Kerala.
4. In 2024, ICAR-CTCRI released Sree Annam and Sree Manna, two NPK use efficient, high yielding and high-quality cooking varieties.
5. Varieties like Kalpaka, Uthama, Vellayani Hraswa, and Nidhi were released by Kerala Agricultural University for specific agro-climatic zones.
6. Orange fleshed sweet potato (OFSP) and purple fleshed sweet potato (PFSP) from ICAR-CTCRI are very popular among farmers.
7. Varieties of taro, elephant foot yam, yams, Chinese potato and arrowroot are also worth mentioning. Dwarf and semi-dwarf yams are good for farming by urban population.

To ensure wider distribution of these varieties, ICAR-CTCRI developed 'minisett' techniques and were further improved and recently a very successful seed production technology using 'protrays' have been successfully developed and scaled up with higher success rate. Seed villages and decentralized seed multiplier model developed and validated by ICAR-CTCRI has now been scaled up for rapid area expansion.

ICAR-CTCRI has also developed scientific crop management practices, sustainable cropping / farming system models in different agro ecological units of Kerala, nature based solutions for sustainable production intensification, sustainable management of biotic stresses and climate resilient agriculture. Significant growth rate in productivity in cassava is attributed to these technological innovations.

B. Impact assessment of research

ICAR-CTCRI conducted a study to assess the impact of improved varieties and agrotechniques of cassava and sweet potato developed and popularised in India during 1971-2018. The impact analysis showed that ICAR-CTCRI's technologies yielded a direct benefit of ₹12,321 crores to producers and consumers. The benefit-cost ratio was 9.75 and internal rate of return (IRR) was 54%. Annual direct benefit from these technologies are valued at ₹197 crores.

Impact assessment by the author based on FAO cassava

production statistics during 1960-2022 and value of output indicated that annual increase in production of cassava due to impact of technologies is to the tune of ₹200 crores per year. Another recent study by ICAR-CTCRI showed that cassava varieties developed by the institute are cultivated in 39% of cassava area in Tamil Nadu and 30% in Andhra Pradesh. Elephant foot yam varieties released by ICAR-CTCRI and All India Coordinated Research Project on Tuber Crops (AICRPTC) cover 100% of the elephant foot yam area in Andhra Pradesh.

Five multi-micronutrient liquid foliar formulations for different tuber crops developed by ICAR-CTCRI and licensed to M/s Linga Chemicals, Madurai resulted in an economic benefit of ₹21.23 crores to farmers over past five years.

Despite these advances, a study revealed that ICAR-CTCRI varieties are cultivated in only 14% of the cassava-growing area in Kerala, indicating the need for focused efforts in dissemination and adoption.

7. Yield Gap

Productivity of tropical tuber crops in Kerala and India in comparison to that of the average of world's five highest yielding countries and world's five highest yielders is given in table 3.

Table 3. Productivity of tropical tuber crops

Crop	Kerala	India	Average of world's five highest yielders	World's highest yield
	(t/ha)			
Cassava	42.91	35.77	32.91	41.41
Elephant foot yam	53.73	24.74	NA	NA
Taro	11.19	15.30	39.80	65.85
Greater yam	30.00	27.00	32.50	79.98
Sweet potato	14.22	11.72	36.34	45.52
Chinese potato	15.00	20.00	NA	NA
Arrowroot	25.00		NA	NA

Cassava productivity in Kerala (42.91 t/ha) is higher than even the world's best (Guyana – 41.41 t/ha). Elephant foot yam productivity in Kerala is exceptionally high compared to the Indian average. However, productivity is low for crops like taro, sweet potato, and Chinese potato, and needs targeted attention. Despite Kerala's top figures in cassava productivity, the current productivity is still only 40% of its potential yield (100 t/ha), suggesting considerable scope for further improvement.

8. Scope for Increasing Production Through Technology Adoption

To significantly boost tuber crops production in Kerala, increasing the rate of adoption of proven technologies is essential. Key proposals include:

A. Expand area under cultivation – focus on cassava

Cassava, the most important tuber crop in Kerala, is declining in area. Currently grown in 55,713 hectares, a target of 1 lakh hectares over the next five years is proposed.

Only 14 blocks in Kerala have more than 1,000 ha under cassava. Another 25 blocks have 500–1,000 ha and 23 blocks have 250–500 ha under cassava. In the remaining 90 blocks, cassava area is less than 250 ha. It is proposed that the highly successful 'seed villages and decentralized seed multipliers model' developed by ICAR-CTCRI needs to be scaled up across the 62 identified blocks (250–2200 ha range). Proposed block-wise area expansion plan (in 5 years):

- a. First 14 blocks: 2,000 ha each
- b. Next 25 blocks: 1,000 ha each
- c. Next 23 blocks: 500 ha each

Corresponding decentralized seed production areas to achieve minimum seed replacement rate of 15-20% per year:

- a. 50 ha in top blocks
- b. 25 ha in middle-tier blocks
- c. 12.5 ha in lower-tier blocks

B. Expand area under cultivation – focus on sweet potato

Sweet potato is gaining importance as a versatile, nutritious and climate resilient short duration crop (2.5-4.0 months) with wide-ranging importance in food, nutrition and livelihoods. It is an excellent source of carbohydrate, dietary fibre, beta-carotene, anthocyanin, vitamin C and minerals like iron and potassium. ICAR-CTCRI has developed a series of orange-fleshed sweet potato (OFSP) for different climatic zones which need to be promoted to combat vitamin-A deficiency especially in children and women. Also, boiled or steamed OFSP has low to medium glycemic index (GI) (41-60). Antioxidant, anthocyanin rich purple fleshed sweet potato (PFSP) is also developed by ICAR-CTCRI.

Proposed action:

- a. Expand sweet potato cultivation to 10,000 ha.
- b. Scale up the successful 'Rainbow Diet Campaign' model developed by ICAR-CTCRI and recognised by FAO as a successful institutional innovation to a statewide programme in select locations. Currently a very successful programme is in implementation in Attappadi in collaboration with Kerala State Kudumbashree Mission.
- c. Create smart clusters of sweet potato with complete value chain established.
- d. Promote sweet potato based diets developed by ICAR-CTCRI in anganwadis as part of the child nutrition programme.
- e. Develop village level processing facilities for value-added products and establish market linkages (local markets and supermarkets).

C. Expand area of other tuber crops

Designate district-specific tuber crop clusters:

- a. Focus districts for elephant foot yam, taro, greater yam, lesser yam are Pathanamthitta and Kollam
- b. Aliparamba panchayat in Malappuram and Manjaly in Ernakulam need special attention for elephant foot yam value chain improvement.
- c. Focus districts for Chinese Potato are Palakkad, Thrissur and Ernakulam.
- d. Focus districts for arrowroot are Thiruvananthapuram, Palakkad and Kollam.

D. Zone-specific production technologies

- a. Agro-ecological unit (AEU) based package of practices recommendations for Kerala's 23 agro-ecological units.
- b. Smart micro-irrigation and fertigation.
- c. Computer model based site-specific nutrient management.
- d. AI, IoT and model-based e-Crop smart farming.
- e. Smart farming for cropping / farming systems involving tuber crops.
- f. Climate-resilient agriculture practices.
- g. Regenerative farming practices that will green the green revolution.

E. Pests and diseases management

Rising threat of pests/diseases:

- a. Cassava: Root and stem rot, mealybug, red spider mite
- b. Elephant foot yam: Collar rot, leaf and pseudostem rot
- c. Sweet potato: Sweet potato weevil
- d. Taro: Leaf blight
- e. Yams: Yam anthracnose
- f. Elephant foot yam, yams and Chinese potato: Root-knot nematodes

ICAR-CTCRI has developed integrated pests and diseases management (IPDM) protocols for all above major issues.

F. Value addition and agribusiness promotion

ICAR-CTCRI has developed and disseminated technologies for micro- and industrial-scale products. To support entrepreneurship, we have a techno-incubation centre (TIC) to provide training and agri-business incubation (ABI) centre for handholding prospective entrepreneurs and startups in business development. Recent signing of a MoU to promote 36 farmer producer companies (FPC) under CISSA and another one with Kerala State Kudumbashree Mission to license 12 technologies for tuber crops value added products are creditable achievements of ICAR-CTCRI.

Development and licensing of the following technology products/machinery are worth noting:

- a. Three bioactive molecules (Nanma, Menma and Shreya) from cassava crop residues
- b. Six multimicronutrient liquid foliar formulations for different tuber crops
- c. Super absorbent polymer from cassava starch
- d. Value added food products from tropical tuber crops
- e. Post harvest machinery and e-Crop

During 2007-2025, ICAR-CTCRI has signed MoU with 80 entrepreneurs and licensed 30 technologies grouped above. A comprehensive list of value addition technologies ready for commercialisation is available at ICAR-CTCRI.

9. Future Research Prospects

To ensure the long-term sustainability and relevance of tuber crops in Kerala and beyond, focused research in the following areas is essential:

A. Protection of indigenous varieties

Many traditional tuber crop varieties in Kerala enjoy local popularity and these should be legally protected (e.g. under PPV&FRA). Currently, such protection is minimal in the tuber crops sector.

B. Development of nutritious, low glycemic index cassava varieties

Cassava, though widely consumed, has a high glycemic index, limiting its use for diabetics. Increasing amylose content in cassava starch from 20% (current average) to 27–30% could make it suitable for diabetic consumption. ICAR-CTCRI, the national active germplasm site (NAGS) of tropical tuber crops holds 1,216 cassava germplasm accessions. Germplasms need to be screened to identify lines, if any, with high amylose content for use in marker assisted selection and development of low GI varieties. Modern tools like genome editing should also be employed in this direction. Modern laboratories and human resources need to be developed in using modern tools like speed breeding, phenomics, artificial Intelligence (AI) and model assisted predictive breeding.

C. Post-harvest shelf-life improvement

Cassava deteriorates within 1–2 days post-harvest. Our goal must be to develop varieties that can last at least 15 days without spoilage. Sweet potato has a bright future in products development for which the tubers will have to be stored for 3–4 months instead of the current possibility of 1–2 months. This will ensure reduced post-harvest losses for a longer duration and better market value, as well as smoother supply to processing units.

D. Nutritional enhancement via biofortification

Tuber crops are primarily rich in carbohydrates but lack proteins, vitamins and micronutrients. There is a necessity to improve the nutritional profile of the varieties since these crops are sources of food and nutrition security of marginalised sections in our society who are the most vulnerable to such nutritional deficiencies. Biofortification has yielded developing beta carotene and anthocyanin rich sweet potato varieties. Research needs to be focussed in improving the protein, vitamins and micronutrients in these crops without compromising yield, cooking quality, pests/diseases resistance and shorter duration.

E. Farming system models based on agro-ecological units

Sixty five per cent of Kerala's cropped area is under cash

crops. To increase tuber crops area, development and popularisation of locally adaptable farming system models for each of the 23 agro ecological unit is needed. Kerala's cropping intensity declined from 136.97% (2000–01) to 126.23% (2020–21). A cropping intensity target of 150–175% in suitable AEUs using tuber crops as intercrops is one of the most important possibilities for area expansion of tuber crops based sustainable production intensification.

F. Climate change adaptation and mitigation

Untimely heavy monsoon, excessive mid-season rainfall, mid-season droughts, elevated heat etc. affect planting and crop health. Climate resilient agriculture varieties and technologies need to be developed and deployed based on the kind of issues in each unit. Smart farming for small land holdings, responsible plant nutrition and circular economy based regenerative farming technologies such as organic farming, natural farming, conservation agriculture etc. need research attention.

AI-based pests and diseases forecasting models should be developed to give early warnings and advisories on a regular basis. Use of Next-Gen research tools like RNAi and genome editing need to be intensified to address such issues. There is a need for infrastructure and skilled personnel for these next-generation approaches. Climate resilient agriculture need to be developed for agro ecological units based on local issues. Village level climate contingency plan and climate risk management committees need to be developed based on local issues.

G. Urban and peri-urban agriculture

Urbanization is at a rapid pace in Kerala and urban-rural divide is fading away and vertical housing in Kerala demand new food production models. Technologies for urban and peri urban farming such as sensor based smart nutrition gardens, soilless cultivation, hydroponics, aeroponics and controlled protected cultivation need to be developed.

H. Value addition research areas

Promising areas for product development include:

- a. Animal feed sector (for fish, goat, pig, poultry)
- b. Ready-to-use infant and baby food, military food
- c. Bubble tea from cassava
- d. Meat analogues from elephant foot yam and taro
- e. Dietary supplements from sweet potato and Chinese potato

- f. Cassava starch-based edible films for controlled drug delivery (e.g., oral cancer)
- g. Scaling of ethanol production technology already developed by ICAR-CTCRI.

I. Mechanization to reduce cultivation cost

Develop machines for planting, weeding and harvesting and ensure women-friendly designs. Develop end-to-end technology to reduce cost, increase yield and empower farmers as agripreneurs. A statewide plan is needed to implement this at scale through Farmer Producer Companies (FPC), Kerala State Kudumbashree Mission women's groups and establish 50-100 smart tuber crop clusters across Kerala.

10. Development and Extension Strategies - Key Recommendations

To enhance tuber crops production, profitability, and sustainability, the following institutional and policy-level interventions are recommended:

A. Close Linkage Among Kerala State Department of Agriculture and Farmers' Welfare, Kerala Agricultural University and ICAR institutions as well as KVKs in Kerala

Agro climatic zone (5 zones) level bi-annual meetings for the following:

- a. Present technologies developed by KAU and ICAR institutions which need to be validated in different AEUs which will be done by Kerala State Department of Agriculture & Farmers Welfare and KVKs in Kerala.
- b. Present results of validation trials done by Kerala State Department of Agriculture & Farmers Welfare and KVKs in Kerala for approval and recommendation to package of practices.
- c. Prepare action plan to scale up the recommended packages for rapid adoption by farmers.
- d. Interaction with entrepreneurs for rapid licensing and commercialisation of the recommended technologies that have commercial value.

B. Biannual conduct of state variety release committee meeting

State variety release committee meeting to be conducted biannually on a regular basis in January and July to consider approval of new varieties for release.

C. Annual publication of package of practices

Kerala Agricultural University (KAU), ICAR institutes,

and other research institutions should discuss and release new varieties and technologies every year. State variety release committee and package of practices recommendations meeting must happen every six months and publish an updated 'Package of Practices Recommendations Crops' annually. This is being ceremoniously practised in many states.

D. Formal seed system of tuber crops in state seed farms

A formal seed system to mass-produce planting materials of important tuber crops varieties for their faster spread among farmers. ICAR-CTCRI will supply nucleus seeds of quality planting materials of released varieties.

E. Focus on sustainable tuber crop-based agribusiness

Promote sustainable agri-business and inclusive development centered on tuber crops. Explore export-oriented startup opportunities. Launch special programmes to support such ventures.

F. Impact assessment of technologies

Though many high-yielding varieties and technologies exist, their field-level adoption needs assessment. Identify commercially viable technologies and prepare them for industrial scaling. Scale up their technology readiness level (TRL) if commercialisation prospects exist.

11. Conclusion

Tuber crops, especially cassava, have historically supported Kerala during the famine of 1876-1880 and at many occasions including the COVID-19 lockdown (2020) in ensuring food security. Cassava is known for higher food energy production per unit area per unit time than other important staples, climate resilience, suitability for agroecological and sustainable farming as well as its multipurpose uses in human and animal food, and in the production of many value added industrial products. Other tuber crops are also a part of the culinary traditions of Kerala. A revitalisation of the production and value chain improvement of these crops that are very close to Malayalees will be an essential pillar of future food, nutrition and livelihood security.

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Tuber crops for food, health, wealth and prosperity



Orange fleshed sweet potato

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