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THE HOUSE OF KERALA KARSHAKAN

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The Doyen of Agrobiodiversity Conservation

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PADMASHREE CHERUVAYAL RAMAN
The Doyen of Agrobiodiversity Conservation

Agriculture is much more than the cultivation of crops; it is a living connection between land, people, knowledge and generations. Across Kerala, farmers and rural communities have preserved crop varieties, farming practices and ecological wisdom that continue to hold value even in a rapidly changing agricultural landscape. At a time when climate change, shrinking agricultural diversity and changing food habits are creating new challenges, protecting this traditional wealth has become as important as developing new technologies. The knowledge embedded in traditional farming systems can offer valuable lessons for building resilient, sustainable and locally adapted agriculture.

The September issue of Kerala Karshakan e-Journal explores this wider relationship between agricultural heritage, biodiversity and sustainable livelihoods. The experiences of farmers and communities featured in

this issue show that conserving traditional varieties is not simply about preserving the past; it can also strengthen food security, climate resilience and rural livelihoods. Alongside these stories, the issue looks at crop revival, foodscaping, direct marketing and innovative agrifood systems, reflecting how traditional resources can find new relevance through scientific approaches, better markets and value addition.

The journey from the farm to the dining table is another important dimension of this issue. Fruits and vegetables are not only sources of income for farmers but also essential components of healthy and diverse diets. New possibilities in food processing, minimally processed produce and healthier cooking methods demonstrate how agricultural products can respond to changing consumer needs while creating opportunities for value addition. The focus on nutrient-rich crops and emerging foods further reminds us that agricultural diversity and nutritional diversity are closely connected.

This issue, therefore, brings together stories that look at agriculture from different but interconnected perspectives—from conserving traditional wealth and biodiversity to strengthening farm livelihoods and promoting healthier food systems. The future of agriculture will depend not only on what new technologies we develop, but also on how wisely we conserve, improve and use the resources and knowledge we already possess. We hope these stories encourage farmers, researchers, students, entrepreneurs and consumers to recognise the value of agricultural diversity and contribute to building a more resilient, sustainable and nutrition-conscious future.

Editor

The first Sree Oommen Chandy Memorial Award, instituted for outstanding contributions to the agricultural sector, is presented to Padma Shri Cheruvayal Raman by Chief Minister V. D. Satheesan and Agriculture Minister Adv. T. Siddique.

Padmashree Cheruvayal Raman

The Doyen of Agrobiodiversity Conservation

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Cheruvayal Raman is globally renowned for his efforts to conserve traditional rice varieties of the Western Ghats region of Kerala. He belongs to the Kurichiya community, one of the settled agriculturist Adivasi communities of Wayanad. In recognition of his significant contribution to agrobiodiversity conservation, the Government of India honoured him with the Padma Shri, one of the country's highest civilian awards. Cheruvayal Raman has a deep understanding of the close relationship between culture and agriculture and its significance for agrobiodiversity conservation. Over time, modernization has contributed to the erosion of many traditional rice varieties that were once cultivated in the wetlands of Kurichiya joint

with paddy cultivation among the Kurichiya. For the Kurichiya, the conservation of traditional rice varieties is not merely about biodiversity conservation or agricultural resilience; it also has profound cultural and spiritual significance. Raman explains that the ancestral spirits worshipped by the Kurichiya are believed to be pleased when diverse traditional rice varieties are conserved, paralelly, these varieties that are well suited to the local ecological context, food culture, and geographical characteristics of the region, and that possess tolerance to climatic variations, pests, and diseases. At present, Raman cultivates 65 traditional rice varieties and provides seeds free of cost to individuals interested in conserving and cultivating them.

The rice conservation efforts of Cheruvayal Raman are widely recognised. However, less attention has been given to his efforts to preserve the broader agricultural heritage of the Kurichiya community, including traditional agricultural tools and implements, straw-thatched Tharavadu (ancestral home), and equipment traditionally used for dehusking paddy and raghi.

Raman's field also serves as a rich reservoir of rare, endemic, threatened and native plant species of the Western Ghats. These plants have traditionally been used by the Kurichiya for various rituals, ethnobotanical purposes, maintenance of soil fertility, and other forms of ecological management and engineering. These lesser-known dimensions of his conservation efforts are particularly significant and are presented in Table 1.

Cheruvayal Raman is also well aware that a one-person initiative to conserve traditional varieties, however significant, is neither sustainable nor sufficient to address broader global challenges such as enhancing climate resilience in agriculture and tackling malnutrition through the conservation and sustainable use of agrobiodiversity. Recognising the importance of creating awareness and transferring knowledge to younger generations, Raman actively engages with a wide range of people, from schoolchildren and community members to researchers and policymakers. Through these interactions, he seeks to encourage a broader understanding of the ecological, cultural, nutritional, and agricultural significance of agrobiodiversity. The lesser-known dimensions of Cheruvayal Raman's contribution are only now beginning to receive wider recognition. His work extends far beyond the conservation of traditional rice varieties; it represents an effort to preserve an entire bio cultural heritage system, in which agriculture,

Cheruvayal Raman is also well aware that a one-person initiative to conserve traditional varieties, however significant, is neither sustainable nor sufficient to address broader global challenges such as enhancing climate resilience in agriculture and tackling malnutrition through the conservation and sustainable use of agrobiodiversity.

PHOTO: RAMITH AMBALAVAYAL

biodiversity, culture, believe system, traditional knowledge, and ecological resilience are deeply interconnected.

A Treasure of Traditional Ecological Knowledge

Cheruvayal Raman is a strong believer in Traditional Ecological Knowledge (TEK). He believes that TEK offers valuable insights for addressing emerging challenges in agriculture, including extreme weather events and the declining health of soils and human populations. According to Raman, TEK has evolved over centuries through human experience and continuous interaction with the agricultural environment. Therefore, he considers TEK an important source of ideas and research questions for the scientific community to explore, validate, and experiment with before taking them to a larger scale.

Raman emphasises the importance of sharing this rich body of traditional knowledge with researchers and the wider scientific community. Much of the TEK associated with agrobiodiversity has been transmitted across generations through oral traditions and everyday agricultural practices. Knowledge related to seed selection, seed conservation and storage, multiplication, exchange, and cultivation is embedded within these traditional knowledge systems. For Raman, documenting and engaging with such knowledge is essential not only for preserving cultural heritage but also for exploring locally grounded solutions to contemporary agricultural and environmental challenges.

Table-1

Local Name	Scientific Name	Status
Pana	Caryota urens	
Chooral	Calamus Travancoricus	Endemic SWG
Kodapana	Corypha umbraculifera	
Pala	Alstonia Scholaris	
Kurukkooti	Mallotus philippensis	
Valachedi	Glyricidia sepium	
Chembarathi	Hibiscus rosa-sinensis l.	
Elanji	Mimusops elengi l.	
Vendek	Lagerstroemia microcarpa wight	
Kulirmavu	Persea macrantha (nees) costerm.	
Chaliru	Flacourtia montana graham	Wild fruit
Thanni	Terminalia bellirica (gaertn.) roxb.	
Ambazham	Spondias Pinnata	
Kariveti (Edala)	Olea Dioica	
Karimurikku	Erythryna sp	
Nadan murikku	Erythryna Stricta	
Kunni	Albizia Odoratissima	
Vatta	Mecaranga Peltata	
Vetti	Aporosa Lindleyana	
Korandi (climbaer)	Salecia Fruiticosa	Endemic SWG
Aranji	Mymusops elengi	
Valanpuli	Tamarindus indicus l.	
Kodampuli	Garcinia gummi-gutta (l.) robs.	Wild edible
Thengu	Cocos nucifera.	
Kamuku	Areca catechu	
Njaval	Syzygium cumini (l.) skeels	Wild fruit
Mavu (30 variety)	Mangifera indica.	

Development Visionary

During his speech at any occasion he reminds the audience about the planetary limits for development. He also insists the relevance of local action. He always sees agriculture land as an extension of forest, therefore, the degradation of forest affect agriculture too and vice- versa. He is strong critic of

PHOTO: RAMITH AMBALAVAYAL

Plavu	Artocarpus heterophyllus (Lam.)	
Anjili	Artocarpus hirsutus lam.	Endemic WG
Medicinal Plants		
Murikooti	Murikootti miniature	
Edinjil	Pterospermum rubijinosum heyne.	Endemic WG, endangered
Arootha	Ruta graveolens l.	
Vayambu	Acorus Calamus	
Aripoo	Lantana Camera	
Aariveppu	Azeadarachta Indica	
Kayanchikuru	Caesalpinia Bonducella	
Sooryakanthi	Helianthus Annuus	
Thippali	Piper longum l.	
Gramboo	Syzygium aromaticum	
Jathika	Myristica fragrans	
Kurumulaku	Piper nigrum l.	
Eswaramulla	Aristoaristolochia Indica	
Aruvalli	Nervelia zeylanica	
Nenthravalli	Bridelia Scandus	
Njerinjil	Pterospermum Rubiginosum	
Keezharnelli	Phyllanthus Amarus	
Navarakizhangu	Dioscorea Oppositipholia	
Nannari	Midesmus indicus (l.) r. br.	
Koomullu	Caesalpinia mimosoides	
Katupukayila	Lobelia nicotianifolia roem. & schult.	
Kovakka	Coccinia Grandis	
Pavakka	Mamordica Charantia	
*SWG : Southern Western Ghats, WG : Western Ghats		

rapid and insensitive expansion of infrastructure in Wayanad by highlighting the uniqueness and vulnerability of the landscapes in Wayanad. He is a strong critic of assessing the profitability agriculture only on the basis of output. He states the relevance to account the ecosystem services offered by various farming systems. Unlike any other profession, farmers and conservators contributing larger social cause through ecosystem services. Therefore, state must ensure such farmers livelihood by ensuring pension.

As an Educator, Raman is very convinced about the potential of young generation to address the contemporary crisis like climate change if properly mentor them. Therefore, wherever possible he is trying to interact with young generation. During the last one year he had interacted with students from 162 education institution starting from local to international education institutes along with his own farm visit. In addition, he delivered lecture at 121 institutions which includes research institutions, collages, non- governmental institutions across the country. Further, he also had the opportunity to interact and share his development visions with 101 bureaucrats and policy makers.

A Global Figure Acting Locally to Address Global Needs

In 2018, Raman was one of the invited participants at the International Symposium on Ethnobiology and Ethnoecology held in Belém, Brazil. In 2016, he received the Plant Genome Saviour Community Award, instituted by the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), Government of India. In 2026, the Government of Kerala honoured him with the first Oommen Chandy Memorial Award for Outstanding Contribution to Agriculture. Raman is a strong believer in grassroots-level action and continues to contribute actively to biodiversity conservation and community development. He serves as a member of the Biodiversity Management Committee of Wayanad and as the patron of the Wayanad District Tribal Development Action Council, a grassroots initiative promoted by M S Swaminathan Research Foundation engaged in the conservation of Wayanad's agrobiodiversity. Through these roles, he shares his decades of experience and learning from the field with communities, researchers, and other stakeholders. Raman considers himself an educator committed to creating awareness about the planetary limits and the importance of living in harmony with nature and its diverse forms of life. His work demonstrates how locally rooted knowledge and grassroots action can contribute to addressing global challenges related to biodiversity loss, climate change, food security, and sustainable agriculture. ■

Balan Paramoola

Preserving the Ethos of Agrobiodiversity Conservation of Kurichiya amid Climate Change and Economic Forces

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Erosion of agrobiodiversity is one of the critical global development crisis. Although agricultural modernisation has helped improve the production of major crops, it has also contributed to the erosion of agrobiodiversity. Extreme weather events have severely affected agricultural production across the globe, highlighting the need for resilient crop varieties more than ever before. In this context, many traditional varieties known for their resilience to various biotic and abiotic stresses are gaining importance. A significant proportion of this diversity is found in agrobiodiversity hotspots such as Wayanad, particularly in the farms and homesteads of Adivasi and local communities. These communities continue to conserve traditional varieties due to their cultural significance and, in some cases, geographical and resource constraints that limit the adoption of modern agricultural practices. At the same time, mono-cropping and the cash-crop economy are increasingly gaining prominence. However, Adivasi communities such as the Kurichiya, along with their rich bio-cultural heritage, continue to support and sustain agrobiodiversity conservation. This case study explores how Kurichiya agriculture has transformed over the years and examines an individual's initiative to conserve agrobiodiversity in the context of these changing agricultural and socioeconomic conditions.

Kurichiya Farming System and Agrobiodiversity Conservation

The Kurichiya are one of the largest family farming Adivasi communities in the Wayanad region of Kerala, southern India. Traditionally, the Kurichiya joint-family system and the sociocultural norms associated

with it played an important role in their sustainable farming practices. Culture and belief systems play an inseparable role in the Kurichiya conservation of agrobiodiversity. For example, traditional rice varieties such as Veliyan and Chennellu (red rice varieties) and Gandhakasala (an aromatic rice variety) are preferred for special occasions and are an integral part of life-cycle rituals, including birth and death ceremonies. Chennellu is specifically given to women and lactating mothers, as the community believes that it is rich in iron and has nutritional benefits. Similarly, tree species such as Chooral are conserved because they are considered essential for the traditional ritual practices of the community, particularly as the Shaman requires this species during ceremonial performances. However, in response to various external forces, particularly those associated with the neo liberal reforms, the traditional joint-family system has undergone significant changes. This transformation has also had profound implications for the community's traditional practices of agrobiodiversity conservation, which were closely intertwined with the joint-family system. The nuclearisation of families, mechanisation of agriculture, the advent of high-yielding varieties, changing aspirations, land-related policy reforms, and the changing social status and dignity associated with farming are among the key factors that have transformed the Kurichiya joint-family system and, consequently, their traditional approaches to agrobiodiversity conservation. While the community positively acknowledges many of the benefits brought about by these changes, community members have also identified critical setbacks in the conservation agro biodiversity.

Today, there is growing global interest in mixed cropping, intercropping, crop–livestock integration, nutrition-sensitive agriculture, agroforestry, and traditional ecological knowledge as pathways towards more sustainable and climate-resilient farming systems. Remarkably, many of these principles have been integral to the Kurichiya farming system since time immemorial. Their traditional agricultural practices demonstrate a holistic approach in which crops, livestock, agroforestry trees, wetlands, and ecological knowledge are closely interconnected. In the current context of eroding biodiversity, the expansion of mono-cropping, and the gradual disengagement from conservation-oriented agriculture, the efforts of individuals and families who continue to preserve the agricultural heritage of the Kurichiya are particularly significant. Their commitment represents a conscious choice to sustain practices that are increasingly under pressure from changing social, economic, environmental, and market forces.

The story of Balan Paramoola and his family is one such example. Their efforts to conserve and sustain the agrobiodiversity embedded in Kurichiya agricultural heritage offer valuable insights into how traditional knowledge and sustainable farming practices can endure amid profound social and environmental change. The following section unfolds Balan's story and his family's continuing journey of agrobiodiversity conservation.

Paramoola: A Kurichiya Joint Family in Transformation

The Paramoola Kurichiya Tharavadu (joint family) has a centuries-old agricultural heritage, particularly in traditional rice cultivation. In 1957, the family held approximately 135 acres of agricultural land, which had declined to around 40 acres by 2018. Several factors contributed to this loss of land, including land alienation associated with settler colonialism, the imposition of land ceilings during the implementation of the Kerala Land Reforms Act, and the abolition of shifting cultivation. Paramoola is one of the 58 major Kurichiya Tharavadu in Wayanad. At its peak, nearly 300 people lived in the Tharavadu, with subsistence agriculture serving as their primary livelihood. By

2018, however, only five people remained in the ancestral home, largely due to the nuclearisation of families. The traditional Tharavadu system is now facing a severe survival threat, with much of the upland area fragmented and allocated among nuclear families.

Despite these changes, the family continues to practise traditional rice conservation as a collective activity. The produce from wetland paddy cultivation is equitably distributed among the nuclear families after setting aside a common share for the Tharavadu, which is used to meet the needs of common rituals and festivals. However, climatic uncertainties and the increasing disengagement of nuclear-family members from collective wetland cultivation have emerged as major challenges to sustaining agrobiodiversity conservation. The maintenance and management of the upland agroforestry system have also become increasingly difficult, contributing to declining productivity. Balan Paramoola, a member of the Paramoola joint family, has taken a leading role in wetland paddy cultivation on behalf of the Odeikaran, (the headman of the Tharavadu). He currently leads the cultivation of approximately 20 acres of wetland paddy. To encourage members of the nuclear families to participate in collective cultivation, Balan introduced an equitable system for sharing the agricultural produce.

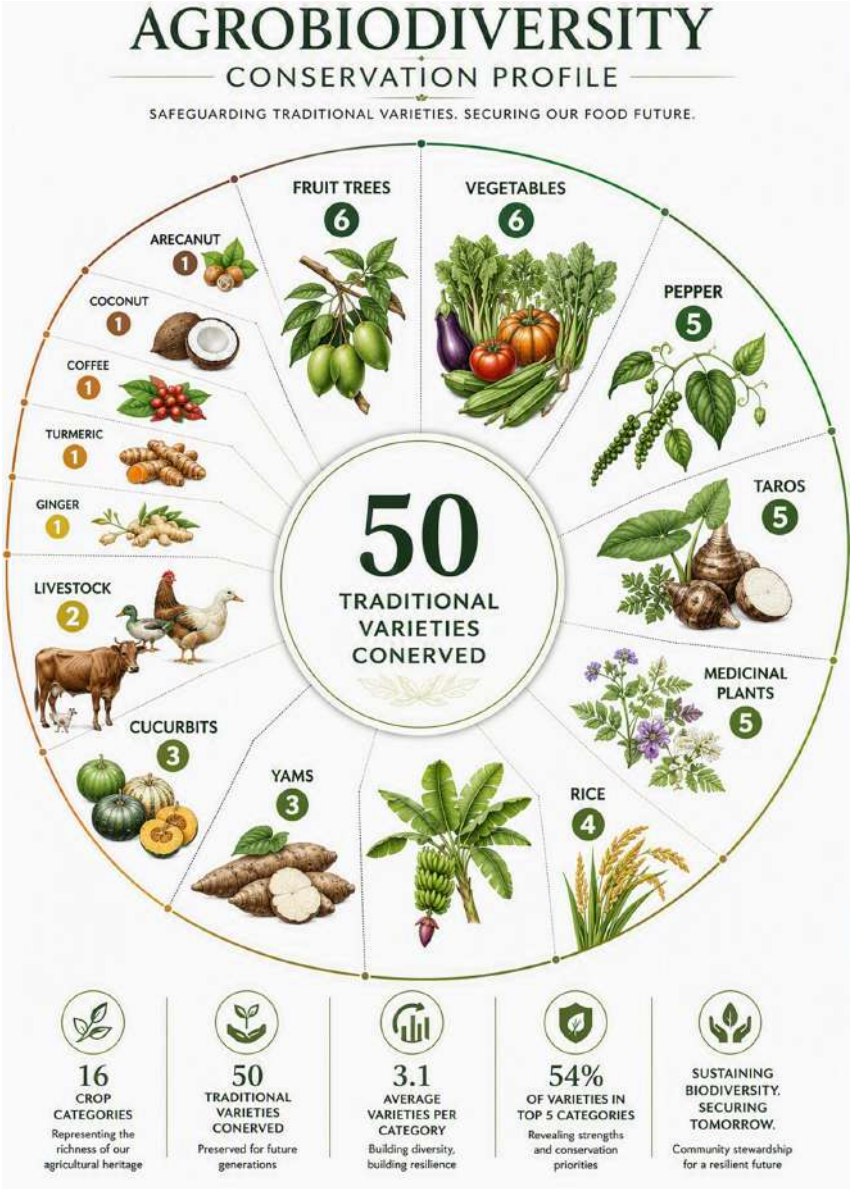
Although relatively young, Balan has worked closely with Kelu Paramoola, a 93-year-old community elder, through whom he learned the knowledge, skills, and practices underlying Kurichiya sustainable farming. Balan also served for an extended period as President and Executive Committee Member of the Wayanad District Tribal Development Action Council (WDTDAC), a grassroots institution working with Adivasi communities and promoting to the agrobiodiversity conservation in Wayanad. He is actively involved in rice seed village programme (An initiative of M S Swaminathan Research Foundation) to promote the conservation of traditional rice varieties of Wayanad. In addition, to strengthening his traditional ecological knowledge, this experience provided Balan with a broader understanding of the importance and purpose of on-farm agrobiodiversity conservation.

Balan Paramoola and his Untold Story of Agrobiodiversity Conservation

As the traditional Kurichiya joint-family system began to erode, many community members of Balan's generation increasingly sought employment outside agriculture, particularly in the informal sector, including construction, painting, and other forms of casual wage labour. For many nuclear families, agriculture gradually became a supplementary rather than a primary livelihood with the active support of his wife Bindhu and two children Akshay and Anoop. Against this prevailing trend, Balan Paramoola chose to remain in agriculture as a full-time livelihood. Around fifteen years ago, he received 1.2 acre of uncultivated upland from the joint family to build his house. Balan gradually transformed it into a productive and diverse farming system based on his traditional knowledge and his own lived experiance.

He adopted a combination of food and cash crops to strengthen both household nutritional security and economic security. Recognising the importance of soil fertility for sustaining agricultural production, he also began rearing livestock, which provided both an additional source of income and organic manure for his fields. Balan's farm represents an integrated farming system in which livestock, poultry, seasonal and perennial crops, and agroforestry are closely interconnected. This diversity enhances the resilience of his farming system to climate-related stresses, including extreme heat and other environmental uncertainties. At the same time, the farm serves as an important site for conserving agrobiodiversity, where traditional crop varieties are maintained alongside other components of the farming system.

Today, Balan's farm is home to a remarkable diversity of crops and varieties, reflecting



both the agricultural heritage of the Kurichiya community and his personal commitment to conserving agrobiodiversity. Climate change-induced extreme weather events have significantly altered the Kurichiya crop calendar, particularly the traditional paddy cultivation cycle.

According to Balan, farming has become increasingly arduous and labour-intensive in the era of climate change. Rising labour costs and the growing shortage of agricultural labour during seasons have added to the challenges. He emphasises the need for customised and locally appropriate agricultural technologies that can reduce labour requirements without undermining the traditional farming system.For Balan, one of the greatest advantages of maintaining crop diversity on the farm is access to a wide range of safe and nutritious foods. His family is largely self-reliant in food, producing and accessing a diverse range of dairy products, meat, eggs, vegetables, tubers, spices, fruits, and grains from their integrated farming system. This diversity not only strengthens household food and nutritional security but also reduces dependence on external exploitative food markets. Currently his field hosts the following crop varieties.

Challenges and Opportunities

Balan's commitment to agrobiodiversity conservation has also created opportunities beyond his farm. His experience and knowledge have earned him recognition and the opportunity to share his perspectives on various national platforms alongside eminent scientists and experts. However, he points out that many other farmers and community members who are equally committed to conserving agrobiodiversity do not receive similar opportunities or recognition.

At the same time, economic sustainability remains a major concern. Balan acknowledges that cash income is essential for meeting the demands of contemporary life, while income from farming has become

Summary details of crops and varieties conserved by Balan Paramoola

Crop	Variety	Type	Characteristics
RICE	CHENNELLU	Red rice	Medicinal rice, culturally important
	GANDAKASALA	White rice	Scented rice
	THONDI	Red rice	
	VELIYAN	Red rice	
PEPPER	KARIMKOTTA	Traditional variety	
	KARIVALANKOTTA	Traditional variety	
	UTHIRAMKOTTA	Traditional variety	
	CHERUVALLI	Traditional variety	Short spikes; small balls
	UPPOOTHARAN	Traditional variety	Short spikes; small balls
GINGER	HIMACHAL		Stout and juicy Dark yellowish and tasty; have medicinal properties
TURMERIC	WAYANADAN MANJAL	Traditional variety	
BANANA	NJAALI POOVAN	Traditional variety	-
	MANNAN	Traditional variety	Have medicinal properties
	CHENKADALI	Traditional variety	Red fruits Small fruits; culturally important
	POOJA KADALI (DEVA KADALI)	Traditional variety	
YAM	KANDI KAACHIL (KUZHI KAACHIL; NEENDI KAACHIL, URULANKACHIL)	Traditional variety	Tuber length over 1 m
	URULAN KAACHIL (PERI KAACHIL)	Traditional variety	Tubers rounded
	CHENA (Elephant Foot Yam)	Traditional variety	
TARO	PAL CHEMBU	Traditional variety	Tubers pure white in colour
	KARIMCHEMBU (KUZHICHEMBU)	Traditional variety	Have medicinal properties Common in paddy fields Have medicinal properties Highly nutritional
	NANA CHEMBU	Traditional variety	
	VELUMCHEMBU	Wild variety	
	THOTTACHEMBU (THOTTATHAALU)	Wild variety	
COFFEE	ROBUSTA	Domesticated	
MEDICINAL PLANTS	KASTURI MANJAL Curcuma aromatica Salisb. (AROMATIC TURMERIC)	Wild variety	Good against fever, cough and skin diseases.
	THULASI Ocimum sanctum L.	Domesticated	
	MURIKOOTI Hemigraphis colorata Blume	Domesticated	
	THIPPALI Piper longum L.	Domesticated	
	PANIKOORKA Plectranthus amboinicus (Lour.) Spreng.	Domesticated	

increasingly volatile. For small and marginal Adivasi farmers who conserve traditional varieties, the economic returns from maintaining diversity are often not commensurate with the labour and resources invested in conservation.

Balan therefore calls for stronger government support to sustain Adivasi agrobiodiversity conservers. He emphasises the need for appropriate agricultural technologies, financial assistance, targeted subsidies, and improved access to premium and niche markets for traditional and biodiversity-friendly agricultural products. Such measures, he believes, can help bridge the gap between conservation and livelihood security, enabling Adivasi farmers to continue their traditional role as custodians of agrobiodiversity while adapting to the realities of climate change and changing markets. ■

Symphony of soil

A forest guardian's journey in biodiversity conservation and sustainable utilization

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In an era of rapid climate change, biodiversity loss, and increasing agricultural intensification, biodiversity conservation through traditional farming practices has become increasingly important for sustaining ecological balance and safeguarding plant genetic resources. Rooted in indigenous knowledge and a deep respect for nature, such farming systems play a vital role in conserving agrobiodiversity while ensuring household food and nutritional security.

A recent field survey conducted in the Kuzhakkad area of Mamalakandam under Kuttampuzha grama panchayath of Ernakulam district revealed that Mr. Raghavan Korallil Vellan, a 62-year-old farmer, has transformed his 2-acre forest-right land into a thriving, entirely organic farming system. Rather than relying on intensive mechanisation, synthetic fertilisers, or chemical pesticides, he follows ecologically sustainable farming practices that integrate

diverse food crops, spices, fruits, medicinal plants, and wild species. His farm demonstrates how traditional agricultural practices can effectively conserve biodiversity, strengthen climate resilience, and preserve valuable plant genetic resources. Through his lifelong commitment, Mr. Raghavan exemplifies the important role of custodian farmers in safeguarding Kerala's rich agrobiodiversity for future generations.

Rooted in Tradition: The Man Behind the Soil

Mr. Raghavan K.V., a 62-year-old farmer from the Urali tribal community, resides in Kuzhakkad, Mamalakandam, in Kerala. Drawing upon generations of indigenous knowledge, he practices traditional organic farming on his two acre forest-right land, conserving a remarkable diversity of crops while maintaining ecological balance.

Through years of hard work, perseverance, and a simple farming livelihood, he overcame numerous hardships to educate and raise his three children, all of whom are now doctors. His journey reflects the dignity of labour and his unwavering commitment to both his family and the land. Supported by a perennial open well and a small irrigation pump, he personally undertakes most of the farm operations, demonstrating his dedication to sustainable agriculture and biodiversity conservation.

Living free from financial liabilities, Mr. Raghavan considers the rich biodiversity of his farm not material wealth to be his greatest asset. His life exemplifies how determination, traditional knowledge, and a deep respect for nature can sustain both a family and an invaluable agricultural heritage.

A Living Botanical Garden

Raghavan's two acre farm represents a living botanical garden, characterised by an exceptional diversity of cultivated and wild plant species maintained under a completely organic farming system. Rather than following conventional input-intensive agriculture, he strictly avoids the use of synthetic fertilisers and chemical pesticides. Soil fertility is sustained through the application of farmyard manure, compost, dried cow dung powder, green manures, and other organic animal manures, which improve soil health, enhance microbial activity, and maintain long-term soil productivity.

The adoption of these ecologically sustainable practices has created a favourable habitat for a wide range of food crops, spices, medicinal plants, fruit trees, and wild species to thrive. The farm serves as an excellent example of how traditional organic farming can simultaneously conserve agrobiodiversity, improve ecosystem health, and promote sustainable agricultural production.

Pepper Diversity

Black pepper constitutes one of the most significant components of Raghavan's agrobiodiversity conservation efforts. Unlike other farmers of the locality, he conserves 11 distinct black pepper varieties maintained on more than 100 vines. The vines are traditionally trained on living standards such as jackfruit (Artocarpus heterophyllus), Gliricidia (Gliricidia sepium), and Indian coral tree (Erythrina spp.), contributing to a sustainable agroforestry system.

His collection includes the improved variety Panniyur-1, known for its long spikes, bold berries, early bearing,

and high yield potential. The farm also conserves several valuable indigenous landraces, including Karimunda, recognised for its tolerance to foot rot disease; Neelamundi, valued for its superior berry quality; Vellanamban, a reliable local yielder; Marampidathi and Vellamundi, traditional hill selections adapted to local conditions; Kuthiravali, characterised by long spikes and an alternate bearing habit Athuthakkadi and the traditional mundi types Thotumundi, Manjamundi, and Cheppakulam Mundi. The conservation of these diverse varieties preserves valuable genetic resources that are important for future crop improvement, disease resistance, and climate resilience.

Cash Crops and Traditional Food Crop Diversity

Raghavan's farm conserves a diverse range of perennial cash crops integrated within a traditional agroforestry system. The farm includes arecanut, more than seven coffee plants, two nutmeg trees, more than five cocoa trees, and coconut palms, all cultivated in a multilayered cropping system that enhances biodiversity, improves soil health, and provides diversified sources of income.

The farm also serves as an important repository of traditional food crop diversity. Raghavan conserves five traditional banana varieties, including Nendran, Palayankodan, and Njalipoovan. Nendran is preferred for cooking and processing into chips, Palayankodan is valued for its sweet taste and regular bearing, while Njalipoovan is appreciated for its flavour, aroma, and nutritional quality. The cultivation of multiple banana varieties enhances household food security and reduces the risk of crop loss.

He also maintains several tuber crops, including tapioca (cassava), elephant foot yam, and taro (Colocasia). Tapioca serves as an important staple food with good drought tolerance and reliable productivity. Elephant foot yam is valued for its high yield, nutritional richness, long storage life, and medicinal properties, particularly in traditional digestive health. Taro is an easily digestible food crop rich in carbohydrates, minerals, and dietary fibre, and is widely used in traditional diets.

A unique feature of the farm is the conservation of yellow and blue arrowroot landraces. These rare varieties produce high-quality starch that is easily digestible and traditionally used as a nutritious food for children, elderly people, and convalescent patients. Arrowroot also holds importance in indigenous medicine for its soothing effect on digestive ailments.

In addition, Raghavan conserves rare wild edible tubers such as Nooran Kizhangu and Thotti Kizhangu, and other yams which have traditionally served as emergency food sources for indigenous communities during periods of food scarcity. These species possess valuable genetic traits for adaptation to local environments and represent an important component of tribal food culture and plant genetic diversity.

Through the conservation of these traditional food crops and wild edible species, Raghavan safeguards valuable genetic resources, strengthens household food and nutritional security, and preserves indigenous agricultural knowledge for future generations.

The Natural Pharmacy

Raghavan's farm serves as a valuable repository of indigenous medicinal plants, conserving several rare and traditionally important species that preserve the rich medicinal knowledge of tribal communities. These plants continue to play an important role in traditional healthcare systems for the treatment of common ailments.

Among the most significant species is Black Turmeric (Karimanjal, Curcuma caesia), a rare medicinal rhizome valued for its anti-inflammatory, analgesic, antimicrobial, and antioxidant properties. It is traditionally used to manage joint pain, respiratory disorders, digestive ailments, and skin diseases. Adalodakam (Justicia adhatoda) is widely recognised for its bronchodilator



and expectorant properties and is extensively used in the treatment of cough, asthma, bronchitis, and other respiratory illnesses. Castor (Avanakku, Ricinus communis) provides medicinal oil used as a natural laxative and for relieving joint pain, muscular inflammation, and various skin disorders.

The farm also conserves important indigenous medicinal herbs, including Murivukooti, traditionally used for wound healing and fracture management; Muyal Cheviyan, valued for treating inflammation, minor infections, and skin ailments; and Karinochi (Vitex negundo), an important medicinal shrub with anti-inflammatory, analgesic, antimicrobial, and insect-repellent properties, commonly used for arthritis, fever, headaches, and respiratory disorders. In addition, several locally important tribal medicinal herbs are maintained for the treatment of digestive disorders, fever, skin diseases, insect bites, and other common health conditions.

By conserving these medicinal plant species, Raghavan safeguards valuable plant genetic resources while preserving the traditional healthcare knowledge of indigenous communities for future generations.

From Abiu to Velvet Fruit: An Exotic Orchard

Raghavan has established a diverse fruit orchard comprising both indigenous and exotic fruit species, making his farm an important repository of fruit crop genetic diversity. The orchard includes three mangosteen plants, two rambutan plants, two abiu plants, five distinct citrus varieties, and one sapota tree. In addition, he conserves one plant each of avocado, mulberry, milk fruit, miracle fruit, velvet fruit, dragon fruit, and custard apple, along with three traditional gooseberry varieties.

The farm also conserves six distinct jackfruit varieties including Vietnam super early each exhibiting variation in fruit characteristics and maturity period, thereby preserving valuable intraspecific diversity. In addition, wild grapes and five large unidentified wild forest fruit trees are maintained as part of the farm ecosystem. These wild species represent important plant genetic resources and highlight the rich biodiversity conserved within the farm, while also warranting further taxonomic documentation.

The conservation of indigenous, exotic, and wild fruit species within a single farming system demonstrates Raghavan's commitment to preserving fruit crop diversity and safeguarding valuable plant genetic resources through on-farm conservation.

Commitment to native breed conservation

In addition to crop cultivation, Raghavan contributes to the conservation of indigenous livestock by rearing two Vechoor cows, one of India's native cattle breeds renowned for its adaptability and cultural significance. Together, the cows produce approximately one litre of milk per day, which is primarily utilised for household consumption. Although the milk yield is modest, it is highly valued for its quality and richness, with one litre being sufficient to prepare nearly 25 cups of tea. The maintenance of this native breed reflects Raghavan's commitment to conserving indigenous animal genetic resources while supporting the nutritional needs of his family through a sustainable farming system.

Table 1: Varietal diversity of crops in Raghavan's field

Category	Crop	Varieties	Remarks
Spices	Black Pepper	Karimunda, Neelamundi, Vellanamban, Panniyur-1, Marampidathi, Vellamundi, Kuthiravali, Athuthakkadi, Thotumundi, Manjamundi, Cheppakulam Mundi	11 varieties; >50 vines
Plantation	Arecanut, Coffee, Nutmeg, Cocoa, Coconut	Traditional cultivars	Mixed multi-storey farming
Banana	Banana	Nendran, Palayankodan, Njalipoovan, Choondilla kanan, Robusta	5 varieties
Tubers	Tapioca, Elephant Foot Yam, Taro, Arrowroot	Yellow & Blue Arrowroot, Nooran Kizhang, Thotti Kizhangu	Traditional & wild tubers
Fruits	Fruit crops	Avocado, Rambutan, Mangosteen, Sapota, Mulberry, Abiu, Milk Fruit, Miracle Fruit, Velvet Fruit, Orange, Dragon Fruit, Custard Apple, Wild Grapes	15+ fruit species
Others	Gooseberry, Jackfruit	3 gooseberry varieties; 6 jackfruit varieties; 5 unidentified forest fruit trees	Conserved germplasm
Livestock	Vechoor cow	2 indigenous cows	Native breed conservation
Medicinal	Medicinal plants	Karimanjal, Adalodakam, Avanakku, Murivukooti, Muyal Cheviyan, Karinochi and unidentified herbs	Traditional medicinal flora

Farm Produce Utilisation and Marketing

Raghavan's farming system primarily focuses on household food security and the conservation of agrobiodiversity rather than commercial production. Most of the farm produce is utilised for household consumption and is shared with extended family members, reflecting the farm's role in sustaining traditional food systems.

Surplus produce is marketed through local channels. Traditional tuber crops, including tapioca, elephant foot yam, taro, and other indigenous tubers, are sold in nearby local markets as well as directly to consumers who visit the farm. Other produce, such as black pepper, bananas, and seasonal fruits, is also marketed locally based on seasonal availability. This direct farm-to-consumer marketing provides supplementary household income while maintaining the farm's conservation-oriented approach.

Raghavan's farming system demonstrates that biodiversity conservation and livelihood generation can coexist within a sustainable agricultural framework. By prioritising the conservation of indigenous crop diversity while meeting household needs and marketing only the surplus, his farm serves as an exemplary model of on-farm conservation, ensuring the continued preservation and sustainable utilisation of valuable plant genetic resources for future generations. ■

Sweet Memories, Sweeter Future

Reviving Kerala's Sugarcane Legacy

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Any elder in rural Kerala, behold the memories of lost tradition of a crop, Sugarcane. Not just facts do they think of, but stories of jaggery bubbling in wide open pans, children enjoying the little sweet chew, festival sweets with aroma and taste mixed with the brown gold "Vellam/Sharkara" and elephants in the temple premises happily enjoying the cane, that stood as mesmerizing view for the hearts. Sugarcane in Kerala, thus was not just an agricultural commodity, but a way of life, woven into the rhythm of traditional village life. But today, the picture looks gloomy, with dramatic loss in cultivation, area converted to commercial crops and young farmers having minimal idea about the legacy the state carried.

A look into the legacy, what the generation missed?

The commercial journey of sugarcane in Kerala dates back to more than a century. Until the 1920's, sugarcane cultivation was confined to the outer skirts of Coimbatore, which later spread outwards, with the arrival of sugar factories/mills. With assured buy back, the cultivation took a leap, covering many areas of Thiruvalla, Pandalam, and Marayur in Kerala. Thus, with a flourishing sugar economy, it was not just the farmers who benefitted, but transporters, factory workers, traders, and jaggery makers all found their livelihoods tied to the crop. Sugarcane cultivation in its peak, thus powered an entire rural value chain.

But golden time's rarely last forever. The losses incurred by sugar mills and its subsequent closure, eventually pushed the farmers to search for alternatives that were more profitable. With this shift, what Kerala lost wasn't just cultivated acreage — but an entire ecosystem of rural enterprise built around sugarcane.

The crop that refused to disappear

Despite the various setbacks, sugarcane never vanished from Kerala altogether. Today, its stronghold is the scenic Marayoor–Kanthalloor region of Idukki district, which accounts for the lion's share of the state's cultivation. Overall, Kerala now cultivates sugarcane on roughly 653 hectares (1)— modest by national standards, but significant to the communities that depend on it. Interestingly now a day's, the purpose of cultivation has shifted, with a lineage towards value addition-through flavoured jaggery and fresh juice rather than industrial sugar production, thus paving way for new doors to open.

When research step in

Perhaps the most heartening chapter in this story is the development of new varieties suitable for jaggery and juice production by ICAR-Sugarcane Breeding Institute, Coimbatore. With the leverage of hosting the world's largest germplasm collection at its Research centre, Kannur, Kerala, scientists have now developed improved varieties, healthy seed production systems, integrated crop management practices, and climate-resilient cultivation technologies, along with several value-added products in Sugarcane.

The arena of value addition has now extended to high end products like the liquid jaggery, powdered jaggery, cane syrup, speciality sweeteners, and hygienically packaged cane juice — products that fetch far better returns when compared to the raw cane/juice supplied. Traditional jaggery-making, once at risk of fading into memory, is now experiencing a revival of its own, this time dressed up with modern packaging and smart branding that appeals to today's health-conscious consumer.

Small in scale, big in potential

It is of sure that, Kerala will likely never rival India's major sugar-producing states in total volume — and perhaps it shouldn't even try to. But its real opportunity lies elsewhere: in becoming recognized for premium quality, value-added sugarcane products and its branding. The state already has the ingredients for this transformation — a deep-rooted jaggery-making tradition, growing consumer appetite for natural and local foods, solid scientific backing, and a farming community that has shown, time and again, its willingness to innovate.

If farmers, scientists, entrepreneurs, policymakers, and consumers can now pull in the same direction, Kerala's sugarcane sector could once again become a source of pride, employment, and rural prosperity. In the end, the sweetness of Kerala's sugarcane future won't come from growing more cane — it will come from extracting more value, more innovation, and more opportunity from every stalk harvested.

— A tribute to Kerala's sugarcane heritage and the scientists and farmers working to secure its future.

Reference

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Fruit Crops for Foodscaping

Integrating Aesthetics with Nutrition

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Foodscaping is an innovative landscape design approach that combines ornamental plants with edible crops to create visually appealing, productive and sustainable gardens. Unlike conventional orchards, foodscapes integrate fruit trees, shrubs, herbs and vegetables into residential and institutional landscapes, thereby enhancing biodiversity, improving household nutrition and promoting environmental sustainability. Several underutilized and exotic fruit species are particularly suitable for foodscaping due to their attractive foliage, colourful flowers, decorative fruits and adaptability to tropical climates. Fruitscaping is the practice of integrating fruit-bearing trees, shrubs and vines into ornamental landscape designs without compromising their visual appeal. Closely related to foodscaping and edible landscaping, fruitscaping focuses specifically on fruit crops that combine beauty with productivity. Instead of relying solely on ornamental plants, fruitscaping replaces or complements them with attractive fruit species that provide seasonal harvests while enhancing the aesthetic character of the garden.The concept is based on the idea that every plant in the landscape should serve more than one purpose. A fruit tree can provide shade, fragrant blossoms, colourful foliage, wildlife habitat and nutritious fruits, all at the same time. Likewise, berry-producing shrubs can function as ornamental borders or hedges while supplying fresh fruits throughout the season.

As urban areas expand and residential spaces become smaller, fruitscaping offers an ideal solution for making gardens more productive without sacrificing their beauty. Tropical regions like Kerala are especially well suited for this approach because the favourable climate supports a remarkable diversity of fruit species that can be successfully incorporated into residential landscapes. In addition to well-known fruit crops, several exotic and underutilized species possess striking ornamental characteristics that make them exceptional landscape plants. The following species are among the most promising for tropical edible landscapes.

Coral Berry

Scientific name: Ardisia elliptica Thunb.
Family: Primulaceae

Coral berry is an evergreen shrub valued for its glossy foliage and abundant clusters of attractive berries that change from pink to deep purple-black upon ripening. The plant produces small white to pale pink flowers in axillary clusters, followed by persistent fruits that provide ornamental interest for an extended period. The ripe berries are edible and contain antioxidant compounds, although they are primarily appreciated for their decorative value. Owing to its compact

growth habit, dense canopy and year-round attractiveness, coral berry is well suited for borders, hedges and mixed edible landscapes.

Peanut Butter Fruit

Scientific name: Bunchosia argentea Cav.
Family: Malpighiaceae

Peanut butter fruit is a small evergreen shrub or tree producing bright red fruits with a unique flavour remarkably similar to peanut butter. The plant exhibits dense branching, glossy foliage and colourful fruits that contrast beautifully with the green canopy. Besides serving as an attractive ornamental shrub, the fruits are consumed fresh and provide vitamin C and antioxidant compounds. Its compact habit makes it suitable for container gardens, patios and small residential foodscapes.

Cocoplum

Scientific name:
Chrysobalanus icaco L.
Family: Chrysobalanaceae

Cocoplum is a dense evergreen shrub or small tree native to tropical coastal regions. It possesses thick, leathery, glossy leaves and produces rounded edible fruits that vary in colour from white and pink to purple depending on the cultivar. The mildly sweet fruits are consumed fresh or processed into preserves. The species exhibits excellent tolerance to salinity, drought and coastal conditions, making it highly suitable for tropical landscapes. Its naturally compact canopy and attractive foliage make cocoplum an excellent edible hedge.

Strawberry Guava

Scientific name: Psidium cattleyanum Sabine
Family: Myrtaceae

Strawberry guava is an attractive evergreen shrub or small tree bearing glossy leaves, white flowers with numerous stamens and aromatic red or yellow fruits. The fruits possess a pleasant strawberry-like flavour and are rich in vitamin C, dietary fibre and antioxidant compounds. The compact canopy, prolific fruiting habit and ornamental appearance make strawberry guava one

of the finest candidates for foodscaping, especially in urban home gardens and institutional landscapes.

Egg Fruit

Scientific name: Pouteria campechiana (Kunth) Baehni
Family: Sapotaceae

Egg fruit is an evergreen tropical tree distinguished by its bright yellow fruits containing dry, creamy pulp resembling the texture of cooked egg yolk. The fruits are rich in provitamin A carotenoids, vitamin C, dietary fibre and essential minerals. Its dense evergreen canopy, glossy foliage and attractive fruits provide both ornamental and nutritional value. As a specimen tree, egg fruit contributes significantly to the diversity and productivity of tropical edible landscapes.

Israel/Jaffaa Orange

Scientific name:
Citrus × sinensis
Family: Rutaceae

Israel orange, popularly known as Jaffa orange, is one of the most renowned cultivars of sweet orange. The evergreen tree bears fragrant white blossoms, glossy dark green foliage and attractive bright orange fruits that enhance the visual appeal of landscapes. The fruits are highly valued for their excellent flavour, high

vitamin C content, flavonoids and antioxidant properties. The combination of ornamental flowering, colourful fruits and nutritional benefits makes Jaffa orange a valuable addition to residential gardens and edible landscapes.

Karonda

Scientific name:
Carissa carandas L.
Family: Apocynaceae

Karonda is a hardy evergreen thorny shrub widely recognized for its ornamental appeal and multifunctional uses. The plant produces fragrant white star-shaped flowers followed by attractive fruits that change from green to pink, crimson and finally deep purple upon ripening. The fruits are rich in vitamin C, iron, calcium and bioactive compounds and are extensively used for pickles, preserves, jams and beverages. Its dense branching habit and tolerance to drought make karonda particularly suitable as an edible hedge, protective boundary planting and climate-resilient component of tropical foodscapes.

Conclusion

These fruit crops illustrate the multifunctional potential of foodscaping by combining ornamental beauty with nutritional and ecological benefits. Their attractive foliage, colourful flowers and fruits, adaptability to tropical environments and relatively low maintenance requirements make them ideal for home gardens, institutional campuses, public parks and urban landscapes. Integrating such species into landscape design not only enhances aesthetic appeal but also promotes biodiversity conservation, healthy diets and sustainable urban horticulture. ■

Chilla Market

A Forest Department Led Marketing Revolution in Chinese Potato for Sustainable Livelihoods of Marayoor Tribes

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Nestled in the rain shadow region of the Western Ghats along the Kerala and Tamil Nadu border, Marayoor is renowned for its natural sandalwood forests, unique biodiversity and indigenous tribal communities, particularly the Muthuvan and Malapulayar tribes. Most tribal settlements are located within the Marayoor Sandal Reserve and Chinnar Wildlife Sanctuary, where agriculture is practiced under natural conditions with minimal external inputs.

For decades, despite producing high quality, chemical free agricultural and forest products, tribal farmers remained economically marginalized due to poor market access and exploitation by intermediaries. Recognizing this challenge, the Kerala Forest Department introduced an innovative direct marketing initiative known as "Chilla Market" in 2014. Today, Chilla has emerged as a successful model of community led agricultural marketing that has significantly improved tribal incomes while promoting sustainable agriculture.

Marayoor: A hub of natural farming

Agriculture in Marayoor is largely organic, relying on traditional farming practices without chemical fertilizers. The region produces a wide range of crops including: Chinese potato, Butter beans, Bird eye chilli, Ginger, Turmeric, Coffee, Pepper, Lemon grass, Gooseberry, Tree tomato, Passion fruit, Orange, Honey, Yam, Colocasia, Banana and Tapioca. Chinese potato, one of

Forest Department, Marayoor

Chinese potato field and harvested tubers

the premium crops cultivated in the higher elevations, has become one of the major produce of the Chilla marketing intervention.

The situation before Chilla

Prior to 2014, tribal farmers faced numerous socio economic challenges as given below.

Major challenges

- Sandalwood theft and illegal smuggling were widespread.
- Farmers depended entirely on middlemen for selling their produce.
- Agricultural products were purchased at extremely low prices.
- Lease farming became common, reducing ownership and bargaining power.
- Income from crops such as Chinese potato, ginger, turmeric, coffee and lemongrass remained very low.
- Many families abandoned agriculture and migrated towards wage labour or other unsustainable livelihood options.

Forest Department Intervention

To address these issues, the Kerala Forest Department launched the Chilla Market in 2014 near the Marayoor Forest Station.

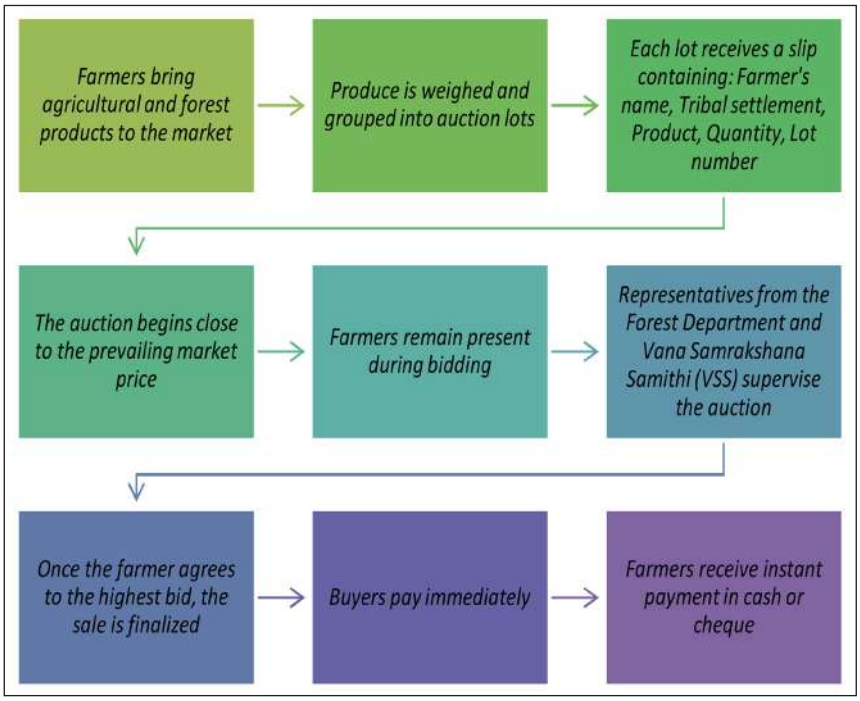
Objectives

- To provide a fair and transparent marketing platform
- To eliminate middlemen
- To enable farmers to receive remunerative prices
- To encourage continued cultivation of traditional crops
- To improve tribal livelihoods
- To strengthen women's participation in agricultural marketing

The most unique feature of Chilla is that the producer decides whether the offered price is acceptable, ensuring that farmers retain bargaining power.

How Chilla market works

The market operates every Thursday (as practiced currently) at the Chilla Market building near the Marayoor Forest Station, Idukki district.



Step-by-step process

Revenue sharing model

A small service charge is collected to maintain market operations and support tribal welfare activities.

Chinese potato auction and marketing at Chilla Market

Sale Value	Service charge (%)
Up to ₹2,000	5
₹2,001–₹5,000	4
₹5,001–₹10,000	3
Above ₹10,000	2

After deducting the service charge, the remaining amount is paid directly to the farmer. The service charge supports market operations and welfare programmes for tribal communities through the Forest Development Agency (FDA).

Chinese potato marketing through Chilla

Chinese potato has emerged as one of the most sought after crops in Chilla Market because of its superior quality, market demand, consumer preferences, size and shape of the tubers. Instead of selling to local middlemen, farmers now sell directly through transparent open auctions, where wholesalers, traders, government employees, Kudumbashree members, tourists and buyers from Kerala and Tamil Nadu compete for produce and offer fair price. This competitive bidding system has substantially improved farm gate prices.

Growth of Chinese potato Sales through Chilla market

- Quantity sold increased from 189.5 kg (2015–2016) to 405.83 tonnes (2024–2025), showing widespread adoption of the Chilla marketing system.
- Total sales value rose from ₹17,133 to ₹1.70 crore, reflecting significant growth in farmers' income.
- Average prices increased from around ₹28/kg during the early years to ₹42/kg in 2024–2025, indicating improved

Year-wise marketing performance of Chinese potato through Chilla Market

Year	Quantity Sold market (kg)	Total Sales (₹)	Average Price market (₹/kg)
2015–16	189.5	17,133	90
2016–17	5,893	190,905	32
2017–18	30,812.5	868,970	28
2018–19	61,378.5	1,710,467	28
2019–20	159,029	4,523,751	28
2020–21	85,209	2,352,994	28
2021–22	227,769	7,007,630	31
2022–23	221,555	7,234,605	33
2023–24	292,778	9,821,968	34
2024–25	405,830	16,953,122	42
2025–26	219,806	8,847,603	40

Price realization before and after Chilla

The introduction of Chilla substantially improved prices received by tribal farmers across several agricultural commodities.

Comparison of prices before and after establishment of Chilla Market

Commodity	Before Chilla (₹)	After Chilla (₹)
Butter beans	10–40	60–130
Gooseberry	5–10	15–40
Chinese potato	Rarely available in organized markets	25–55
Bird eye chilli	10–100	150–550
Lemon	15–35	30–100
Honey	100–200	350–600
Ginger	15–30	30–65
Tree tomato	10–40	60–110

price realization.

- Overall, the data clearly show that Chilla Market has evolved into a successful direct marketing platform, enhancing market access, ensuring transparent price discovery and substantially improving the livelihoods of tribal Chinese potato growers in Marayoor.

Impact on tribal communities

Economic benefits

- Higher farm-gate prices through competitive auctions.
- Elimination of middlemen.
- Immediate payment after sale.
- Increased household income.
- Expansion of market linkages to Idukki, Ernakulam, Kottayam and neighbouring districts of Tamil Nadu.

Social benefits

- Enhanced bargaining power of tribal farmers.
- Greater participation and leadership of tribal women.
- Reduced dependence on moneylenders.
- Revival of abandoned agricultural lands.
- Improved awareness of farmers' marketing rights.
- Reduced involvement in illegal livelihood activities.
- Stronger coordination between tribal communities and government departments.

Environmental benefits

- Promotion of natural and chemical free farming.
- Conservation of indigenous crops and traditional farming practices.
- Sustainable utilization of forest and agricultural resources.

A replicable model for tribal agricultural marketing

The success of Chilla market shows how a transparent, community-oriented marketing platform can transform tribal livelihoods. By enabling farmers to sell directly through open auctions, ensuring immediate payment and guaranteeing fair price discovery, the initiative has restored confidence in agriculture while improving income and social well-being. The Chilla market model provides an excellent example of how Forest Departments, tribal institutions and local communities can collaborate to create efficient agricultural marketing systems, particularly for niche, high value crops such as Chinese potato. The model offers valuable lessons for replication in other tribal and hill regions across India where farmers continue to face market inefficiencies and exploitation. ■

Transforming Livelihoods through Cassava Based Agrifood Systems

A Progressive Farmer's Success Story

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Cassava is one of the most important tuber crops cultivated in Kerala, contributing significantly to food security, nutritional security, and the livelihoods of farming communities. The crop is well adapted to the agro-climatic conditions of the state and is highly valued for its drought tolerance, high carbohydrate content, and stable market demand. The major cassava-growing districts in Kerala are Thiruvananthapuram (13,064 ha; 23.38%), Kollam (10,553 ha; 18.89%), and Kottayam (6,502 ha; 11.64%). During 2023–24, Thiruvananthapuram district ranked first in both area under cassava cultivation (13,064 ha) and production (434,930 tonnes), highlighting its pivotal role in the state's cassava economy.

Among the progressive cassava farmers of Thiruvananthapuram district, Mr. Rajan has emerged as a leading cultivator and custodian of cassava genetic diversity. A resident of Vlathankara P.O., Chenkal, Parasala, he has made remarkable contributions to cassava cultivation and varietal conservation through his innovative, sustainable, and farmer-centric production practices. His commitment to preserving diverse cassava varieties, coupled with the adoption of improved crop management technologies, has established him as a model farmer in the region. Mr. Rajan's

success demonstrates how scientific cultivation practices, conservation of indigenous germplasm, and a strong commitment to sustainable agriculture can enhance farm productivity while contributing to the long-term resilience of the cassava production system.

Farmer profile

Mr. Rajan, a 57-year-old progressive farmer from Chenkal village in Parasala Block of Thiruvananthapuram district, has been actively engaged in agriculture for more than four decades. With his unwavering dedication, hard work, and innovative outlook, he has successfully developed a diversified and sustainable farming system centred around cassava cultivation. He cultivates approximately 8 acres of land, comprising 0.5 acre of his own land and 7.5 acres of leased land. Irrigation for his farm is primarily sourced from the Neyyar Dam irrigation system, ensuring a reliable water supply for year-round cultivation. While cassava remains his principal crop, he also grows banana, vegetables, and several other tropical tuber crops. This diversified cropping system not only enhances the efficient utilization of available resources but also improves soil health, minimizes production risks, and provides a stable and regular source of income throughout the year. His integrated farming approach has made his farm economically viable, environmentally sustainable, and a model for other farmers in the region.

Conservation and cultivation of cassava varieties

One of the distinctive features of Shri Rajan's farming system is his commitment to the cultivation and conservation of a wide range of cassava varieties. His efforts in maintaining varietal diversity not only ensure stable and resilient production under varying environmental conditions but also contribute significantly to the conservation of valuable cassava genetic resources. Such on-farm conservation plays an important role in safeguarding traditional and improved germplasm for future generations.

The cassava varieties cultivated by Shri Rajan include Sree Rajan Kappa, Vella Priyan, Ulli Chuvalla, Sree Pavithra, Sree Reksha, and Vellayani Hraswa. These varieties differ in terms of yield potential, maturity period, tuber quality, taste, cooking characteristics, and adaptability to local agro-climatic conditions. By cultivating a diverse portfolio of varieties, he is able to ensure household food security, meet the varying preferences of consumers and market demand, reduce production risks, and conserve the rich traditional cassava diversity of the region. His farm thus serves as a valuable repository of cassava germplasm and an excellent example of on-farm biodiversity conservation integrated with profitable farming.

Cropping system and farm management

Shri Rajan follows a well-planned cropping system that enhances farm productivity while maintaining soil health. The predominant cropping sequence is banana–cassava–banana, which improves soil fertility, reduces pest and disease incidence, and ensures efficient use of farm resources. Cassava is planted at a spacing of 3 × 3 feet, and proper drainage channels are maintained to prevent water stagnation and promote healthy tuber development.

To maximize land use and

generate additional income, he practices intercropping during the early growth stages of cassava with short-duration crops such as bhendi (okra), cucumber, long cowpea, and amaranthus. These intercrops provide early income before cassava reaches maturity. The integrated system improves land use efficiency, suppresses weeds, conserves soil, enhances nutrient and water utilization, and reduces production risks. By combining crop rotation with intercropping, Shri Rajan has developed a productive, profitable, and climate-resilient farming system that serves as

a model for sustainable cassava cultivation.

Organic nutrient management

Shri Rajan follows eco-friendly and sustainable farming practices by relying mainly on organic nutrient sources. He applies about 1.5 truckloads of farmyard manure and 500 kg of poultry manure per acre to improve soil fertility and crop growth. He also uses locally available wood ash as a soil amendment. Notably, he does not use inorganic fertilizers or synthetic plant protection chemicals in his farm.

These organic farming practices help maintain soil health, conserve beneficial soil organisms, and reduce environmental pollution. The organically produced cassava and other farm products fetch premium prices in the market, improving farm income. By adopting organic farming, Shri Rajan contributes to climate change mitigation, environmental conservation, and the long-term sustainability of agriculture while demonstrating a successful model of eco-friendly cassava cultivation.

Economics of cassava production

The cost of cassava cultivation on Shri Rajan's farm is approximately ₹1.38 lakh per acre. The major expenses include land preparation, mound making, and planting (₹30,000), lease rent (₹40,000 per acre/ year), harvesting and loading (₹15,000), marketing expenses (₹33,266), irrigation (₹10,000), drainage maintenance (₹10,000), weeding and earthing up (₹22,000), and the application of organic manures, including farmyard manure and poultry manure (about ₹7,000). Despite the relatively high cultivation cost, the adoption of improved crop management practices, organic farming, and efficient marketing enables Shri Rajan to achieve profitable and sustainable cassava production.

Cassava cultivation on Shri Rajan's farm generates substantial economic returns. With an average yield of 20 tonnes per acre and a market price of about ₹30 per kg, he earns approximately ₹6.0 lakh per acre from cassava tubers. Additional income of around ₹6,000 each is obtained from the sale of cassava stems as planting material and cassava leaves as cattle feed, bringing the total income from cassava cultivation to about ₹6.12 lakh per acre. Further, intercropping with vegetables such as bhendi, cucumber, and long cowpea provides an additional income of around ₹31,000 per acre, significantly enhancing the overall profitability of the farming system.

Major challenges in cassava cultivation

Despite the profitability of cassava cultivation, farmers continue to face several constraints that affect productivity and income, he added. The major challenges include the incidence

Particulars	Amount (Rs.)/acre
Land preparation including mound making and planting (30 labour × 1000)	30,000
Farm Yard Manure – 1.5 load× 3000	4,500
Broadcasting FYM/Ash/Poultry manure (6 labour × 1000)	6,000
Cost of poultry manure (500 kg × 2)	1,000
First weeding and earthing up (12 labour × 1000)	12,000
Second weeding and earthing up (10 labour × 1000)	10,000
Deepening of drainage channels (10 labour × 1000)	10,000
Irrigation during early stages (10 labour × 1000)	10,000
Harvesting including loading (15 labour × 1000)	15,000
Marketing cost including fee	33,266
Lease rent for land/ year	40,000
Total cost	1,71,766
Cassava tubers (20,000 kg × Rs.30/kg)	600,000
Stem sale (2000 stems × Rs.3)	6,000
Cassava leaves for cattle feed	6,000
Income from intercropping (bhendi, cucumber and long cowpea)	31,000
Total income	6,43,000

of pests and diseases, which often result in yield losses and increased crop management costs. Labour scarcity and the rising cost of agricultural wages further increase the overall cost of cultivation, reducing profit margins. In addition, fluctuations in market prices create uncertainty in farm income, while changing climatic conditions, such as irregular rainfall, prolonged dry spells, and extreme weather events, adversely affect crop growth and productivity. Addressing these challenges through improved crop management practices, climate-resilient technologies, and effective market support mechanisms is essential for ensuring the sustainability and profitability of cassava farming.

Awards and recognitions

Shri Rajan is a recipient of the Best Cassava Farmer Award conferred by ICAR–Central Tuber Crops Research Institute (ICAR–CTCRI), Thiruvananthapuram, during the Institute's 58th Foundation Day celebrations in July 2021. He serves as a Decentralized Seed Multiplier (DSM) of ICAR–CTCRI and is an active member of the Vegetable and Fruit Promotion Council Keralam (VFPCK) and the Cooperative Society. With his rich farming experience and commitment to promoting improved cassava cultivation practices, Shri Rajan has emerged as a resource person for several farmer training programmes organized by various agencies. His successful adoption of improved technologies, quality seed production, and willingness to share knowledge have made him a role model and an inspiration to farmers in his locality.

Conclusion

The success story of Shri Rajan from Parasala demonstrates the immense potential of sustainable cassava cultivation in improving farmers' livelihoods. Through the conservation of diverse cassava varieties, adoption of organic farming practices, and integration of intercropping, he has developed a profitable and environmentally sustainable farming system. His experience illustrates how scientific crop management combined with traditional knowledge can enhance productivity, conserve agricultural biodiversity, and ensure stable farm income. Shri Rajan's achievements serve as an inspiration to other farmers and underscore the importance of promoting diversified and sustainable farming systems for resilient agriculture and long-term rural development. ■

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Minimally Processed Fruits and Vegetables
Freshness, Safety, and Quality Perspectives

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Abstract

Minimally processed fruits and vegetables (MPFV) represent a rapidly growing segment of the food industry, driven by consumer demand for fresh, convenient and healthy products. These products undergo preparatory steps such as washing, peeling, cutting and packaging, while maintaining their fresh-like characteristics. This article highlights the fundamental aspects of MPFV, including processing techniques, microbial safety, quality maintenance, packaging strategies, and consumer acceptance. Challenges such as enzymatic browning, moisture loss, and microbial spoilage are discussed, alongside technological solutions like modified atmosphere packaging (MAP) and edible coatings. Emphasis is placed on maintaining nutritional and sensory quality, ensuring food safety and extending shelf life. MPFV provide significant opportunities in promoting healthy eating habits, reducing food waste and enhancing value addition in the horticultural sector.

Introduction

The global demand for ready-to-eat, nutritious and fresh-like products has fueled interest in minimally processed fruits and vegetables (MPFV). Unlike traditional processed foods, MPFV are prepared using mild operations such as washing, trimming, peeling, slicing and packaging, which retain their natural flavour, aroma, and nutritional quality. They are commonly referred to as 'fresh-cut produce.' The main objective of minimal processing is to provide convenience without compromising freshness, safety, or quality. However, due to the absence of severe thermal processing, MPFV are more vulnerable to microbial contamination, enzymatic browning, and rapid spoilage. This necessitates advanced handling, processing, and packaging techniques to extend shelf life while maintaining consumer acceptability.

Importance And Features

- Vegetables and fruits are highly perishable due to their tenderness, high moisture, and susceptibility to microbial spoilage.
- Processing operations like peeling, trimming, coring and slicing account for about 10–30% of the processing time.
- The objective of minimal processing is to extend shelf life while maintaining freshness, quality and safety.
- These vegetables cater to the growing demand for convenience foods and contribute significantly to reducing post-harvest losses.

Changes During Storage

Minimally processed vegetables continue to respire after cutting, leading to physiological, biochemical, and microbial changes.

Nutritional value – Cutting and slicing increase exposure to oxygen, leading to loss of vitamin C. Due to peeling induced stimulation of lipoxeganase enzyme, beta carotene content gets reduced.

Texture – Loss of turgor pressure results in a softer, less crispy texture which is undesirable.

Appearance – Colour loss, enzymatic browning, and lack of uniformity may occur. Brown discolouration caused by polyphenol oxidase activity.

Flavour – Spoilage microbes cause off-flavour due to anaerobic metabolism. Activity of lipolytic and proteolytic enzymes also cause off-flavour development.

Microbial load – High water activity and damaged tissues favour rapid microbial growth.

Physiological disorders – Soft rot, browning, wilting, fermentative spoilage, and off-flavour formation may be there.

Processing Techniques

The processing of MPFV typically involves several sequential steps: selection of raw material, washing and sanitization, peeling, cutting or slicing, disinfection, drying, and packaging. Each step influences the final product quality.

- Washing and sanitization: Removal of dirt, pesticides, and microorganisms using chlorinated water, organic acids, or ozone.
- Cutting and slicing: Mechanical cutting increases surface area.
- Disinfection: Application of mild sanitizers to control microbial load.
- Packaging: Modified atmosphere packaging (MAP) and vacuum packaging are widely used to reduce oxygen exposure and delay spoilage.

To maintain quality and extend shelf life, several treatments are applied:

1. Refrigeration (< 4°C) – Reduces respiration and microbial growth.
2. Chemical Additives –
   - Textural improvers (Calcium salts).
   - Anti-browning agents (acidulants, enzyme inhibitors, reducing agents like ascorbic acid, chelating agents).
   - Antimicrobial agents (chlorine, hydrogen peroxide, ozone, organic acids).
   - Normal Anti-microbials – Spices, herbs, and plant extracts with natural antimicrobial activity.
3. Mild Heat Treatment – Short exposure to 40°C to inhibit spoilage enzymes.
4. Modified Atmosphere Packaging (MAP) – Low O_2 and high CO_2 slow respiration but must be controlled to avoid lactic acid bacterial growth.
5. Ionizing Radiation – Low-dose radiation reduces microbial population and delays spoilage.
6. Reduction of Water Activity – Using partial drying or addition of solutes like sugar and salt.
7. High Pressure Processing (HPP) – Inactivates enzymes like polyphenol oxidase while maintaining freshness.

Steeping Solutions for Vegetables (Shelf-Life Extension)

A typical schedule includes:

Salt (3–5%), acids (lactic + acetic), and potassium metabisulphite (0.1–0.2%) depending on the vegetable.

Storage life may be extended up to 6–9 months for crops like cauliflower, peas, carrot, radish, and lotus stem.

Benefits and Global Relevance

1. **Nutritional integrity** – MPFP retains higher level of vitamins, minerals, antioxidants, and dietary fiber compared to fully processed foods.
2. **Consumer preferences** – Pre-cut and ready to use fruits and vegetables save time and preparation efforts.
3. **Sustainability** – MPFP can reduce food waste by prolonging shelf life and utilizing surplus produce.
4. **Economic opportunities** – They create value chains that benefit farmers, processors, consumers, retailers across the globe.

In countries like USA and Canada MPFP has become a key segment of the fresh produce industry, while nations such as India and

Brazil are rapidly expanding their MPFP market due to urbanization and changing lifestyle.

Microbial Safety and Quality Maintenance

The safety of MPFV is a major concern due to the absence of intense heat treatment. Pathogens such as Escherichia coli, Salmonella and Listeria monocytogenes pose significant risks. To ensure microbial safety, strict hygiene practices, use of sanitizers and cold chain management are essential. Quality deterioration in MPFV occurs due to enzymatic browning, texture softening, and moisture loss. Technologies such as edible coatings, anti browning agents (ascorbic acid, citric acid), and low-temperature storage are employed to maintain quality.

Packaging Strategies

Packaging plays a critical role in extending the shelf life of MPFV. Modified atmosphere packaging (MAP) regulates oxygen and carbon dioxide levels, slowing down respiration and microbial growth. Vacuum packaging, biodegradable films and active packaging (antimicrobial films, oxygen scavengers) are also gaining importance. Edible coatings using polysaccharides and proteins provide an eco-friendly solution for quality preservation.

Modern solutions and strategies

Global research has focused on non-thermal and environment friendly preservation techniques like,

1. Modified Atmospheric Packaging (MAP)
2. High Pressure Processing
3. Ultraviolet treatment
4. Edible coating with natural antimicrobials
5. Hurdle technology (combining mild intervention for improved safety)

These techniques aims to maintain quality while ensuring consumer safety without heavy chemical preservatives.

Applications and Consumer Acceptance

Minimally processed fruits and vegetables are widely used in salads, ready-to-cook vegetable mixes, fruit juices and catering industries. Consumers prefer MPFV due to their convenience, freshness, and nutritional benefits. However, their relatively high cost, short shelf life, and the need for refrigeration remain challenges to wider adoption. Increasing awareness about health and wellness has significantly boosted the demand for fresh-cut produce in urban markets.

Conclusion

Minimally processed fruits and vegetables represent a vital innovation in the food industry, providing consumers with safe, nutritious, and convenient products. Despite challenges related to microbial safety and shelf life, advances in packaging, sanitization, and quality preservation technologies have expanded their commercial potential. Continuous research is needed to optimize processing techniques, enhance food safety, and develop sustainable packaging solutions. MPFV not only meet consumer demands but also contribute to reducing food waste and adding value to horticultural produce.

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Hot Air Frying

A Healthier Alternative to Traditional Deep-Fat Frying for Health-Conscious Consumers

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Oil frying is one of the oldest, simplest, and most widely used cooking methods in both households and commercial food processing. It involves cooking food in hot oil or fat, resulting in desirable characteristics such as a crispy and crunchy texture, attractive colour, characteristic flavour, and appealing taste. These sensory attributes enhance palatability and make fried foods highly popular among consumers. Frying is essentially a dehydration process involving simultaneous heat and mass transfer, which induces a series of physical, chemical, and structural changes in the food. Depending on the amount of oil used and the method of heating, frying techniques include pan-frying, sautéing, stir-frying, and deep-frying. In pan-frying, food is cooked in a relatively thin layer of oil and turned manually to ensure uniform cooking. Deep-frying involves completely immersing the food in hot oil, generally at temperatures of about 150-200°C, producing a crisp outer layer while cooking the interior. Sautéing and stir-frying use comparatively smaller amounts of oil and high temperatures to cook small pieces of food. Sautéing is generally carried out in a wide, flat pan using moderate to high heat, whereas stir-frying is typically performed in a wok at very high temperatures with continuous tossing or stirring.

Despite its desirable sensory qualities, conventional oil frying has certain nutritional and health-related concerns. The process can substantially increase the fat and energy content of food due to oil absorption. Moreover, exposure to high temperatures, particularly in carbohydrate-rich foods, may promote the formation of acrylamide, a potentially harmful process contaminant. These concerns have increased consumer demand for foods containing less fat and fewer undesirable processing compounds. Several pre-treatment and modified frying techniques have therefore been explored to reduce oil uptake while retaining the desirable characteristics of fried

foods. Pre-treatments such as pre-drying, soaking, blanching, coating, and microwave treatment can help control moisture loss and oil absorption during frying. Vacuum frying, which operates at reduced pressure and consequently at lower frying temperatures, is another approach used to improve product quality and reduce the formation of heat-induced undesirable compounds. The growing preference for low-fat and healthier food choices has encouraged the food industry, particularly the snack and chips sector, to develop alternative frying technologies. Among these, hot air frying has emerged as a promising approach for producing foods with a crisp texture, attractive colour, and desirable flavour using little or no added frying oil. Thus, hot air frying offers an opportunity to enjoy the sensory appeal of traditionally fried foods while addressing the increasing demand for healthier, lower-fat alternatives.

Hot Air Frying

Hot air frying is a promising alternative to traditional oil frying and is gaining popularity among health-conscious consumers because of its convenience, versatility, ease of use, and potential health benefits. It can produce foods with lower oil/fat content, reduced acrylamide formation, and better retention of nutrients. It is an emerging technology for preparing fried foods by circulating hot air around the food, with a small amount of oil mist sometimes used to promote uniform heat transfer and desirable surface characteristics. Hot air frying uses circulating hot air at temperatures of up to 200°C. In some products, such as potatoes and other carbohydrate-based foods, a small amount of oil may be added to improve sensory and

textural properties. For products such as meat, chicken, and seafood, the fat naturally present in the food may be sufficient. Consequently, hot air frying can produce lower-fat and lower-calorie foods compared with conventional deep-fat frying.

Hot air frying can produce foods with characteristics similar to traditionally deep-fried products while using significantly less oil. It also offers environmental benefits by reducing oil consumption and minimizing waste and effluent generation. The technology is increasingly used for preparing fish, meat, vegetables, and tubers, providing consumers with a healthier alternative to conventional deep frying. By reducing dependence on both plant- and animal-based frying oils, hot air frying can also help reduce the environmental footprint of food preparation. Thus, for consumers seeking both health and sustainability, hot air frying is emerging as an attractive alternative to conventional oil-immersion frying.

Advantages

Air frying offers several advantages, including better retention of vitamins and minerals, particularly water-soluble vitamins, lower fat content, and potentially reduced acrylamide formation. Its versatility allows the preparation of a wide range of foods, including fish, meat, vegetables, and tubers. In fish, it helps retain omega-3 fatty acids while maintaining the tenderness of delicate varieties such as cod and salmon. In meat, it promotes uniform cooking while reducing fat content and preserving texture. For vegetables, air frying enhances flavour and texture while helping retain vitamins and antioxidants. In tubers, it produces crispy fries or chips with significantly less oil. Air frying also offers greater convenience, as it eliminates oil splattering and reduces the need for oil disposal, while generating less smoke and odour due to minimal oil usage. However, air-fried products may not always achieve the same level of crispness and characteristic flavour as traditionally deep-fried foods. In addition, the relatively small capacity of commercially available air fryers remains a major limitation for their large-scale application in food processing.

Hot Air Frying Equipment

In a hot air fryer, a fan positioned at the top circulates air heated by an electrical resistance element

(150-200°C) around the food in a small chamber. The high-velocity airflow mimics the heat circulation of hot oil in deep-fat frying, promoting browning and crust formation while cooking the interior. The forced airflow is similar to that in a convection oven. However, heat and mass transfer are faster in deep-fat frying than in hot air frying. Although the frying temperature may be similar, hot air frying generally requires a longer processing time than deep-fat frying. As the popularity of hot air frying continues to grow, a wide range of home-use appliances is available to meet different cooking needs and batch sizes. Common options include low-capacity compact fryers and high-capacity cabinet-type hot air frying ovens, making healthier frying more convenient for households. Compact air fryers are countertop appliances with a basket or small frying chamber designed for small-batch preparation. High-capacity cabinet-type ovens have larger chambers with products placed on trays or racks, making them suitable for scale-up and production trials. High-performance industrial air fry systems continuously produce "fried-like" products through controlled application of surface oil followed by a uniform flow of pressurized, high-velocity cooking air in an impingement oven. These systems produce breaded products with reduced oil content while maintaining the taste, texture, and appearance of traditional deep-fried foods. Applications include chicken breasts, strips, nuggets and other boneless chicken pieces, breaded seafood, cheese sticks, vegetables, and non-breaded products such as taquitos and egg rolls.

Air frying conditions of selected foods

Air-frying conditions are product-specific and depend on the equipment used. The frying temperature and time must be optimized to achieve desirable crispness and colour while minimizing oil uptake, excessive browning, and thermal degradation. The temperature-time combinations used for selected food products are presented in the table below.

Food	Temperature, °C	Time, min
Doughnut	150-180	4-8
Arapaima meat	150-190	5-12.5
Fillet mackerel	132-188	13-16
Pink perch fillets	160-200	5-15
Potato French fries	180-200	12-24 min
Falafel	140-200	5-15
Surimi	120-200	10-15
Sturgeon steaks	130-190	15
Breaded stuffed chicken	177-204	20-25
Chicken nuggets	190	15
Fish cutlet	180	12
Potato chips	185	25
Malaysian fish sausage	150	15
Sardine fillets	180	10
Chicken thigh, wing and breast	180	35
Chicken nuggets	190	15
Samosa	160	10-12
Fish snack	180	12

Conclusion

Access to modern retail, e-commerce platforms, and social media, along with greater affordability, has significantly influenced the snacking choices of Millennials and Gen Z across both rural and urban populations. Air-fried products that offer texture and appealing flavours comparable to oil-fried products are likely to attract health-conscious consumers because of their lower fat and calorie content. The future of consumer-friendly air-frying technology appears promising, offering a practical way to enjoy tasty, crispy snacks with less fat and fewer calories. As consumers increasingly seek healthier options without compromising taste and texture, air-fried foods are poised to become an important part of the evolving snacking landscape.■

Purple Carrots
A Superfood with Hidden Health Benefits

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The Carrot That Came Before Orange

Ask anyone to picture a carrot and the answer is almost always the same: long, crisp and bright orange. Yet for most of the carrot's history, orange was the exception, not the rule. The cultivated carrot (Daucus carota L.) was first domesticated in the region of present-day Afghanistan and Central Asia more than a thousand years ago, and those earliest carrots were purple and yellow. Purple carrots travelled westwards to the Mediterranean and eastwards into the Indian subcontinent, where deep purple and black-purple types are still lovingly grown in the northern plains and known simply as kali gajar (black carrot). The familiar orange carrot is a much later development, popularised by Dutch growers only around the sixteenth and seventeenth centuries. So when you bite into a purple carrot, you are tasting the original carrot, and one of the most healthful vegetables you can put on your plate.

What Makes a Purple Carrot Purple?

The secret lies in a family of natural plant pigments called anthocyanins, the same water-soluble pigments that colour jamun, blueberries, black grapes and red cabbage. In purple carrots, the dominant anthocyanins are derivatives of cyanidin, stored mainly in the root's outer tissues; in the darkest 'black' carrots the pigment extends right through the core. A special feature of carrot anthocyanins is that a large share of them are acylated, chemically decorated in a way that makes them unusually stable against heat, light and changes in acidity. This stability is exactly why the food industry prizes black carrot extract as a natural colourant, and why the health-giving pigments survive cooking better than those of many other crops.

Purple colour does not come

at the cost of the usual carrot goodness. Many purple types, especially those with purple skin and an orange core, still carry carotenoids, the vitamin A precursors that make ordinary carrots so valuable for eyesight and immunity. A purple carrot can therefore deliver a double package: anthocyanins plus carotenoids in a single root.

Hidden Health Benefits: What Science Says

Anthocyanins are among the most intensively studied dietary antioxidants, and purple and black carrots are one of the richest and most affordable vegetable sources of them. Research across food science, nutrition and medicine points to a consistent set of benefits:

- Powerful antioxidant action: anthocyanins neutralise free radicals, the unstable molecules that damage cells and accelerate ageing. Purple carrots typically show several-fold higher total antioxidant activity than orange carrots.
- Heart and blood vessel health: regular intake of anthocyanin-rich foods is associated with better blood lipid profiles, healthier blood pressure and improved function of the blood vessel lining.
- Blood sugar management: purple carrot pigments and fibre together help slow starch digestion and improve insulin response in experimental studies, a promising point for a country facing a diabetes epidemic.
- Anti-inflammatory effects: chronic low-grade inflammation underlies many lifestyle diseases; anthocyanins help calm the inflammatory signalling pathways involved.
- Gut health: the pigments and dietary fibre of purple carrots act as food for beneficial gut bacteria. The traditional North Indian fermented drink kanji, made from black carrots, water, salt and crushed mustard seeds, is a naturally probiotic beverage enjoyed for generations.
- Vision and immunity: where carotenoids are also present, the classical carrot benefits for eyesight, skin and immune function come as a bonus.

Purple carrots are no magic cure, and these benefits come from eating them as part of a varied, sensible diet. Few vegetables, however, pack such a combination of pigments, fibre, minerals and vitamins at such a low cost.

Improved Varieties for Indian Farmers

For decades, purple and black carrots in India were mostly local landraces, nutritious but variable in shape, colour depth and yield. Systematic breeding has changed this. At the ICAR–Indian Agricultural Research Institute, New Delhi, dedicated improvement of anthocyanin-rich carrots has produced Pusa Asita, a striking black-purple carrot with intense pigmentation suited to the North Indian plains, alongside other Pusa selections in red, orange and novel colours bred for warmer, tropical growing conditions. Punjab Agricultural University has likewise released improved black carrot material for the region. These varieties combine the traditional deep colour with uniform, smooth roots, better yields and uniform internal colour, traits that fetch a premium in urban and health-food markets.

Can Kerala Grow Purple Carrots?

Carrot is a cool-season crop, and Kerala already has proof that it can be grown well: the high ranges of Idukki district, in the Kanthalloor–Vattavada belt, and parts of Wayanad produce excellent carrots during the cooler months. These highland pockets, with their mild temperatures, are naturally suited to purple and black carrot cultivation, and a distinctive coloured carrot could become a signature product for these farm-tourism villages. In the plains, temperate carrots struggle, but tropicalised carrot varieties bred to form roots and colour under warmer conditions open a realistic window during the December–February season, particularly at moderate elevations. A few practical pointers for growers trying purple carrots:

- Choose deep, loose, well-drained sandy loam soils; hard or stony soils cause forked, misshapen roots.

Purple Versus Orange: A Quick Comparison

Feature	Purple / black carrot	Orange carrot
Main pigment	Anthocyanins (± carotenoids)	Carotenoids (β-carotene)
Key health role	Antioxidant, heart, blood sugar, gut health	Vitamin A, vision, immunity
Antioxidant activity	Very high	Moderate
Special uses	Kanji, juices, natural food colour, nutraceuticals	Salads, halwa, juices, cooking
Season in India	Cool season; hills and winter plains	Cool season; tropical types widen the window

- Sow seed thinly on raised beds or ridges; thin seedlings early to 5–8 cm spacing for straight, marketable roots.
- Maintain even soil moisture; alternating drought and flooding splits the roots and dilutes colour.
- Harvest at tender maturity (root diameter of roughly 2.5–4 cm); over-mature roots turn woody.
- Purple colour develops best under cool nights; in warmer sites, prefer varieties bred for tropical conditions.

From Farm to Market: Value Addition Opportunities

The real excitement around purple carrots is commercial. Black carrot concentrate is an internationally traded natural food colourant used in juices, confectionery, ice creams and yoghurts as consumers turn away from synthetic dyes. For farmer producer organisations and agri-startups, purple carrots offer a ladder of products: fresh premium bunches for urban retail; bottled kanji as a probiotic health drink; cold-pressed purple carrot juice and blends; dehydrated flakes and powder for bakery and nutraceutical use; and anthocyanin-rich extract for the food-colour industry. Even at the household level, purple carrots make eye-catching salads, pickles, halwa with a royal violet hue, and a kanji that turns a beautiful ruby-purple as it ferments. Kerala's strong tradition of value-added spice and fruit enterprises could readily extend to this crop.

The Road Ahead

Purple carrots bring together an ancient Indian vegetable and very modern health science. Breeders are now using genomics and rapid pigment-screening tools to raise anthocyanin content further, improve flavour and extend adaptation to warmer regions, which will matter greatly for southern India. For farmers, the purple carrot is not a novelty; it is the crop's own heritage returning with a premium price and a proven nutritional story. For consumers, the advice is simpler still: the next time you see purple carrots in the market, buy them. Behind that royal colour lies one of the most affordable superfoods our fields can offer.

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