Policy Paper on

Harnessing Exotic Fruit Crops for Sustainable Diversification

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Harnessing Exotic Fruit Crops for Sustainable Diversification

भारत सरकार
GOVERNMENT OF INDIA
सत्यमेव जयते

बागवानी मिशन
Horticulture Mission



01

Diversification

Shift from low-return staple crops to high value fruits
Encourage region specific cultivation for sustainable income
Integrate exotic fruits in mixed orchards and homested



02

Atmanirbhar Bharat

Promote domestic cultivation of exotic fruits
Strengthen nursery networks & quality planting materials
Foster innovation, entrepreneurship & local value addition



03

Nutrition & Health Security

Enrich diets with vitamins, minerals and antioxidants
Combat malnutrition through nutrient fruits
Link horticulture diversification with public health



04

Agro-processing and value addition

Growth of the agro-processing industry, offering opportunities for value addition, employment generation, and rural entrepreneurship.
Encourage value added products (juices, powders, oils, nutraceuticals



05

Sustainability and Climate Resilience

Introduce climate resilient crops like dragon fruit, avocado, passion fruit



06

Import substitution

Cut Rs 300 crore fruit import bills
Develop domestic clusters for production & processing
Strengthen export competitiveness through certification & branding

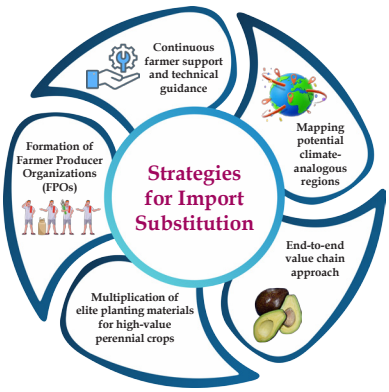




ATMANIRBHAR HORTICULTURE: CLEAN PLANT PROGRAMME









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Preface

India's horticultural sector has emerged as a dynamic driver of agricultural growth, rural employment, and nutritional security. Within this vibrant landscape, exotic fruit crops have gained significant attention owing to their high market value, nutritional richness, and growing consumer demand. Once considered niche commodities, fruits such as dragon fruit, avocado, rambutan, mangosteen, and passion fruit are now entering mainstream markets, reflecting shifting dietary patterns and globalization of food preferences. This transformation presents an immense opportunity to enhance farm profitability and achieve the national goal of doubling farmers' income through crop diversification and value addition.

The growing import dependency for several high-value fruits underscores the need for a structured policy framework that promotes domestic production, post-harvest management, and market integration. Harnessing the potential of exotic fruit crops can contribute not only to economic resilience but also to nutritional and environmental sustainability. Moreover, these crops, suited to varied agro-climatic zones, offer possibilities for diversification in regions where traditional crops face challenges of declining productivity or climate-induced stress.

This policy paper, "Harnessing Exotic Fruit Crops for Doubling Farmers' Income: A Policy Framework for Sustainable Diversification in India," comprehensively examines global and national trends in production, trade, and consumption of exotic fruits. It highlights their nutritional, pharmaceutical, and economic importance, along with their suitability across different regions of India. The document also identifies the key challenges hindering their expansion-such as limited availability of quality planting materials, research gaps, and inadequate policy support—while proposing strategic interventions for overcoming these barriers.

The framework emphasizes import substitution, export promotion, value addition, and sustainable production systems that align with the principles

of *Atmanirbhar Bharat*. It advocates for region-specific cultivation plans, public–private partnerships, and integration of exotic fruit crops into national horticultural missions to ensure inclusive growth.

It is hoped that this policy framework will serve as a guiding document for researchers, policymakers, and development agencies to strengthen India's exotic fruit ecosystem and empower farmers through innovation-led, sustainable diversification".



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The authors sincerely express their profound gratitude to the progressive farmers and growers, whose proactive initiatives, dedication, and steadfast commitment to cultivating exotic fruit crops have played a pivotal role in shaping the perspectives and recommendations presented in this policy paper. Their practical insights, innovative cultivation practices, and willingness to adopt sustainable approaches have provided an essential foundation for the analyses and conclusions drawn herein. Furthermore, the authors extend their deepest appreciation to the officials of the State and Central Departments of Horticulture, as well as other agencies involved in promoting horticulture, for their invaluable guidance, technical expertise, and continuous support. Their collaborative efforts have been instrumental in fostering diversification and sustainability in horticultural practices, cultivation.



Harnessing Exotic Fruit Crops for Sustainable Diversification

Executive Summary

India's horticulture sector is undergoing rapid diversification, with rising consumer demand for exotic and high-value fruits such as dragon fruit, avocado, passion fruit, strawberry, blueberry, and rambutan. These crops offer immense potential to enhance farmers' income, promote nutritional security, and reduce dependence on imports. Despite suitable agro-climatic conditions, their domestic cultivation remains limited due to inadequate planting material, weak post-harvest infrastructure, and fragmented value chains. This paper outlines a strategic policy framework for accelerating the adoption of exotic fruit crops through area expansion, varietal improvement, capacity building, and public–private partnerships. It highlights their nutritional, medicinal, and economic importance, emphasizing their role in climate-resilient, sustainable diversification and income enhancement. Strengthening research, planting material systems, and value addition initiatives can position India as a competitive producer and exporter of high-value exotic fruits.

Keywords: Exotic fruit crops, Farmers' income, Crop diversification, Sustainability, Import substitution, High-value horticulture, Climate resilience



Avocado



Mangosteen



1. Introduction

India's fruit market has long been vibrant, supported by an extraordinary diversity of both indigenous and exotic crops. In recent years, changing lifestyles, dietary westernization, and growing health awareness have reshaped consumer behaviour, driving a strong demand for exotic and imported fruits. The preference for fruits such as avocado, dragon fruit, blueberry, and passion fruit reflects an expanding appreciation for varied flavours, higher nutritional content, and wellness-oriented food choices. This transition also signals an increasing aspiration among consumers for diversity in taste and nutrition, alongside a commitment to healthier living.

Many parts of India are naturally endowed with diverse agro-climatic conditions—ranging from tropical to subtropical—that are ideally suited for cultivating a wide range of novel fruit crops. Crops such as avocado (*Persea americana* Mill.,), dragon fruit (*Selenicereus* spp.), mangosteen (*Garcinia mangostana* L.), rambutan (*Nephelium lappaceum* L.), macadamia nut (*Macadamia integrifolia* Maiden & Betche), longan (*Dimocarpus longan* Lour.,), durian (*Durio zibethinus* L.), passion fruit (*Passiflora edulis* Sims), Manila tamarind (*Pithecellobium dulce* (Roxb.) Benth.), soursop (*Annona muricata* L.), strawberry (*Fragaria ananassa*) and blueberry (*Vaccinium corymbosum* L.) possess significant potential for nutritional enrichment and market diversification. These fruits are rich in antioxidants, vitamins, and other nutraceutical compounds, offering multiple health benefits while catering to the emerging niche market for functional foods.

Many of these crops were initially introduced from Southeast Asia, largely through seedling origin, with only limited documentation and systematic evaluation. Recent efforts by research institutes and progressive farmers, however, have demonstrated encouraging adaptability in specific agro-ecological zones, suggesting significant potential for area expansion, income enhancement, and crop diversification. Given India's growing challenge of malnutrition, climate variability, and the need to sustain grower profitability, this exotic fruit crops represent promising "future fruits" that can combine economic, nutritional, and ecological benefits. Commercial cultivation of



selected exotic fruits such as dragon fruit, avocado, and passion fruit has recently gained notable traction in Kerala, Karnataka, Tamil Nadu, and other states, supported by rising market demand and the development of niche consumer segments. These fruits are now being grown successfully in small orchards, mixed fruit systems, and homestead gardens, with inter- and intrastate trade expanding steadily.

In the broader context, India remains a global leader in fruit and vegetable production, ranking second worldwide after China. Fruit production sector is poised for substantial growth, with the fresh fruits market expected to expand at a compound annual growth rate (CAGR) of 6.7 to 7.58% between 2024 and 2029, reaching a market volume of $167.00 billion by 2029. As per the National Horticulture Database (2023–24), the country produced 112.62 million metric tonnes of fruits and 204.96 million metric tonnes of vegetables, cultivated over 7.04 million hectares. India holds the top global position in the production of bananas (25.56%), mangoes (including mangosteen and guava) (44.46%), and papayas (38.64%). During the same year, exports of fruits and vegetables were valued at ₹15,039.27 crores (USD 1,814.58 million), with fresh fruits contributing ₹8,178.22 crores (USD 986.32 million). Yet, per capita fruit consumption remains low between 100–200 g per day, against the recommended 150 g suggesting vast untapped potential in both production and consumption sectors. Simultaneously, India imported 59.3 thousand metric tonnes of fresh fruits, primarily from Thailand, Vietnam, and Chile, positioning the country as the second-largest importer of fresh fruits globally after China. This growing dependence on imports underscores the urgent need to strengthen domestic production of high-value exotic fruits, thereby reducing import reliance and creating new income opportunities for farmers.

1.1. Global Trend and Domestic Demand of Exotic Fruit Crops

Exotic fruits-defined as non-native fruits cultivated outside their natural origin and distinguished by unique sensory characteristics and limited market share-have witnessed a steady rise in global demand over the past decade (Reis, 2019). This surge reflects the growing consumer inclination towards nutrient-dense, flavourful, and health-promoting foods, as well as the influence of international culinary trends and expanding trade networks.



Globally, markets in Asia, the Middle East, and North America are showing a sharp increase in the consumption of fruits such as avocado, dragon fruit, blueberry, passion fruit, and mangosteen. These fruits appeal to consumers for their vibrant colours, exotic flavours, and perceived health benefits, including antioxidant and anti-inflammatory properties. According to the Food and Agriculture Organization (FAO, 2021), the market for exotic fruits is currently valued at approximately ₹3,000 crores, and is expanding rapidly as global retail chains and e-commerce platforms integrate these products into mainstream distribution.

Data from Volza's India Import Report (2023) indicate that Indian importers purchased 57,700 shipments of fresh fruits from 2,373 suppliers, ranking India third globally after China (95,325 shipments) and the United Arab Emirates (54,488 shipments). This robust import activity highlights India's dependence on foreign suppliers to meet the growing domestic appetite for exotic fruits.

According to Asian Fruits (2022), the global trade in fresh fruits is largely driven by apples and oranges, which together account for more than 80% of total imports. However, the fastest-growing import categories are high-value exotics such as avocados, cherries, kiwifruits, and blueberries, each registering annual growth rates exceeding 40%. Avocado imports alone have surged across Asia and Europe due to increasing adoption in vegan and fitness-focused diets. Similarly, the demand for berries and tropical fruits such as rambutan and mangosteen continues to climb, driven by their positioning as "superfruits" rich in antioxidants and phytonutrients.

India's domestic market mirrors these international trends. The shift in consumer preference toward exotic fruits is fuelled by urbanization, rising disposable incomes, health consciousness, and exposure to global cuisines. These changes are further supported by the rapid expansion of organized retail-including supermarkets, hypermarkets, and online grocery platforms-that ensure year-round availability and quality assurance. According to the Global Retail Development Index (GRDI, 2021), India ranks second globally in market attractiveness for retail investment, with the sector contributing 11–12% to national GDP, employing over 35 million people, and generating annual sales of USD 1.16 trillion (Kearney, 2021).



The growth of organized and modern retail systems, combined with advancements in cold-chain logistics, has created new avenues for marketing high-value fruits across metropolitan and semi-urban markets. This evolving retail ecosystem-coupled with an increasingly health-conscious consumer base—positions India as one of the most promising emerging markets for exotic fruit cultivation and trade.



Blueberries

1.2. Global Production Scenario of Exotic Fruit Crops

The global demand for exotic fruits has grown steadily over the past decade, driven by rising consumer awareness of their nutritional and therapeutic value, as well as by expanding international trade. In response, the cultivation and production areas of these crops have increased significantly across Asia, the Americas, and parts of Africa and Oceania (Table 1 & Fig.1). While production remains geographically concentrated, the overall trend reflects a global transition toward high-value horticultural crops with strong export potential and health-linked appeal. Among producing regions, Asia and the Americas dominate global production. China, Vietnam, Thailand, and Indonesia are the principal contributors in Asia, while Mexico, Peru, and the United States lead in the Americas. The FAOSTAT (2023) data indicate the following key production trends:

Avocado (*Persea americana* Mill.,): Global production stands at 10.47 million tonnes, cultivated across 954,689 hectares. The American region accounts for 69.4% of global output, led by Mexico (2.97 million tonnes), followed by Colombia and the Dominican Republic.

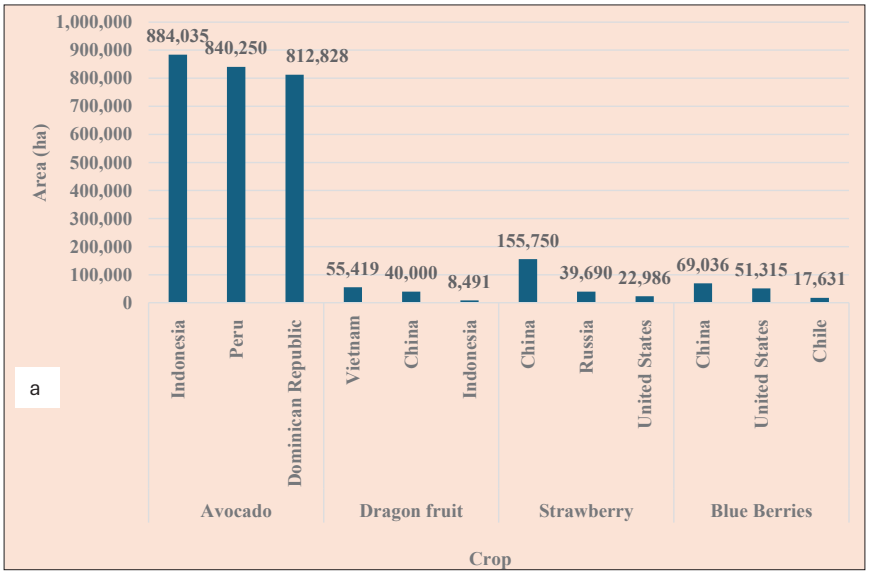
Dragon fruit (*Selenicereus* spp.): Global production is estimated at 2.1 million tonnes from 112,264 hectares, with Vietnam accounting for more than half (1.07 million tonnes), followed by China and Indonesia.

Strawberry (*Fragaria* × *ananassa*): Total global production reaches 10.48 million tonnes across 434,977 hectares, with China leading at 4.21 million tonnes, followed by the United States and Egypt.

Blueberry (*Vaccinium corymbosum* L.): World production totals 1.22 million tonnes over 186,413 hectares, dominated by the United States, Peru, and Canada, which together contribute nearly 80% of global supply.

In Southeast Asia, mangosteen (*Garcinia mangostana* L.) and rambutan (*Nephelium lappaceum* L.) are cultivated extensively in Indonesia, Thailand, and the Philippines, while longan (*Dimocarpus longan* Lour.) production is dominated by China and Thailand, together accounting for over 75% of global output. Durian (*Durio zibethinus* L.) is another high-value crop concentrated primarily in Thailand and Malaysia, both of which have witnessed exponential export growth in recent years, particularly to China. Similarly, macadamia nuts (*Macadamia integrifolia* Maiden & Betche) are cultivated primarily in Australia, South Africa, and Kenya, whereas passion fruit (*Passiflora edulis* Sims) production is concentrated in Brazil, Ecuador, and Kenya.

Overall, the production landscape of exotic fruits demonstrates regional specialization and comparative advantage, with tropical and subtropical regions leading the expansion due to favourable climates and established export infrastructure. However, global demand continues to outpace supply for several fruits-particularly avocado, blueberry, and dragon fruit-indicating a widening opportunity for new entrants such as India to enhance production and market share. By capitalizing on its diverse agro-climatic zones, increasing consumer demand, and growing export potential, India can strategically position itself within this expanding global value chain. Strengthened investments in varietal improvement, nursery infrastructure, and climate-resilient cultivation practices can enable India to emerge as a significant producer of select exotic fruit crops in the coming decade.



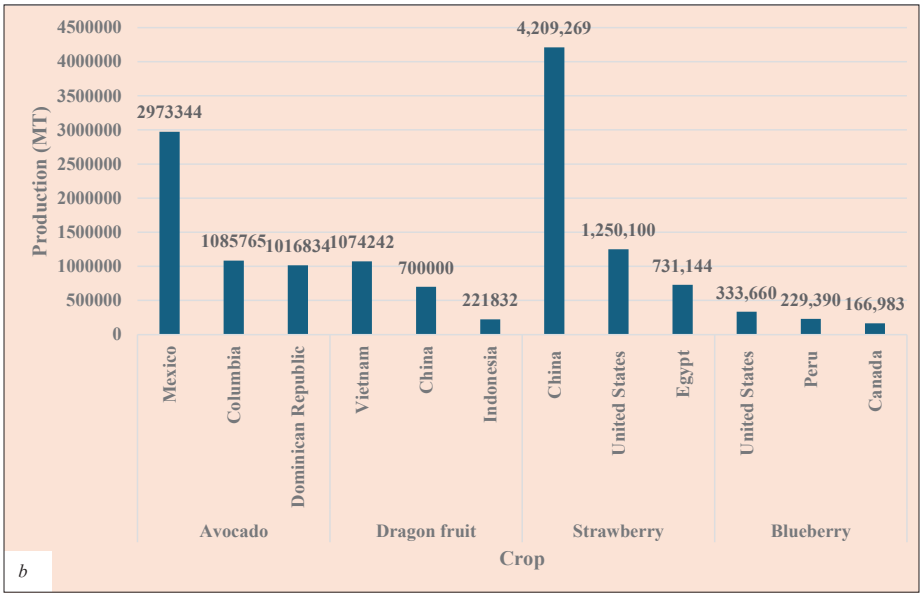
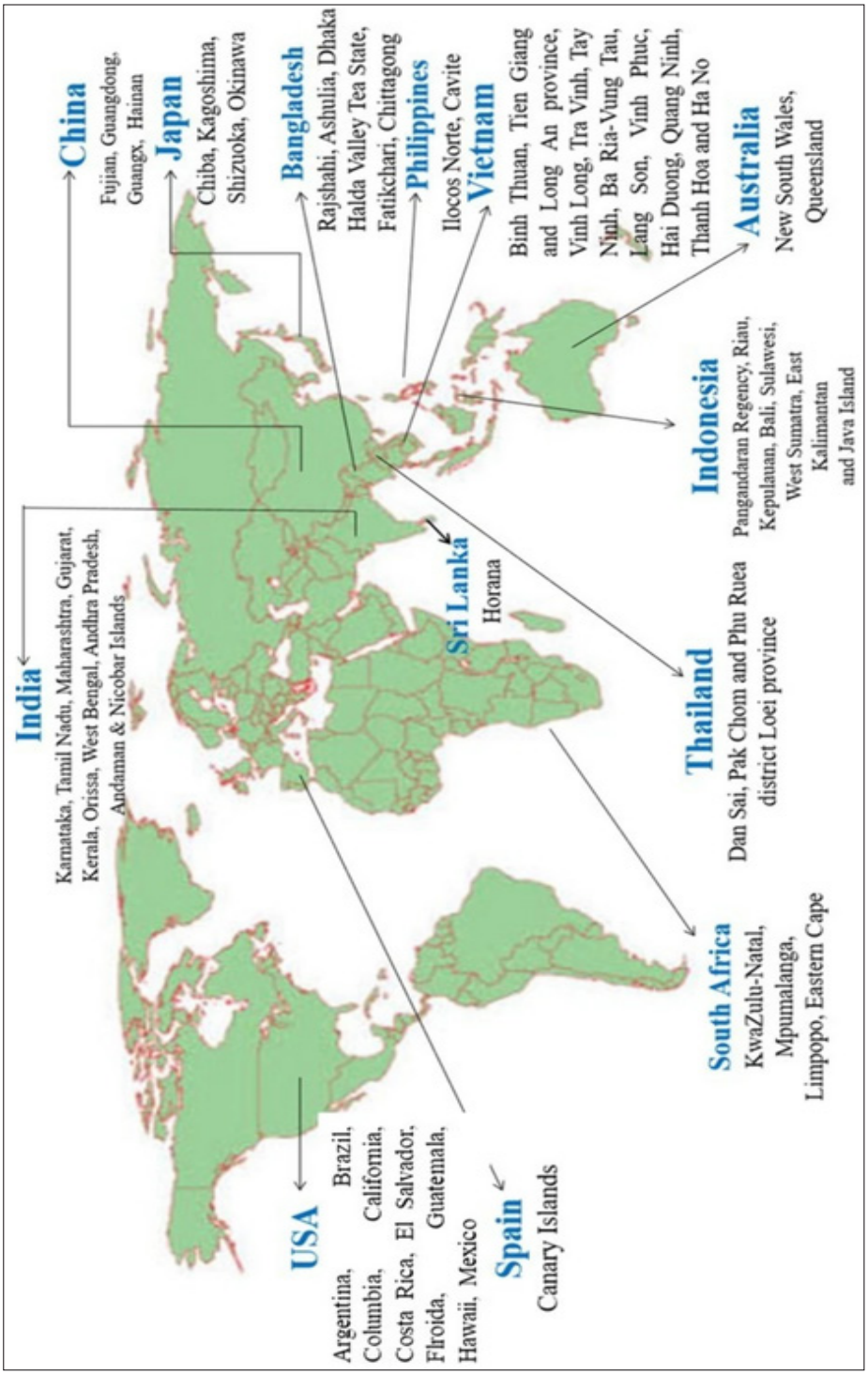


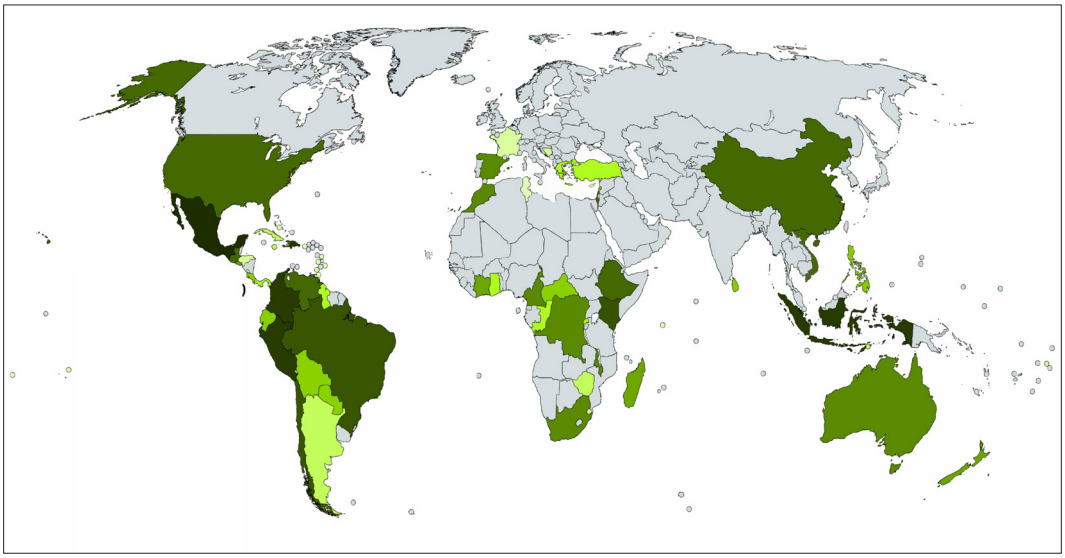
Figure 1 a & b. Global area & production scenario of exotic fruit crops during 2023

Table 1. Global production scenario of exotic fruit crops during 2023

Crop	Country	Area (ha)	Country	Production (MT)	Reference
Avocado	Indonesia	884,035	Mexico	2,973,344	FAOSTAT, 2023
	Peru	840,250	Colombia	1,085,765	
	Dominican Republic	812,828	Dominican Republic	1,016,834	
Dragon fruit	Vietnam	55,419	Vietnam	10,74,242	Wakchaure *et al.*, 2020;
	China	40,000	China	7,00,000	
	Indonesia	8,491	Indonesia	2,21,832	
Strawberry	China	155,750	China	4,209,269	FAOSTAT, 2023.
	Russia	39,690	USA	1,250,100	
	USA	22,986	Egypt	731,144	
Blue Berries	China	69,036	USA	333,660	
	USA	51,315	Peru	229,390	
	Chile	17,631	Canada	166,983	



Important countries in Dragon fruit production



Important countries in Avocado production

1.3. Global Trade Scenario of Major High-Value Fruits

The global trade in high-value exotic fruits such as avocado, strawberry, and blueberry is dominated by a small group of producer and exporter nations that have established strong production systems, cold-chain logistics, and export linkages. The worldwide exotic fruits market size is expected to reach USD 35.82 Billion by 2033. Over the last decade, these fruits have emerged as lucrative commodities in international markets due to their high nutritional value, extended shelf life under controlled conditions, and increasing incorporation into global food and health trends (Table 2).

Avocado remains the fastest-growing tropical fruit in international trade. Mexico leads global exports with approximately 1.22 million tonnes annually, followed by Peru and the Netherlands, which serve as major re-export hubs to Europe. On the import side, the United States accounts for over 1.26 million tonnes, underscoring its heavy dependence on foreign supply. Other major importers include Spain and France, reflecting strong European consumer demand.

In the case of strawberries, Spain dominates global exports with around 0.25 million tonnes, followed by Mexico and the United States. The primary importers are the United States (0.27 million tonnes), Germany, and Canada, indicating that temperate countries remain the main consumption centres.



Blueberry trade has shown remarkable expansion over the past five years, driven by its recognition as a "superfruit." The United States functions both as a leading exporter (≈54,000 tonnes) and as the world's largest importer (≈0.25 million tonnes), owing to strong domestic consumption and re-export activities. Morocco, Peru, and the Netherlands have also emerged as key exporters, while Canada and Germany are prominent among importers.

This growing global exchange of exotic fruits highlights robust consumer demand across developed economies for nutrient-rich, high-value horticultural commodities. At the same time, it exposes the widening gap between production capacity and consumption, particularly in countries with favourable climates but limited organized cultivation systems.

For India, this trend presents both a challenge and an opportunity. Despite possessing the agro-climatic advantage for producing many of these crops, India currently imports large quantities of avocados, blueberries, and dragon fruits to meet domestic demand. By investing in crop-specific production clusters, post-harvest infrastructure, cold-chain logistics, and export-oriented certification systems, India could capture a meaningful share of the global exotic fruit trade. Strengthening public–private partnerships, incentivizing high-value crop cultivation, and developing research-led production strategies can collectively position India as a competitive player in the international market for exotic fruits.

Table 2. Global trade scenario of exotic fruit crops during 2023

Crop	Country	Export (tonnes)	Country	Import (tonnes)	Reference
Avocado	Mexico	1220918.61	USA	1261581.02	FAOSTAT, 2023
	Peru	598492.89	Netherlands	497872.8	
	Netherlands	438430.82	Spain	242061.73	
Strawberry	Spain	246564.99	USA	267013.56	FAOSTAT, 2023
	Mexico	184772.42	Germany	114724.38	
	USA	151676.08	Canada	107835.71	
Blueberries	USA	54091.76	USA	253384.65	FAOSTAT, 2023
	Morocco	50750.61	Canada	57554.2	
	Netherlands	40480.44	Germany	39291.82	



1.4. India's Production Scenario of Exotic Fruit Crops

India's engagement with exotic fruit cultivation is at an early but promising stage. While large-scale commercial plantations are yet to be fully established, the country's diverse agro-climatic zones—spanning tropical, subtropical, and temperate regions—offer immense potential for expanding the production of high-value exotic fruits such as dragon fruit, avocado, passion fruit, strawberry, and blueberry.

Avocado (*Persea americana* Mill.,) cultivation in India remains limited and largely unorganized, though its popularity has been increasing in recent years. The crop performs well in the tropical and subtropical regions of Tamil Nadu, Kerala, Karnataka, and Maharashtra, as well as in certain northeastern hill regions at altitudes between 800 and 1,600 meters. Key producing pockets include Kodaikanal and Ooty (Tamil Nadu), Kodagu and Gundlupet (Karnataka), and select areas in Northeast India. Current annual production is estimated at approximately 5,000 tonnes, with steady year-on-year growth. Given its high lipid content and value in the health food and cosmetic industries, avocado has substantial export potential and could become a profitable diversification crop in southern and northeastern India.

Dragon fruit (*Selenicereus spp*.), locally known as Kamalam, has experienced the most rapid expansion among exotic fruits in India. Introduced in the late 1990s, its cultivation has grown from a mere 4 hectares in 2005 to about 14,510 hectares in 2023–24, producing approximately 53,720 metric tonnes annually. Major producing states include Andhra Pradesh, Karnataka, Maharashtra, Gujarat, Kerala, Tamil Nadu, Odisha, West Bengal, Telangana, and the Andaman and Nicobar Islands. The crop's low input requirements, climate resilience, and strong domestic demand have made it a model for import substitution and farmer income enhancement.

Strawberry (*Fragaria* × *ananassa*) cultivation is concentrated mainly in Maharashtra, Haryana, and Jharkhand, covering around 3,030 hectares and producing 21,100 metric tonnes annually. The Mahabaleshwar region of Maharashtra remains India's leading strawberry cluster, contributing more than half of national production. However, despite favourable climatic zones in Himachal Pradesh, Uttarakhand, and parts of Karnataka and Tamil Nadu, production remains modest compared to domestic demand, indicating a strong need for area expansion and improved protected cultivation technologies.



Passion fruit (Passiflora edulis Sims), another nutritionally valuable exotic crop, is cultivated over about 10,560 hectares, yielding 47,910 metric tonnes annually. The Northeastern states of Manipur, Nagaland, and Mizoram dominate production, with smaller areas in Kerala and Tamil Nadu. The crop's processing potential for juices and nutraceutical products, coupled with suitable agro-climatic conditions in the Western Ghats and Himalayan foothills, presents a major opportunity for scaling up through organized cultivation and contract farming models.

The current production data (NHB, 2023–24) highlight both the progress and the gaps (Table 3) Although the total cultivation area for these fruits remains limited relative to India's potential, the upward trend in adoption signals strong market confidence and viability. With targeted policy support, improved planting material, and cluster-based development, India can expand exotic fruit production to meet both domestic demand and export potential. Scaling up these crops can contribute directly to doubling farmers' income, enhancing nutritional security, and promoting sustainable diversification in Indian horticulture.

Table 3. India's production scenario of exotic fruit crops during 2023-24

Crop	States	Area (ha)	States	Production (MT)	Reference
Dragon fruit	Andhra Pradesh	7970	Andhra Pradesh	27890	NHB, 2023-24
	Mizoram	3540	Telangana	7170	
	Karnataka	600	Maharashtra	6230	
Total		14510		53720	
Strawberry	Maharashtra	1940	Maharashtra	10730	NHB, 2023-24
	Jharkhand	230	Haryana	5260	
	Haryana	230	Jharkhand	1410	
Total		3030		21100	
Passion fruit	Nagaland	6040	Manipur	26660	NHB, 2023-24
	Manipur	2930	Nagaland	16290	
	Kerala	500	Mizoram	2230	
Total		10560		47910	



1.5. India's Trade Scenario of Major High-Value Fruits (Import Dependency)

Despite favourable agro-climatic conditions for cultivating several high-value exotic fruits, India remains heavily dependent on imports to meet domestic demand. Import data (FAOSTAT, 2023; Table 4) clearly indicate a strong and growing reliance on foreign supply for fruits such as dragon fruit, avocado, longan, and blueberry, which are increasingly sought after in both retail and hospitality sectors.

Among these, dragon fruit shows the highest import volume, with 21,432 tonnes valued at ₹175.69 crore, highlighting a significant domestic production gap. The major market destination for dragon fruit is UAE (~35.7% of exports), Bangladesh (~16.0%), Nepal, Netherlands, etc. Avocado imports stand at 3,931 tonnes worth ₹88.72 crore, reflecting its premium positioning in urban markets and limited local supply. Longan follows with 2,260 tonnes valued at ₹24.36 crore, while blueberries, though imported in smaller quantities (710 tonnes), command a high market value of ₹35.31 crore due to their luxury segment demand. In contrast, rambutan and mangosteen register minimal import volumes (30–29 tonnes) and comparatively low import values (₹1.15 crore and ₹0.95 crore, respectively), suggesting that these are still niche fruits within the Indian market (Table 4 & Fig. 2).

Overall, the data reveal that India's domestic production of exotic fruits meets only a fraction of total demand, forcing a substantial dependence on imports, primarily from Thailand, Vietnam, Chile, and Indonesia. This imbalance underscores the urgent need to strengthen domestic cultivation systems, improve access to high-quality planting material, and establish efficient post-harvest and marketing infrastructure.

A coordinated national strategy that integrates research support, quality certification, and investment in cold-chain infrastructure can play a pivotal role in reducing import dependency. Promoting cluster-based production, public–private partnerships (PPP) for processing and distribution, and export-oriented production models would enable India to shift from an import-dependent to a self-reliant and export-capable exotic fruit economy.



Table 4. India's Trade Scenario of Major High-Value Fruits during 2022 & 2023

Fruit	Import (Tonnes)	Value (Crore)
Avocado	3931.18	88.72
Dragon fruit	21432.25	175.69
Mangosteen	29.31	0.95
Longan	2260.99	24.36
Rambutan	30.18	1.15
Blueberry	710.30	35.31

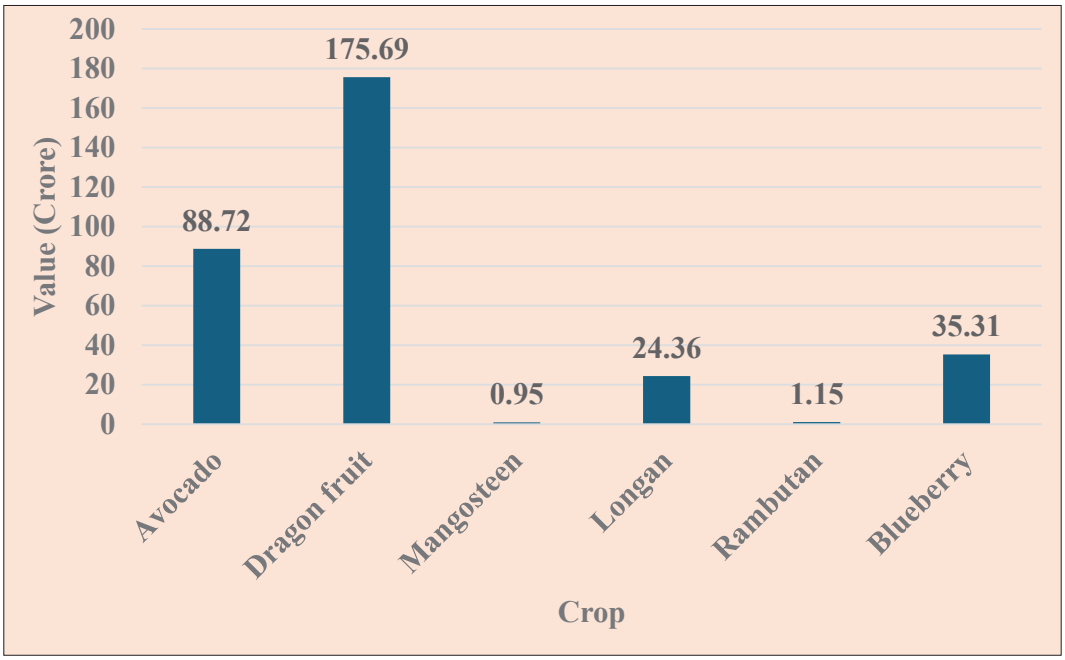


Figure 2. India's Trade Scenario of Major High-Value Fruits during 2022 & 2023



2. Nutritional Value of Exotic Fruit Crops

Exotic fruits are increasingly recognized for their exceptional nutritional composition and health-promoting properties, making them valuable additions to both diets and agricultural diversification strategies. These fruits are rich in vitamins, minerals, dietary fibre, and antioxidants, and many contain unique bioactive compounds with proven therapeutic and functional food potential. Such attributes make them particularly relevant in addressing nutritional deficiencies and lifestyle-related disorders prevalent in both urban and rural populations.

Avocado (*Persea americana Mill.,*), another high-value exotic fruit, is renowned for its rich content of healthy monounsaturated fats, particularly oleic acid, along with vitamins E and K, folate, and potassium. Its high lipid profile not only contributes to cardiovascular health but also makes it a sought-after raw material in cosmetic and nutraceutical industries.

For instance, soursop (*Annona muricata L.*) is abundant in vitamin C and diverse antioxidants such as flavonoids and acetogenins, compounds associated with anti-inflammatory, antimicrobial, and anticancer activity. Similarly, dragon fruit (*Selenicereus* spp.), recently popularized among Indian growers, is high in fiber, vitamin C, betalains, and polyphenols, which contribute to its antioxidant and immune-boosting properties. It is increasingly referred to as a "functional food" owing to its potential role in improving metabolic health and supporting diabetes management.

Likewise, macadamia nuts (*Macadamia integrifolia Maiden & Betche*) provide a concentrated source of energy, dietary fibre, and essential fatty acids, promoting heart and brain health. Other fruits such as mangosteen (*Garcinia mangostana L.*), rambutan (*Nephelium lappaceum L.*), longan (*Dimocarpus longan* Lour.), and passion fruit (*Passiflora edulis* Sims) are equally important for their diverse phytonutrients. These include xanthones, carotenoids, and polyphenols, which exhibit strong antioxidant and anti-aging effects. The high micronutrient density and low glycaemic



index of these fruits further enhance their potential as functional foods in preventive healthcare.

A summary of the nutrient composition of major exotic fruits cultivated or promoted in India is presented in Table 5, highlighting their significant contribution to dietary quality and public health.

Table 5. Nutritional value of exotic fruit crops.

Fruit	Scientific Name	Major Nutrients (per 100 g edible portion)	Reference
Avocado	*Persea americana Mill.,*	Fiber (6.8 g), Vitamin A (7 µg), Vitamin C (8.8 mg), Vitamin E (1.97 mg), Vitamin K1 (21 µg), Folate (89 µg), Vitamin B6 (0.29 mg), Niacin (1.91 mg), Riboflavin (0.14 mg).	USDA, 2011; Afzal *et al*., 2022
Dragon Fruit	*Selenicereus* spp.	Protein (0.16–0.23 g), Fat (0.21–0.61 g), Fiber (0.7–0.9 g), Vitamin C (8–9 mg), Calcium (6.3–8.8 mg), Phosphorus (30–36 mg), Iron (0.5–0.61 mg).	TFIDRA, 2005; Hossain *et al*., 2021
Mangosteen	*Garcinia mangostana L.*	Protein (0.41 g), Carbohydrates (17.9 g), Fat (0.58 g), Vitamin C (2.9 mg), Vitamin A (35 IU), Calcium (12 mg).	Rizaldy *et al*., 2021
Rambutan	*Nephelium lappaceum L.*	Protein (0.66 g), Fat (0.24 g), Fiber (0.38 g), Vitamin C (21.5–49.5 mg), Vitamin B1 (0.10 mg), Vitamin B12 (3.42 µg).	Sirisompong *et al*., 2011; Biswas, 2021
Longan	*Dimocarpus longan* Lour.	Protein (1.31 g), Carbohydrates (15.1 g), Fat (0.1 g), Fiber (1.1 g), Vitamin C (84 mg), Niacin (0.3 mg), Vitamin B12 (0.14 µg), Vitamin B1 (0.031 mg), Calcium (1 mg), Iron (0.13 mg).	USDA, 2018; Van *et al*., 2023

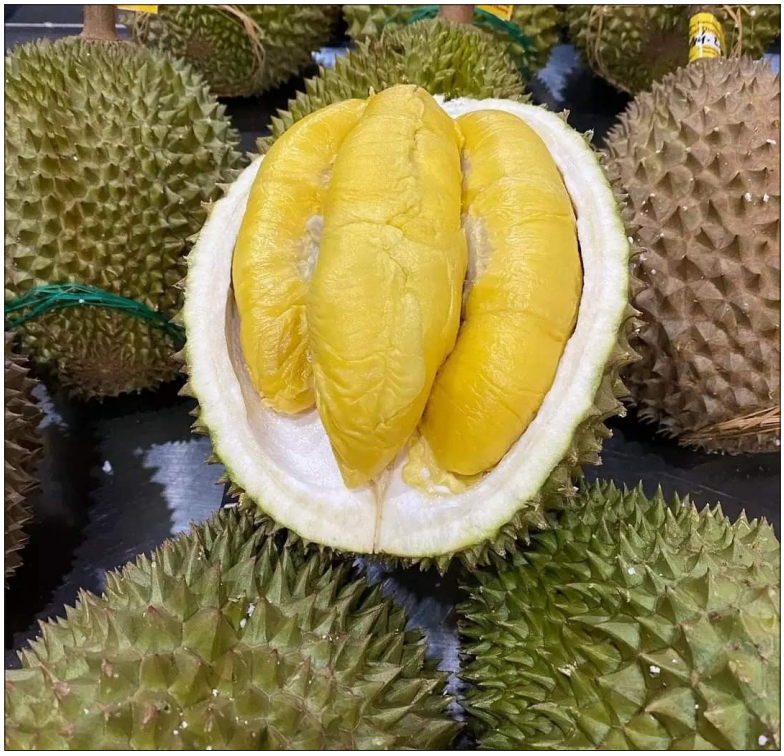


Durian	*Durio zibethinus L.*	Protein (1.4–3.5 g), Carbohydrates (15.6–34.6 g), Fat (1.6–5.3 g), Vitamin C (19.7 mg), Vitamin B1 (0.374 mg), Vitamin B2 (0.2 mg), Vitamin B3 (1.074 mg), Potassium (70–601 mg).	Charoenkiatkul *et al.*, 2016
Macadamia Nut	*Macadamia integrifolia* Maiden & Betche	Protein (7.91 g), Carbohydrates (13.82 g), Fat (75.77 g), Fiber (8.6 g), Energy (718 kcal), Vitamin C (1.2 mg), Iron (3.69 mg)	USDA, 2019
Passion fruit	*Passiflora edulis*	Protein (2.2 g), Carbohydrates (23.4 g), Fat (0.7 g), Fiber (10.4 g), Vitamin C (30 mg), Vitamin A (1274 IU), Vitamin E (0.02 µg), Iron (29 mg), Phosphorus (68 mg).	USDA, 2013, Zhou *et al.*, 2020
Strawberry	*Fragaria ananassa*	Protein (0.67 g), Carbohydrates (7.98 g), Fat (0.30 g), Fiber (2 g), Vitamin C (58.8 mg), Iron (0.41 mg).	USDA, 2015, Bezerra *et al.*, 2024
Blueberry	*Vaccinium corymbosum L.*	Protein (0.74 g), Carbohydrates (14.5 g), Fat (0.33 g), Fiber (2.4 g), Vitamin C (9.7 mg), Iron (0.28 mg).	USDA, 2015, Zhou *et al.*, 2020
Soursop	*Annona muricata L.*	Protein (1.2 g), Carbohydrates (14.9 g), Vitamin C (29.6 mg), Vitamin B1 (0.11 mg), Niacin (1.28 mg), Vitamin B12 (0.05 µg), Sodium (0.63–0.65%), Potassium (1.39–1.41%).	Afzaal *et al.*, 2022
Manila tamarind	*Pithecellobium dulce* (Roxb.) Benth.	Protein (3 g), Carbohydrates (18.2 g), Fat (0.4 g), Fiber (1.2 g), Vitamin C (0.133 mg), Ash (0.6%).	Roselin *et al.*, 2022

The data in Table 5 affirm that these fruits are dense sources of micronutrients and antioxidants, offering broad nutritional and therapeutic potential. Their promotion through domestic cultivation can simultaneously address nutritional security, public health, and economic diversification objectives in India's horticulture sector.



Yellow variety of Rambutan



Durian



3. Nutraceutical Importance

Beyond their nutritional significance, exotic fruits are increasingly valued for their medicinal and therapeutic properties. A growing body of scientific evidence supports the role of these fruits in preventing or managing chronic diseases, owing to their high concentrations of bioactive compounds such as flavonoids, alkaloids, polyphenols, carotenoids, and terpenoids. These phytochemicals exhibit a wide range of pharmacological activities, including antioxidant, anti-inflammatory, antimicrobial, antidiabetic, cardioprotective, and anticancer effects. For example, Avocado (*Persea americana Mill.,*) is known for its cardioprotective and anti-inflammatory effects, attributed to its monounsaturated fatty acids and antioxidants such as tocopherols and carotenoids. Studies have linked its regular consumption with reduced LDL cholesterol, improved digestion, and enhanced skin and bone health (Stephen & Radhakrishnan, 2022). Similarly, dragon fruit (*Selenicereus* spp.) is rich in vitamin C, betalains, and polyphenols, which not only promote gut health and regulate cholesterol and blood glucose levels but also exhibit anti-inflammatory and prebiotic properties (Tenore *et al*., 2012).

Soursop (*Annona muricata L.*) has long been used in traditional medicine for treating fever, respiratory disorders, and infections. Modern pharmacological research has confirmed its anticancer potential, as acetogenins and flavonoids derived from its leaves and fruit pulp have shown activity against several cancer cell lines (Coria-Téllez *et al*., 2018; Mutakin *et al*., 2022).

Other exotic fruits like mangosteen (*Garcinia mangostana L.*), rambutan (*Nephelium lappaceum L.*), and longan (*Dimocarpus longan* Lour.) also possess strong medicinal properties (Biswas, 2021). Mangosteen is known as the "Queen of Fruits" and is a rich source of xanthones, compounds with powerful antioxidant and anti-inflammatory activity that promote immune and skin health (Obolskiy *et al*., 2009). Rambutan seeds and rind extracts display antibacterial, antiallergic, and antidiabetic properties, while longan is noted for supporting neurological and cardiovascular health (Biswas, 2021). In addition, passion fruit (*Passiflora edulis* Sims) has demonstrated anti-anxiety, antihypertensive, and anti-inflammatory effects (Akinmoladun *et al*., 2019),

while macadamia nuts are known for their neuroprotective and antidiabetic benefits (Dotto & Sabally, 2021). These therapeutic attributes make exotic fruits highly valuable not only as food but also as raw materials for pharmaceutical,

Collectively, these findings reaffirm that exotic fruit crops represent a unique convergence of nutrition, medicine, and market opportunity. Promoting their cultivation and processing can generate value-added nutraceutical products, create rural employment, and align with India's goals of food security, public health improvement, and bioeconomy development.





4. Economic Importance of Exotic Fruit Crops

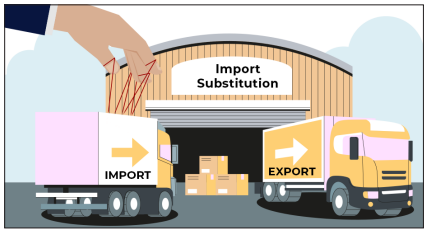
4.1. Diversification



Exotic fruit crops provide farmers with a valuable opportunity to diversify their income sources and reduce dependence on staple crops such as rice, wheat, and maize. Their adaptability to a wide range of agro-climatic conditions makes them suitable for regions where traditional crops perform poorly. Many of these fruits are hardier and more resilient to adverse weather conditions, allowing farmers to spread production risks and minimize economic losses from monocropping. For instance, dragon fruit (*Selenicereus* spp.) can be cultivated successfully in marginal and semi-arid lands that are unsuitable for conventional crops. Its increasing domestic and international popularity as a "superfruit" has opened up new market opportunities, particularly due to its rich content of vitamin C, antioxidants, and betalain pigments that are used in both food and nutraceutical industries. Studies indicate that farmers cultivating dragon fruit have experienced income increases of up to 25%, especially in regions such as Gujarat, Maharashtra, and Karnataka, where the crop is gaining rapid adoption. Diversification into exotic fruits also contributes to risk mitigation, improves soil health, and enhances farm system resilience through mixed-cropping or integrated orchard models. By integrating high-value exotic fruits into existing fruit-based systems, farmers can maintain stable income streams even under fluctuating climatic and market conditions.

4.2. Export Potential: Import Substitution by enhancing the production of high-value crops

Exotic fruits hold strong export potential due to the global rise in consumer demand for functional and health-oriented foods. With increasing awareness



of nutrition and wellness, international markets—particularly in North America, Europe, and the Middle East—have shown growing preference for exotic fruits such as avocado, dragon fruit, soursop, mangosteen, and passion fruit. Avocado (*Persea americana Mill.,*) has become a staple in diabetic and fitness diets owing to its low sugar content and high levels of monounsaturated fats, especially oleic acid, which enhances digestibility and heart health. Avocado oil is also valued in the cosmetic and skincare industries, comparable in quality to olive oil. Similarly, dragon fruit is increasingly recognized for its antioxidant properties, vitamin C, fibre content, and betalain pigments, which have applications in natural food colouring, nutraceutical formulations, and functional beverages. Given these trends, India can position itself as a competitive producer and exporter of select exotic fruits by strengthening supply chains, certification standards (GlobalGAP, HACCP), and export-oriented clusters. With proper branding and quality assurance, Indian exotic fruits could gain access to premium markets in the European Union, Japan, and Gulf countries.

4.3. Agro-Processing and Value-Addition



The cultivation of exotic fruit crops is closely linked to the growth of the agro-processing industry, offering opportunities for value addition, employment generation, and rural entrepreneurship. Farmers and small enterprises can significantly enhance profitability by converting raw fruits into processed products such as jams, juices, pulps, powders, dried snacks, and nutraceutical extracts (Table 6).

Exotic fruits such as avocado and soursop are also extensively utilized in the cosmetic and pharmaceutical industries-for example, avocado oil is a key ingredient in natural skincare products, while soursop leaf and seed extracts are used in herbal and anticancer formulations. This integration of exotic fruits into processing value chains helps reduce post-harvest losses, stabilizes prices, and promotes sustainable business models. Processing activities not

only improve economic returns but also create employment opportunities in rural and peri-urban areas through production, packaging, logistics, and retail. This has significant implications for poverty reduction and rural development, particularly among smallholder farmers and women-led enterprise.



Red pulp variety of Dragon fruit



Ready to serve (RTS)



Spray Dried Red Dragon fruit Powder













Dragon fruit Juice Prepared from Spray Dried Red Dragon fruit Powder



Avocado



Spray Dried Avocado Powder



Guagamole



Avocado Juice

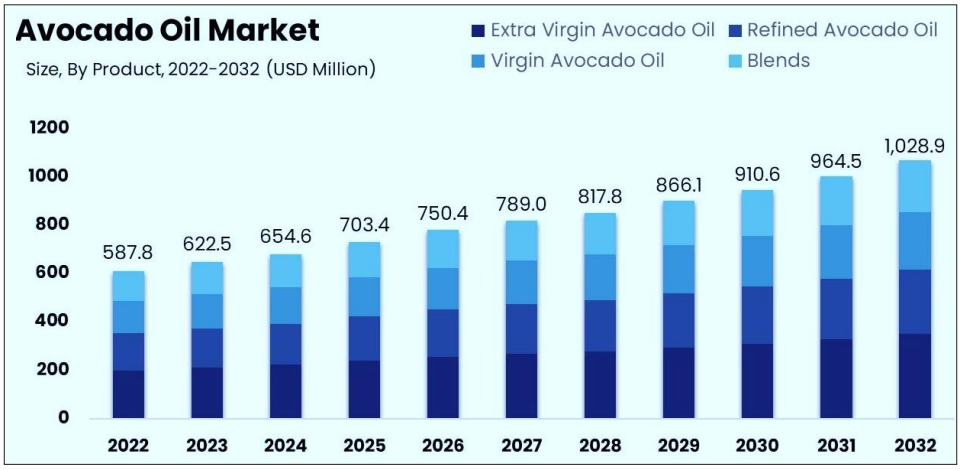
Avocados are primarily grown for the fresh fruit market, either domestic or export. Although avocado is mostly consumed fresh, it is characterized by high oil content. The market of fresh avocado is certainly the main one and also generates a remarkable quantity of second-grade produce which is discarded, despite its relatively high oil content. The avocado oil consists of 71% monounsaturated fatty acids (MUFA) and Polyunsaturated fatty acids (PUFA), and 16% saturated fatty acids which helps to promote healthy blood lipid profiles and enhance the bioavailability of fat soluble vitamins and several phytochemicals in the avocado oil have been linked to prevention of cancer, age-related macular degeneration, and cardiovascular diseases and also avocado oil is potentially used in cosmetic industry, these generated an increase in consumer demand for avocado oil. Rapid urbanization, expanding purchasing power of consumers, and an increasing inclination towards cooking in a healthy oil that is fortified with essential nutrients represent one of the major factors driving the demand for avocado oil around the world. Additionally, the avocado oil business has



been significantly influenced by the culinary scene. Avocado oil market held a market worth of USD 287.2 million in 2022, and it is anticipated that it will reach a market value of USD 975 million by 2033, growing at a CAGR of 5.9% from 2023 to 2033. Global data shows that significant quantities of avocado are designated for oil production, although it is not enough to meet consumer demand, but it is opening a window to explore the market. Popularizing avocado oil in the field of food and beverages, pharmaceuticals and medicinal formulations, personal care and cosmetics, etc., aids to attain self-reliance by import substitution of edible oil.

The global avocado oil market shows a steady upward trend from 2022 to 2032, increasing from USD 587.8 million in 2022 to USD 1,028.9 million by 2032. Among the different product categories, extra virgin avocado oil holds the largest market share, followed by refined and virgin avocado oils, while blends contribute a smaller yet gradually rising portion. This consistent growth reflects a compound annual growth rate of around 6–7 percent, driven by increasing consumer awareness of health benefits, the growing demand for natural and functional foods, and the expanding use of avocado oil in cosmetic and pharmaceutical industries (Fig. 3).

The increased production of avocado oil as a substitute for vegetable oil will be a significant step towards achieving Atmanirbhar Bharat by reducing dependence on imports. Establishing an "Avocado Oil Unit" will enhance the production of high-quality oil, as avocado oil is rich in monounsaturated fatty acids (MUFA) that offer greater health benefits compared to other edible oils. This initiative will also help in doubling farmers' income and minimizing postharvest losses of avocado fruits.



Statista, 2025

Figure 3. Global scenario of avocado oil market



Avocado Oil

Table 6. Value addition and market value of various exotic fruit crops

Fruit	Value addition	Market value	Key products	Reference
Avocado	Value-added products such as oil, powders, snacks and cosmetic products.	Believing avocados are healthy and knowing avocadoes contain good fats, especially avocado oil, there is a great demand for its products.	Avocado oil, Avocado powder, Avocado based snacks, Beverages, Avocado Seed flour.	Huang *et al*., 2023
Dragon Fruit	Frozen pulp, juices, jams, powders, natural colorant (betalains), nutraceuticals, cosmetics.	Specialty fruit market with increasing global demand for functional foods.	Juice, powder, jam, colorant extract, beverages.	Tenore *et al*., 2012
Mangosteen	Xanthone-rich extracts for nutraceuticals, cosmetics, dried rind powder, beverages.	Premium fruit in fresh market and extracts industry; demand for nutraceutical xanthones growing.	Extracts, supplements, cosmetic serums, powders, functional drinks.	Obolskiy *et al*., 2009



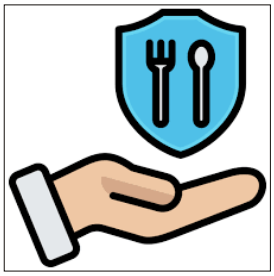
Rambutan	Value added products such as Juices, Beverages, Jam and Seed Oil. Fat of rambutan is used in manufacturing of candles, soaps and fuels.	Rambutan is experiencing a surge in both national and international demand, driven by its unique flavor, nutritional benefits, and increasing popularity in exotic fruit markets.	Rambutan Juice, Jam, Rambutan Seed oil, Candles, Soaps, Fuel	Bhattacharjee *et al*., 2022
Longan	Value added products such as dried longan, longan juice, longan wine, longan seed extracts	Longan is rich in vitamin C, antioxidants, and other vital nutrients there is an increase in increasing global demand, especially in North America and Europe. Present longan's growing popularity, both domestically and internationally is increasing.	Canned longan, Juice, Fruit wine	Zubairu *et al*., 2025
Durian	Processed/ dried slices, frozen pulp, canned puree, chips, confections, aroma extracts, seed flour.	Global durian market is expanding rapidly, especially exports to China; valued in billions with strong CAGR.	Frozen pulp, durian chips, puree, ice-cream, powder.	Mondol *et al*., 2020
Macadamia Nut	Shelled nuts, roasted snacks, macadamia oil, nut butter, flour.	High-value nut crop; global market > USD 2 billion, strong growth trend.	Roasted kernels, oil, butter, flour, confectionery.	Dotto & Sabally, 2021



Passion fruit	Juice concentrate, puree, jam, seed oil, powdered pulp.	Global passion fruit industry expanding; strong demand in juice/flavoring sector.	Juice concentrate, jam, frozen pulp, seed oil, seed flour.	Akinmoladun *et al.*, 2019
Strawberry	Frozen fruit, puree, jams, dried slices, bakery fillings, anthocyanin-rich extracts.	Major berry crop; billions in fresh and processed market value worldwide.	Jam, puree, frozen berries, dried fruit, extracts.	Basu *et al.*, 2014
Blueberry	Frozen berries, purees, juice, anthocyanin extracts, jams, dried berries.	Global blueberry market worth billions; strong demand in frozen, nutraceutical and fresh fruit sectors.	Frozen berries, concentrate, dried fruit, jam, extracts.	Khoo *et al.*, 2017
Soursop	Frozen pulp, juices, herbal leaf extracts, seed oil for cosmetics.	Rising niche demand in beverages and supplements; pulp and leaf extracts valued in health product markets.	Frozen pulp, juice blends, supplements, cosmetics.	Coria-Téllez *et al.*, 2018;
Manila tamarind	Dried pulp powder, jams, bakery inclusions, antioxidant-rich extracts.	Underutilized fruit; increasing research interest in nutraceutical/ functional food applications.	Fruit powder, jam, bakery products, extracts.	Rajan *et al.*, 2011

4.4. Food Security and Nutritional Benefits

Exotic fruit crops can play an important role in enhancing food and nutritional security, particularly in regions with prevalent micronutrient



deficiencies. These fruits provide rich sources of vitamins (A, C, E, and K), minerals, fibres, and antioxidants, which contribute to better health and immunity. For example, dragon fruit is an excellent source of vitamin C, antioxidants, and selenium, helping to strengthen immune function and combat oxidative stress.

Regular consumption of such fruits can improve maternal and child health, reduce incidences of anaemia, and contribute to balanced diets among vulnerable populations. Integrating exotic fruits into local food systems not only improves dietary diversity but also enhances cultural and culinary significance, particularly when promoted through local food value chains and community-based nutrition programs.

4.5. Sustainability and Climate Resilience



Many exotic fruit crops exhibit strong adaptation to climate variability and can contribute to the sustainability of agricultural systems. Crops such as dragon fruit, soursop, and passion fruit are naturally drought-tolerant, pest-resistant, and input-efficient, making them suitable for regions facing climate-induced stress. For instance, dragon fruit thrives in arid and semi-arid zones, such as Rajasthan and Gujarat, where water availability is limited. Its ability to grow under high temperatures with minimal irrigation and nutrient inputs makes it a climate-resilient crop for sustainable agriculture. Moreover, many of these fruits are compatible with organic and low-input farming systems, enabling farmers to tap into premium organic markets while conserving soil and water resources. Green Pest & Disease management modules can be used in the production. The adoption of such crops enhances ecological sustainability by reducing reliance on synthetic agrochemicals and promoting biodiversity, while ensuring long-term economic stability for farming communities.



5. Exotic Fruit Crops Suitable for Different Regions of India

The cultivation of exotic fruit crops can be strategically expanded across India's diverse agro-climatic zones. Regional specialization will allow efficient resource utilization and higher productivity, while improving local livelihoods. The following zones present the best opportunities (Tables 7 & Fig. 4):

5.1. Arid and Semi-Arid Regions (Rajasthan, Gujarat, Haryana, Madhya Pradesh)

These regions, characterized by low rainfall, poor soil quality, and high temperature, are ideal for drought-tolerant exotic fruits such as dragon fruit (*Selenicereus* spp.). The crop has been successfully cultivated in Kutch (Gujarat) and Western Maharashtra, providing farmers with a profitable alternative to low-return cereals.

5.2. Tropical Regions (Kerala, Tamil Nadu, Karnataka, Telangana, Andhra Pradesh)

These areas, with high rainfall and humidity, are suited for avocado, rambutan, mangosteen, and durian, particularly in higher-altitude zones of the Western Ghats. These fruits benefit from the tropical microclimate, rich soils, and abundant rainfall, making them ideal for homestead cultivation and mixed orchards.

5.3. Hilly and Temperate Regions (Himachal Pradesh, Uttarakhand, Jammu & Kashmir)

The cooler climates of India's hill regions are favourable for strawberry, blueberry, and passion fruit, which require lower temperatures and well-drained soils. These areas are also suitable for developing protected cultivation systems and tourism-linked agribusinesses such as fruit picking and processing units.

5.4. Coastal Regions (Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Odisha, West Bengal)

Coastal zones with high humidity and saline soils are ideal for fruits like rambutan, mangosteen, avocado, and macadamia nut, which tolerate salinity and moisture well. These crops can diversify coastal farming systems while supporting the organic and export markets for tropical fruits.

5.5. North-Eastern Hill Region

The biodiversity-rich North-East is well suited for avocado, longan, soursop, and passion fruit, given its high rainfall and mild temperatures. These crops can boost the regional economy through processing enterprises (juices, jams, herbal extracts) and provide sustainable income alternatives for hill farmers.

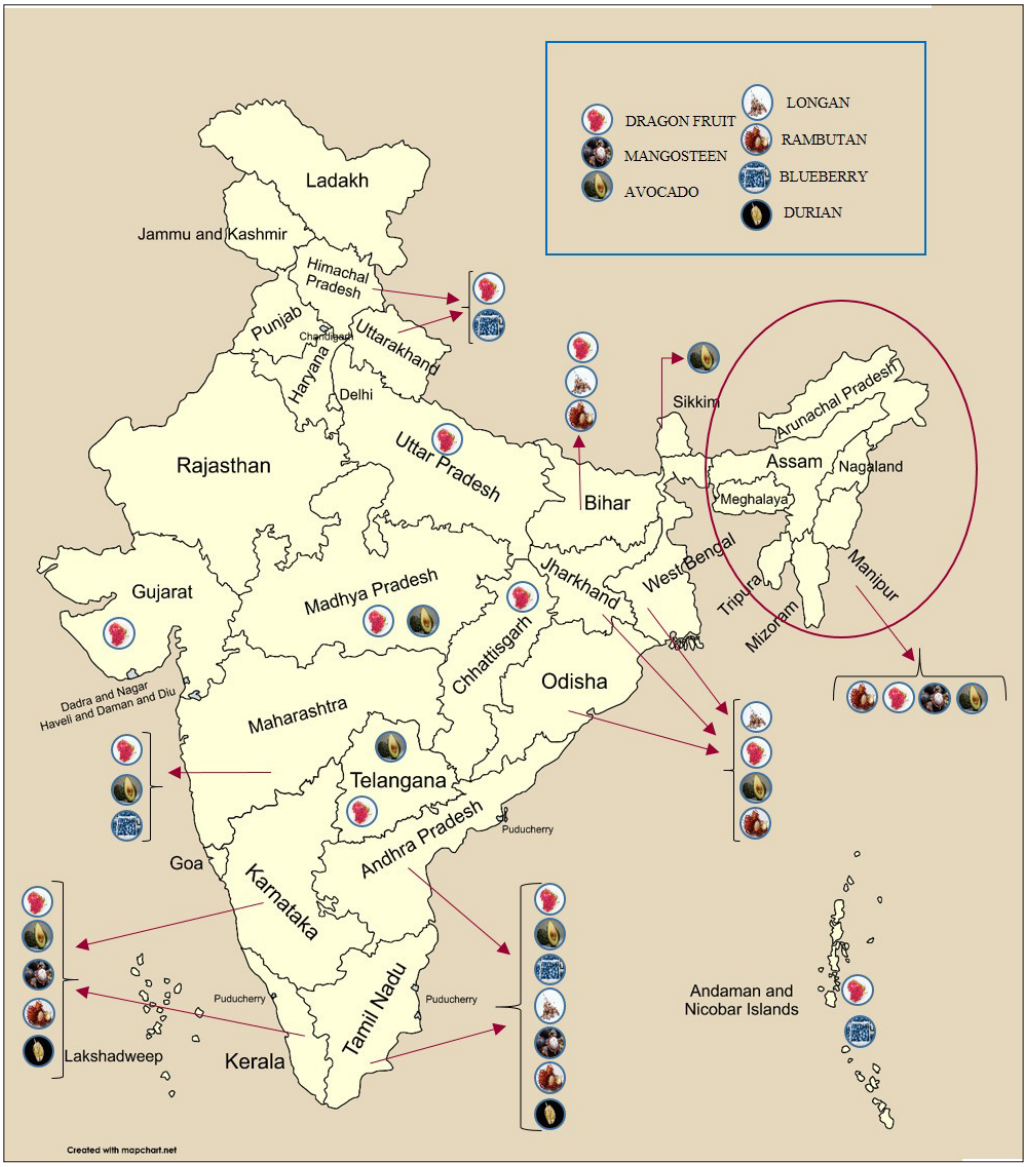


Figure 4. Exotic Fruit Crops Suitable for Different Regions of India



Table 7. Suitable areas for cultivation of exotic fruits

Fruit	Suitable areas for cultivation	Spacing requirements
Avocado	Kerala, Tamil Nadu, Karnataka, Telangana, Maharashtra (Nashik region), some hilly areas (Nilgiris, Sikkim/Eastern Himalaya).	**6 x 6 m** (plant-to-plant / row-to-row)
Dragon Fruit	Karnataka, Maharashtra, Gujarat, Kerala, Tamil Nadu, Andhra Pradesh, Telangana, Tripura, UP,Bihar,MP.	**3m × 3m** (plant-to-plant / row-to-row)
Mangosteen	Kerala, Tamil Nadu (Pollachi, Palani, Coonoor), Karnataka	
Rambutan	Kerala (Pathanamthitta, Kottayam), parts of Tamil Nadu and Karnataka; expanding in Kerala rubber-replanting areas.	Standard / mature trees: **8 × 8 m**; or **8 × 6 m**, **6 × 6 m**; for vegetatively propagated (smaller / dwarf) trees can use **5 × 5 m** or **4 × 4 m** spacing.
Longan	West Bengal, north Bihar (alluvial plains), suitable in other tropical/ subtropical areas (Jharkhand, Chhattisgarh, NE states).	**6 × 6 m to 10 × 10 m** for plant-to-plant and row-to-row, depending on soil, climate, manure/fertilizer, and variety
Durian	Kerala, Tamil Nadu, Karnataka (Western Ghats / Nilgiris / Coimbatore region).	**7 × 7 m** or **8 × 8 m** (plant-to-plant / row-to-row)
Macadamia Nut	Kerala, Tamil Nadu, Karnataka, Telangana; also reported in some eastern coastal areas / Odisha, West bengol.	**8 × 4 m** (row × tree) for upright varieties. **9 × 5 m** for spreading varieties. **10 × 10 m** used for all varieties where wide spacing is desired.
Passion fruit	Western Ghats (Nilgiris, Wayanad, Kodaikanal, Coorg), Karnataka (Coorg), Kerala, Tamil Nadu (hill tracts), NE states (Manipur, Nagaland, Mizoram, Sikkim), Himachal in some pockets.	**2 × 3 m** (plant to plant × row to row) under Kniffin/trained trellis systems; **3 × 3 m** under "bower" systems



Strawberry	Himachal Pradesh (mid-hills), parts of Jammu & Kashmir, Uttarakhand, some plains/ subtropical areas under protected cultivation (Bihar, West Bengal, Kerala hill stations).	Planting distance varies with variety and land type. Typically, (30 × 60) cm spacing is followed.
Blueberry	Maharashtra, Karnataka, Himachal Pradesh, Tamil Nadu, Uttarakhand	**1.5 × 3.0 m** or **2 × 3 m** (plant to plant × row to row)
Soursop	Kerala, Telangana, Tamil Nadu, parts of NE and other subtropical/ tropical areas	**6m x 6m** (plant-to-plant / row-to-row)
Manila tamarind	Andhra Pradesh, Telangana, Chhattisgarh, many dryland districts across peninsular India	**8-10 m × 8-10 m** spacing adopted for grafted tamarind plants



6. Challenges in the Promotion and Commercialization of Exotic Fruit Crops

The cultivation and commercialization of exotic fruit crops in India, despite showing great promise, face several systemic challenges. Among these, two critical bottlenecks are the inadequate availability of high-yielding improved varieties and the limited supply of quality planting material, both of which constrain the expansion of commercial cultivation and limit farmer participation.

6.1. Inadequate Availability of High-Yielding Improved Varieties



The lack of high-yielding, improved, and regionally adapted varieties represents one of the foremost challenges in the successful development of exotic fruit cultivation in India. Unlike traditional fruit crops such as mango, banana, or guava—where well-established breeding and varietal improvement programs exist-exotic fruits like dragon fruit, durian, rambutan, mangosteen, and longan are relatively new introductions to Indian horticulture. As a result, systematic breeding initiatives for these crops are still in their infancy. This gap has led to a scarcity of varieties that combine high productivity with resistance to pests, diseases, and abiotic stresses, or adaptability to the country's diverse agro-climatic zones. The introduction of new germplasm is further constrained by stringent quarantine and phytosanitary regulations, which, though essential for preventing pest and pathogen incursions, inevitably delay varietal import and testing.

Even when improved varieties are introduced from other countries, their field performance often declines under Indian conditions, owing to differences in soil characteristics, climatic conditions, and local pest–disease complexes. This results in inconsistent yields and unpredictable fruit quality,



deterring large-scale adoption. Propagation also presents a technical barrier. Many exotic fruit crops require advanced vegetative propagation methods such as grafting, air-layering, or micropropagation through tissue culture, which are cost-intensive and demand specialized skill and infrastructure. The limited number of certified nurseries with expertise in these crops further exacerbates the problem. Additionally, awareness among farmers remains low regarding the availability and benefits of improved exotic fruit varieties. This reduces demand at the farm level, discouraging private sector nurseries and research organizations from investing in the production and distribution of such materials. Consequently, the inadequate availability of improved high-yielding varieties continues to restrict productivity, hinder commercialization, and slow the pace of adoption of exotic fruit crops across potential growing regions.

6.2. Inadequate Availability of Quality Planting Material



The limited supply of healthy, disease-free, and true-to-type planting material poses another major constraint in the expansion of exotic fruit cultivation. For crops such as dragon fruit (Kamalam), avocado, and passion fruit, reliable planting material is not available at the scale required to meet the rising demand from farmers and agripreneurs. The lack of a standardized certification and nursery accreditation system for exotic fruit crops has led to inconsistent quality and authenticity of planting material distributed by both public and private nurseries. This often results in poor crop establishment, uneven yields, and low fruit quality, thereby reducing farmer confidence and the overall economic viability of these crops. In addition, insufficient mother plant blocks, inadequate infrastructure for mass multiplication, and the absence of organized germplasm repositories contribute to the ongoing shortage. Without access to reliable planting sources, many farmers resort to importing material informally or using unverified propagules, which increases the risk of pest and disease introduction and reduces crop uniformity.



Table 8. Estimated demand of exotic fruit crops planting material

Crops	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	Total no of plants in lakhs
Dragon fruit	15.00	13.50	16.30	16.50	18.50	18.50	18.00	116.30
Avocado	12.60	12.50	12.50	10.50	10.50	8.50	7.50	74.60
Passion fruit	2.00	2.25	2.50	2.00	2.00	1.50	1.50	13.75
Total	57.10	55.00	59.25	56.50	58.00	53.50	50.25	389.60

6.3. Beyond the Orchard: Limited Research, Opportunities, and Government Initiatives for India's Exotic Fruit Potential

6.3.1. Limited Research on India's Exotic Fruit Potential



Despite India's growing interest in exotic fruit cultivation, there remains a significant gap in scientific and commercial research on these crops. Fruits such as dragon fruit, rambutan, passion fruit, and avocado, though non-native, are being rapidly adopted by farmers due to their high market value and consumer demand. However, the scientific foundation supporting their expansion is still limited. Research gaps exist in post-harvest handling, storage, processing technologies, shelf-life enhancement, and value addition. Value addition refers to enhancing the economic worth of fruits beyond their fresh form—through juices, jams, dried products, nutraceuticals, or innovative packaging and branding. Despite the rising cultivation of these fruits, India lacks a robust R&D framework for developing processing techniques, improved storage infrastructure, and new high-value derivatives. This limited focus has left a large portion of their economic and nutritional potential untapped. With greater emphasis on applied research and commercialization, India could significantly boost farmer income, reduce post-harvest losses, and create a new generation of value-added, export-ready fruit products from these exotic species.



6.3.2. Limited Government Intervention Through Policy

The role of government in promoting exotic fruit crops has so far been facilitative rather than directive. For crops like dragon fruit, avocado, and kiwifruit, the government provides financial incentives, planting material subsidies, and training programs, while encouraging private investment and farmer autonomy. State horticulture departments, especially in Karnataka, Maharashtra, and Gujarat, have taken proactive measures—offering saplings, technical guidance, and market linkages to growers. However, the government does not fix prices or manage farm operations; instead, it focuses on creating an enabling environment by: Supporting research and varietal improvement programs, facilitating infrastructure development (cold chains, packhouses, and transport), and Encouraging credit access and export facilitation.

This policy approach promotes innovation, entrepreneurship, and private sector participation, allowing farmers to make independent production and marketing decisions while benefiting from a supportive institutional framework.



7. Opportunities in Exotic Fruit Sector

India is uniquely positioned to capitalize on the global surge in demand for high-value, nutrient-dense fruits. The country's diverse agro-climatic conditions, large consumer base, and expanding processing industry offer a solid foundation for scaling up exotic fruit production and trade.

7.1. Nutritional and Health Opportunities

Exotic fruit crops are rich in vitamins, minerals, and antioxidants, which enhance immunity and prevent chronic diseases. Rising consumer awareness toward health and wellness has spurred rapid growth in demand for these nutrient-rich fruits. By expanding production, India can meet both domestic and export markets, while improving public health outcomes through better diets.

7.2. Economic and Income Diversification

Exotic fruit crops are high-value commodities capable of generating significantly higher returns compared to traditional staples. Diversifying into these crops protects farmers from income volatility associated with weather shocks or price fluctuations. Such diversification enhances income stability, resource use efficiency, and farm resilience.

7.3. Value Addition and Year-Round Availability

Many exotic fruits are highly seasonal, but their processing into juices, jams, powders, and dried products allows availability throughout the year. With the growing demand for convenient and ready-to-eat fruit products, the value-added segment offers huge potential for agripreneurs and MSMEs. Developing strong processing and branding ecosystems can unlock export opportunities and rural employment.

7.4. Import Substitution and Export Potential

Domestic production of exotic fruits remains insufficient to meet current demand, resulting in substantial imports from Thailand, Vietnam, and Chile. By



promoting cultivation within India, the country can reduce import dependency, save foreign exchange, and achieve self-reliance in high-value horticulture. Given its agro-climatic diversity—from tropical to temperate zones—India can emerge as a major global exporter of exotic fruits with targeted support in R&D, logistics, and certification systems.

7.5. Contribution of High-Value Crops to Farm Income

According to Chand (2016), high-value crops (HVCs) like fruits, vegetables, condiments, and sugarcane occupy only 19% of India's gross cropped area (GCA) but contribute nearly 41% of the total value of crop output. In contrast, staple crops occupying 77% of GCA contribute an equivalent share of output value, highlighting the higher productivity of HVCs. The average productivity (adjusted for cropping intensity) for HVCs is ₹1,42,777 per hectare, compared to ₹41,169 per hectare for staples. Thus, shifting just one hectare from cereals to HVCs could raise gross returns by ₹1,01,608 per hectare—underscoring the potential of diversification toward exotic fruits as a strategy for doubling farmers' income.



8. Government Initiatives and Policy Programs

The Government of India has taken several notable steps to promote exotic fruit cultivation through targeted schemes and institutional support.

8.1. National Horticulture Mission (NHM)

Provides financial assistance for the cultivation of exotic fruits such as dragon fruit, kiwi, passion fruit, and avocado, aimed at crop diversification and income enhancement.

8.2. Mission for Integrated Development of Horticulture (MIDH)

Focuses on holistic development of horticulture, including production, post-harvest management, processing, and marketing. It promotes technology transfer, creation of value chains, and establishment of market linkages for high-value fruits.

8.3. Rashtriya Krishi Vikas Yojana (RKVY)

Encourages crop diversification strategies, including exotic fruit crops, as a means to reduce production risk and increase profitability through state-led interventions.

8.4. Clean Plant Program (CPP)

To ensure self-reliance in disease-free planting material production, the Clean Plant Program (CPP) is being implemented with Asian Development Bank (ADB) funding. Establishes Clean Plant Centres (CPCs) across agro-climatic zones for major high-value fruit crops. Ensures pathogen-free, certified planting material using advanced therapeutic and tissue culture techniques. Introduces traceability and certification systems to guarantee authenticity. Aims to make India self-sufficient in the production and distribution of clean planting material for exotic and high-value fruits. This Central Sector Scheme, implemented through the National Horticulture Board (NHB), will significantly enhance productivity, profitability, and biosecurity in fruit crop cultivation.



8.5. Area Expansion and Crop Diversification Programs

Under various national and state-level initiatives (Table 9), exotic fruits such as dragon fruit, avocado, blueberry, mangosteen, passion fruit, rambutan, and strawberry are being actively promoted in new regions. States including Karnataka, Arunachal Pradesh, Nagaland, Tamil Nadu, Gujarat, and Maharashtra have emerged as pioneering hubs for these crops. These programs not only enhance farm income and employment but also support import substitution and foster export-oriented production.

Table 9. Plan for area expansion of exotic fruit crops

Crops	Present Area (in ha)	Target Area (in ha)	States covered
Avocado	800	543	Andhra Pradesh, Goa, Karnataka, Punjab, Tamil Nadu, Manipur, Nagaland, Uttarakhand, Arunachal Pradesh, Meghalaya, Sikkim, Tripura
Dragon fruit	3425	3686	Andhra Pradesh, Bihar, Chhattisgarh, Gujarat, Goa, Karnataka, Odisha, Punjab, Telangana, Tamil Nadu, West Bengal, Assam, Manipur, Nagaland, Uttarakhand, Haryana, Maharashtra, Rajasthan, Arunachal Pradesh, Meghalaya, Sikkim, Tripura
Passion fruit	9947	625	Karnataka, Manipur, Nagaland, Andhra Pradesh, Arunachal Pradesh
Mangosteen	9	600	Karnataka, Arunachal Pradesh, Nagaland, Tripura
Strawberry	2653	1735	Andhra Pradesh, Bihar, Goa, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Assam, Manipur, Meghalaya, Nagaland, Tripura, Himachal Pradesh, Rajasthan, Tamil Nadu. West Bengal



Rambutan	36	370	Karnataka, Arunachal Pradesh, Manipur, Nagaland, Tripura
Blueberry	1044	230	Madhya Pradesh, Maharashtra, Tamil Nadu, Arunachal Pradesh, Nagaland, Uttarakhand

8.6. Institutional Interventions and Strategic Measures for Enhancing India's Exotic Fruit Sector

8.6.1. Institutional Role and Capacity Building

- ICAR-IIHR (Indian Institute of Horticultural Research) is playing a pivotal role in driving research, development, and technology dissemination for exotic fruit crops in India. The institute has developed standardized cultivation protocols for crops such as dragon fruit (Kamalam) and avocado, while also producing and supplying quality planting material to farmers.
- State Horticulture Departments and Krishi Vigyan Kendras (KVKs) complement these efforts through extensive farmer training programs, focusing on integrated nutrient and pest management (INM/IPM), protected cultivation techniques, and best orchard management practices. Demonstration units established under these agencies showcase successful cultivation models to accelerate adoption among growers.
- The promotion of high-value crops under various national and state programs prioritizes dragon fruit, kiwi, passion fruit, and avocado as profitable alternatives to traditional crops. These crops are introduced in regions with favorable agro-climatic conditions to optimize yield and profitability. Simultaneously, market-oriented production models are being developed to strengthen linkages between farmers and domestic as well as international markets.
- Capacity building and farmer empowerment initiatives include the establishment of demonstration plots, hands-on training programs on post-harvest management, and value addition techniques such as the preparation of jams, juices, and dehydrated products. Farmers are also trained in crop rotation, intercropping, and integrated farming systems, promoting sustainable agricultural diversification.



- Post-harvest and export promotion activities emphasize the establishment of cold storage facilities, packhouses, grading units, and ripening chambers for exotic fruits. These infrastructure components help in minimizing post-harvest losses, ensuring better price realization, and supporting export readiness. The long-term goal is to reduce import dependency through enhanced domestic production and to create globally competitive export value chains for Indian exotic fruits.

- Public–Private Partnerships (PPPs) are being promoted to bridge critical gaps in supply chain management, planting material production, technology dissemination, and market access. Collaborations with private agribusiness firms, startups, and cooperatives are encouraged to provide technical assistance, invest in processing infrastructure, and introduce innovation-led Agri entrepreneurship models.

- Research on climate-resilient exotic crops is being expanded to identify and promote fruit crops that are drought-tolerant, water-efficient, and adapted to arid and semi-arid conditions. These efforts help farmers adapt to climate variability while improving profitability through off-season and resource-efficient cultivation systems.



9. Strategies for Import Substitution

The rapid increase in consumer demand for exotic fruits in India has led to a heavy reliance on imports, with domestic production meeting only a fraction of total consumption. To reduce import dependency and strengthen national self-reliance in high-value horticulture, a comprehensive, multi-dimensional strategy is required.

9.1. Key Strategic Actions

9.1.1. Continuous farmer support and technical guidance: As exotic fruit crops are relatively new to India, farmers require sustained technical assistance on cultivation practices, orchard management, and pest control. Parallel efforts must be made to develop post-harvest, processing, and marketing infrastructure to ensure full value-chain integration.

9.1.2. Mapping potential climate-analogous regions: Identify and map climate-analogous zones where agro-climatic conditions mirror those of major exotic fruit-producing regions globally. This will enable targeted promotion and clustering of exotic fruit cultivation in ecologically suitable areas.

9.1.3. Innovation and product development: Encourage research and product innovation to expand the application of exotic fruits in the food, nutraceutical, pharmaceutical, and wellness industries. Developing new, commercially viable products can significantly increase market potential and attract private investment.

9.1.4. Formation of Farmer Producer Organizations (FPOs): Establish crop-specific FPOs for exotic fruits to strengthen collective marketing, bargaining power, and economies of scale. FPOs can play a key role in aggregating produce, negotiating better prices, and connecting growers to domestic retail chains and exporters.



9.1.5. End-to-end value chain approach: Adopt a holistic production-to-market framework, encompassing pre-production, cultivation, post-harvest management, processing, logistics, and marketing, to ensure equitable returns for all stakeholders and improve the economic viability of exotic fruit farming.

9.1.6. Establishment of Centres of Excellence (CoEs): Create commodity-specific Centres of Excellence (CoEs)—for instance, a Centre of Excellence for Kamalam (Dragon Fruit)—to facilitate technology validation, capacity building, and model orchard demonstration. These CoEs can serve as hubs for research–extension linkages and PPP engagement.

9.1.7. Technology adoption and infrastructure strengthening: Promote adoption of modern horticultural technologies, including drip fertigation, hydroponics, protected cultivation, and solar-powered cold chains, to improve productivity and extend the shelf life of perishable fruits.

9.1.8. Partnership and convergence across sectors: Encourage multi-agency coordination between research institutions, private processors, marketing boards, and state agencies at national, regional, and district levels to promote synergy and resource optimization in production, processing, and trade.

9.1.9. Cluster-based development for scale efficiency: To achieve economies of scale and export competitiveness, implement cluster-based models for exotic fruit cultivation. Clusters focused on specific high-value crops can facilitate input standardization, certification, branding, and export-oriented production.

9.1.10. Multiplication of elite planting materials for high-value perennial crops: Given the expanding area under horticulture and the growing popularity of high-value exotic fruits such as dragon fruit, avocado, rambutan, longan, durian, and macadamia nut, there is an urgent need to import, evaluate, and multiply elite varieties. Currently, India imports high-value fruits worth nearly ₹10,000 crore annually, while domestic production meets only 20–30% of total demand (Table 10). Farmers often depend on inferior or unverified planting materials, resulting in low yields and poor quality.



Table 10. The import requirement of exotic fruit crop planting material for mass multiplication and distribution to suitable regions.

Crop	No of plants	Appox. Cost (crores)	Country
Avocado (Gem Hass, Lamp Hass, Daganya, Maluma Hass, Dusa, etc)	1,00,000	20	USA/Israel/Mexico New Zealand/South-Africa
Dragon fruit (Siam Red, LD1, Asunta Series & etc)	2,00,000	10	Vietnam/Japan/China
Longan (Ping pong, SZ S2)	1,00,000	20	Taiwan/Thailand China/USA
Macadamia Nut	50,000	5	Australia
Durian (Musang King, Mong Thong)	50,000	5	Thailand/Malaysia
Passion fruit (Orange)	50,000	5	Thailand/Taiwan
Pummelo (Dien, Honey, Daxanh, Nam roi)	50,000	1	Vietnam
Salak (Bali)	50,000	1.5	Indonesia

9.1.11. National initiative should be launched to: Import elite germplasm from internationally recognized sources, establish nucleus orchards and mother blocks, promote rapid multiplication through tissue culture and vegetative propagation, and support large-scale distribution through certified nurseries. This strategy would help reduce import dependency, enhance farmer income, and position India as a regional hub for high-value exotic fruit production and export.



10. Conclusion

Exotic fruits are increasingly being recognized for their exceptional nutritional value, therapeutic properties and market potential. Rich in essential vitamins, minerals, antioxidants and dietary fibre, these fruits play a vital role in promoting health, enhancing immunity, and preventing chronic diseases. Many exotic fruits—such as dragon fruit, avocado, passion fruit, and kiwi—contain unique bioactive compounds that contribute to improved digestion, cardiovascular health, and metabolic balance. From an economic perspective, the cultivation of exotic fruit crops offers a transformative opportunity for Indian farmers. As high-value crops, they provide substantially higher returns per unit area compared to traditional staples, while simultaneously contributing to crop diversification and climate resilience. With India's diverse agro-climatic zones and growing consumer demand, these fruits can serve as profitable alternatives in both tropical and subtropical regions. However, domestic production remains limited, compelling India to import large volumes to meet rising consumption—resulting in a significant outflow of foreign exchange. Promoting large-scale cultivation of exotic fruits can thus serve multiple national objectives: enhancing farmer income, reducing import dependency, improving nutritional security and strengthening the rural economy. Achieving this requires a twin-track strategy—first, by increasing productivity and value addition through research, improved planting material, and infrastructure; and second, by integrating Indian farmers more deeply into global agri-value chains through export-oriented production systems. This approach aligns seamlessly with India's vision of doubling farmers' income and advancing Atmanirbhar Bharat.

Strategic investments in processing, cold-chain logistics, and digital precision agriculture, coupled with Farmer Producer Organizations (FPOs) dedicated to exotic fruits, can empower smallholders to access premium domestic and international markets. These crops, catering to an expanding base of health-conscious global consumers, can further drive innovation in functional foods, nutraceuticals, and agro-processing industries. By integrating exotic fruit



cultivation into the national agricultural development strategy, India can position itself as a major producer, processor, and exporter of high-value fruits. This will not only enhance productivity and profitability but also transform farmers into globally connected agri-entrepreneurs, ensuring that the vision of sustainable income growth and resilient horticultural transformation becomes a tangible reality.





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