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Organic dragon fruit cultivation and market dynamics in India: A systematic review

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Abstract

Dragon fruit (*Selenicereus* spp.), has emerged as a high value crop with significant potential in India due its high nutritional value, wider climatic adoptability and vast global demand. In this review a synthesized recent scientific findings and actual field-based insights to develop a comprehensive package for successful organic dragon fruit cultivation and vigour's marketing in India and global level. The study has highlighted agro-climatic requirements, advanced organic nutrient management practices, pest and disease control through biological strategies, and efficient water management practices. Furthermore, a detailed evaluation of domestic and international market dynamics of dragon fruit, along with its value addition opportunities, and policy support mechanisms. Based on the various scientific studies it is indicate that organic dragon fruit production enhances soil health, ensures premium pricing (20–30% higher than conventional produce) for the certified products, and improves export potential. In the flip of this the constraints in implementation such as lack of standardized organic packages, certification challenges, and post-harvest handling losses and also limit large-scale organic farming adoption are discussed in a very meaningful way. The review proposes an integrated organic dragon fruit production as well as marketing model and finds significant research gaps for future investigation. Organic dragon fruit cultivation can serve as a sustainable and profitable model for Indian farmers, particularly rural youth. This article provides a detailed guideline to the rural youth who are interested in farming as well as the young entrepreneurs fascinated in production and marketing of organic products.

Keywords: Dragon fruit, organic cultivation, organic certification, sustainable agriculture, post-harvest management, exotic fruits, high-value horticulture

1. Introduction

India, being primarily agrarian, experienced significant changes in agriculture after the Green Revolution, with the widespread use of agro-chemicals having the most detrimental impact on soil health, human health and the environment. 2019a). This resulted to the restart organic farming activities by Indian farmers in much innovative and efficient manner. Meanwhile, the increasing popularity of agriculture among the young generation, as an excellent business opportunity, has contributed to the introduction of new and improved technologies and diversified crops. Among them, the dragon fruit is the one of the promising good returns crop, However, to but it has restrictions in consumption, as well as the export market because of vigorous cultivation by using chemicals. This shows the huge potential in the production of organic dragon fruit, which, together with innovative methods of organic farming, provide young farmers with better management, increased returns, and the safety of the environment. The dragon fruit has been ranked among the tropical superfoods because of its high nutrient composition and low level of calories. It has been reported that it can assist in regulation of chronic illnesses, digestive health and immunity. It is also rich in different vitamins, minerals, and dietary fibres, which makes it a perfect option in losing weight, controlling diabetes, and reducing cholesterol (Karunakaran *et al.*, 2019) [24]. In the meantime, organic agriculture systems have received more awareness in the recent decade as possible solutions to the problems of the conventional agriculture. Organic farming has potential on environmental protection, non-renewable resources conservation, better food quality, and premium price of the produce. It is

not only becoming a measure that addresses consumer demand, it is also becoming a need of the farmers that helps in changing rural agriculture into an eco-friendly practice. Organic farming may be used as a remedy, establishing the basis of sustainable agriculture, converting the costs, and enhancing health and sustainability of soil (Elayararaja and Vijai, 2020). Such importance and the rising demand in the population and influencing young farmers to organic production of dragon fruits. A number of reasons can be attributed to the success of the organic dragon fruit production, such as the availability of high-quality planting resources, the understanding of organic inputs, and the successful management of pests and diseases, as well as the presence of a market with organic products.

1.1 Background and Global Significance

Dragon fruit (*Selenicereus* spp., formerly *Hylocereus* spp.), commonly known as pitaya, it is a perennial climbing cactus which is native to Mexico and Central America (Nerd and Mizrahi, 1996)^[45]. Belonging to the family *Cactaceae* (2n=22), This crop is one of the nutrient-rich tropical crop. Dragon fruit as gained global popularity by its high economic returns and nutritional value. Dragon fruit is rich in antioxidants, vitamins, and minerals, leading as an important crop for commercial cultivation (Mizrahi *et al.*, 2007)^[34]. However, to This perennial climbing cactus, being herbaceous in nature, has been able to capture the attention of the world market as a superfood because of its prominent appearance, remarkable nutritional value, and many health advantages. Growing in the Americas (Central America, Guatemala, and southern Mexico), dragon fruit has been introduced successfully to other parts of Asia-Pacific and into other tropical areas, especially Vietnam, Thailand, and Malaysia, as well as China and more and more in India. The world market of dragon fruits exhibited an impressive growth rate which is estimated to be USD 15.30 billion in 2024 with the targets moving to USD 30.72 billion in 2030. Vietnam is the world leader at more than 1 million tonnes each year with approximately 600 million USD of their exports and Thailand, Ecuador and emerging markets such as India. Asia-Pacific has the largest market share of 70.1 per cent of the whole world, which is a result of decades of cultivation experience and a well established export infrastructure.

1.2 Status of Dragon Fruit Cultivation in world and India

The economic yield of the crop will start after 2 years and the capacity of the plant to bear fruits over a period of 20 years with very minimal care and upkeep makes dragon fruit an interesting diversification alternative in the hands of Indian farmers. At global level China is leading as a major producer with 40,000 hectare area under cultivation, one of the major importer and domestic supplier (Chen and Paull, 2019)^[7]. It is successfully cultivated in various counties viz., Indonesia, Israel, Malaysia, Taiwan, Thailand, Sri Lanka, Bangladesh, Vietnam, Myanmar, Philippines, Japan, Cambodia, Singapore, South Korea, In India dragon fruit is rapidly expanding nationwide, with the primary regions include Maharashtra, Gujarat, Andhra Pradesh, and Telangana, with notable cultivation also occurring in Kerala, West Bengal, Karnataka, Tamil Nadu, Odisha, Arunachal Pradesh, Nagaland, Manipur, Rajasthan and Mizoram. Furthermore, sporadic cultivation has been documented in states such as Punjab, Chhattisgarh, Uttar Pradesh, Bihar, among others, highlighting its potential across diverse agro-climatic zones (Kakade *et al.*, 2025)^[23].

1.3 Nutritional and Health Attributes

Dragon fruit is a nutritious powerhouse, which is rich in many compounds that are healthy to the human being. The fruit has 50-60 calories in the 100g, very little fat is found in it (0.1-0.2g), it has a lot of dietary fiber (2.9-3.0g), and a lot of vitamin C (3-5mg per 100g). It is a good source of such important minerals as iron (0.55-0.65mg), magnesium (12.6-18mg), phosphorus (20-25mg), and calcium (10-12mg) per 100g. The fruit is also very high in antioxidants such as betalains, lycopene, vitamin E, and beta-carotene that offer protection against oxidative stress and act as anti-inflammatory agents. According to scientific evidence, the consumption of dragon fruits promotes the health of the digestive tract by prebiotic fibers that favor the growth of beneficial gut flora, promotes the maintenance of blood glucose levels by acting as a low-glycemic index, enhances the operation of the immune system by rich in vitamin C and antioxidants, and ensures weight loss owing to a high concentration of fiber and low caloric content. These health qualities have directed dragon fruit as the right crop in the management of chronic diseases, such as diabetes, cardiovascular diseases, and obesity (Chatterjee *et al.*, 2024, Mande *et al.*, 2023)^[6, 33].

1.4 Significance of Organic Dragon Fruit Production

Organic farming is not new to India, rapid hype for the agrochemicals after the green revolution hindered the significance of organic farming due to release of various hybrids and incidence of new pest and diseases. But over a period of time many farmers in the nation have realized the need for organic farming and demand for the organically produced food increased rapidly. This has created increased interest in organic farming practices among Indian farmers. At the same time, the increased involvement of the youth in agriculture as a lucrative business, as well as the understanding of the high market price of organic products, provoked interest in organic production of dragon fruits. The recent weakness of dragon fruit in the market is to a large extent caused by the intensive use of chemicals in the production of their fruit, this puts them at a disadvantage in accessing the export markets that require that they have organic certifications. Production of organic dragon fruit also has several benefits: increased market presence, both in the domestic and the international market, high prices (ranging between 20-30% more than conventional farming), better soil health, fewer negative effects on the environment, and appeal to health-conscious customers. The awareness of the potential of organic farming in offering sustainable solutions to the challenges of conventional agriculture explains the reason why there are need to have well-structured organic packages of dragon fruit cultivation.

2. Justification and Objectives of the Study

Dragon fruit represents a rapidly expanding global market valued at USD 25.15 billion in 2025, projected to reach USD 30.72 billion by 2030 (Mordor Intelligence, 2025)^[37], with India emerging as a significant producer despite being less than 1% of global supply. Indian cultivation has expanded exponentially from 4 hectares in 2005 to 3,000 hectares by 2020, generating ₹18-33 lakhs annual profit per acre in established areas. However, comprehensive scientific documentation of organic dragon fruit cultivation packages adapted to India's diverse agro-climatic zones remains absent from contemporary agricultural literature (Statetimes, 2025). Conventional farming practices focused on intensive chemical inputs application rather than

export market access and limit profitability compared to organically certified products, which commands 20-30% premium price in the most premium markets (Volza, 2022) ^[52]. At the current agriculture scenario there is a knowledge gap existing related to the organic production practices, with respect to the nutrients supply, management of pest and diseases are done through organic sources, and also promotion and market development strategies necessitates comprehensive research synthesis to enable farmer adoption and India's participation in expanding international markets. Production of organic dragon fruit bring into line tactically with government initiatives including the Mission for Integrated Development of Horticulture (MIDH), National Mission on Organic Farming, and Agricultural Export Policy (Ministry of Agriculture & Farmers Welfare, 2023, 2024) ^[35, 36]. This kind of policy frameworks provides both the financial support and technical assistance for organic commercial crop production. Countries agriculture sector in post Green Revolution focused mainly on food grain production, and use of chemical fertilizers, pesticides etc., which induced soil degradation, chemical contamination, and environmental pollution which resulted in requiring shift to sustainable organic production systems (Elayaraja & Vijai, 2020) ^[10]. Keeping all the facts in view the organic dragon fruit cultivation is the way to the sustainability imperatives through elimination of the synthetic inputs, with combination of green manure crops, bio-fertilizers, bio-pesticides and organic inputs. Furthermore, government is also emphasising on bringing the rural youth back to agriculture as a policy priority positions dragon fruit as an ideally-suited opportunity given high profitability, moderate management intensity, and assured market opportunities (Sharma and Pandey, 2024) ^[50]. In this review article bridges the recent research achievements and field-based evidence to provide practical guidance on organic dragon fruit cultivation and marketing in India.

2. Agro-Climatic Requirements

2.1 Climate and Temperature Requirements

Dragon fruit, though a member of the Cactaceae family (typically desert area growing plant), it differs significantly in its climatic requirements. It requires sufficient water supply and specific temperature parameters for its optimal growth and development. The ideal temperature range for dragon fruit cultivation ranges from 20-29°C, with the plant capable of tolerating short-term exposure to temperatures as low as 0°C and as high as 38-40°C. However, temperatures exceeding 40°C causes plant damage with yellowing of stems and reduced growth. Similarly, prolonged exposure to frost conditions is detrimental to plant survival and establishment (Mizrahi *et al.*, 2007, Nobel. and De la Barrera, 2002.) ^[34, 46].

2.2 Rainfall and Water Requirements

Though its succulent nature, dragon fruit possesses relatively high-water requirements compared to other cacti. The crop requires fairly equitable rainfall distribution throughout the year, with a minimum of 600-800 mm is essential. Excessive rainfall, particularly in fruiting and fruit formation periods, poses significant challenges including flower drop, fruit drop, and increased susceptibility to many fungal diseases. Therefore, areas with heavy rainfall concentration are not much ideal for dragon fruit cultivation, whereas regions with consistent, well-distributed rainfall prove ideal.

2.3 Suitable Agro-Climatic Zones in India

Dragon fruit cultivation in India is well-suited to different agro-

climatic regions of Southern, Western, and North-Eastern India, characterized by dry, frost-free climatic conditions. The crop demonstrates excellent adaptability to diverse Indian climates, ranging from high-temperature, low-humidity arid regions such as Rajasthan and Gujarat to higher-rainfall, higher-humidity areas including Kerala and northeastern states. Major Indian states which are identified as ideal for successful dragon fruit production are Karnataka, Kerala, Tamil Nadu, Maharashtra, Gujarat, Odisha, West Bengal, Andhra Pradesh, Telangana and Andaman & Nicobar Islands. Maharashtra and Gujarat's high temperature regions enhance fruit sweetness and quality, whereas, Andhra Pradesh and Karnataka with fertile soils and moderate rainfall resulted in better yields.

3. Soil Requirements and Land Preparation

3.1 Soil Requirements

Dragon fruit cultivation can be cultivated in a wide range of soil types provided that adequate drainage and good organic matter are present in the soil. The most ideal soil comprises sandy loam or loamy soil with high organic content, ensuring proper root formation and penetration, along with adequate aeration. Prevention of waterlogging in the field is critical factor as excessive soil moisture induces root rot and plant death. The optimal soil pH range for successful dragon fruit cultivation is 5.5 to 8.5 (Chakma *et al.*, 2014) ^[5], with slightly acidic to neutral pH condition are most favourable. Farmers need to conduct periodic soil pH testing and apply soil amendments such as lime or gypsum to maintain optimal pH balance. Heavy clay soils are usually not suitable unless their drainage characteristics are substantially improved through soil amendment with organic matter and compost-induced raised bed systems.

3.2 Land Preparation Procedures for Organic Cultivation

Ideal land preparation constitutes the base of successful dragon fruit cultivation. Inclusive land preparation procedures, specifically adapted for organic production, are essential to optimize plant establishment and long-term productivity of dragon fruit.

Site selection: farm area selected for dragon fruit cultivation should prioritize well-drained areas with proper sunlight exposure, avoiding waterlogged or low lying areas prone to water stagnation. In economic point of view area should have better road connectivity and access to the market.

land preparation: One deep ploughing during summer months effectively destroys many soil borne pests and disease causing microbes along with incorporation of weeds into the soil, it should be followed by one light ploughing to achieve better tilth. Harrowing and levelling operations ensure even field topography, eliminating undulations. However, proper drainage is also essential for removal of excess of water from the field (ICAR-IIHR, 2018) ^[18].

Green manuring: Before establishment of dragon fruit in the field its ideal to grow a green manure crop in the field and incorporated into the field. It improves the soil physical, chemical, and biological properties along with supplying essential nutrients (Sanginga and Wooster, 2009) ^[49]. Green manure crops, typically legumes such as sunn hemp, dhaincha, or any nitrogen-fixing plants, enhance nitrogen availability through biological fixation and increase organic matter content upon incorporation.

4. Organic Planting Material Selection and Propagation

4.1 Selection of Planting Material

Biggest challenge in organic dragon fruit farming resides in the availability of certified organic planting material. Dragon fruit propagation occurs predominantly through vegetative parts, ensuring true-to-type plants and faster fruiting compared to seed propagation or through tissue culture. The most ideal approach involves sourcing planting material from established organic dragon fruit cultivators or purchasing from trustworthy certified organic nurseries or farmers. Selected planting material must be disease free, exhibiting vigorous growth, and derived from well-established mother plants known for superior productivity and fruit quality (Nagarjun P. and Shoji lal Bairwa, 2024) ^[39].

4.2 Propagation Techniques

Dragon fruit propagation primarily by utilizing the stem cuttings measuring 15-30 cm or 20-25 cm in length from mature, disease-free plants. Cuttings should ideally be prepared 1-2 days before planting to allow latex to dry, preventing rotting during establishment. Organic disease prevention measures such as treating cut ends with bioagents including *Trichoderma* and *Pseudomonas* and other beneficial microorganisms helps to suppress pathogenic fungi and bacteria.

Nursery raising: further the treated cuttings are to be planted in polyethylene bags containing a growth medium comprising soil, well-decomposed compost, and sand in a 1:1:1 ratio. This balanced medium provides adequate moisture and drainage which promoting root development.

4.3 Planting Spacing and Arrangements

The recommended spacing varies according to soil fertility conditions and management intensity.

Standard spacing: In normal, well-fertile areas, a spacing of 3.0-4.0 m × 3.0 m between pillars with four plants per pillar is recommended. This spacing provides adequate air circulation, along with reducing disease incidence while maximizing light availability for fruiting. where as in low fertile dryland areas denser plant population is recommended (3.0 m x 2.5 m pillar spacing) to compensate the yield reduction per unit area (Nangare *et al.*, 2020) ^[43].

Support structure design: Dragon fruit plants require robust support structures comprising concrete pillars (typically 2-3 meters height) with horizontal trellising systems to guide vine growth and facilitate harvesting. Proper pillar installation ensures structural integrity supporting plant weight at full productivity. At present cemented poles with cemented rings are very much ideal for cultivation of dragon fruit which not only helps for better establishment of the plant also durable compare to other supporting structures.

5. Integrated Nutrient Management for Organic Dragon Fruit Cultivation

In recent times, the sustainable agricultural practices have significantly focused on the use of organic and biofertilizer combinations to enhance crop productivity in view to reduce the environmental hazards (Sharma and Singh, 2020) ^[50]. Organic manure, such as FYM, vermicompost, plays an important role in enhancing soil structure, increasing soil microbial biomass, and improving nutrient availability (Kumar *et al.*, 2019 and Arancon *et al.*, 2004) ^[31, 1].

5.1 Enrichment of Organic Manure

The cornerstone of organic nutrient management involves preparation of scientifically enriched organic compost, integrating biological and organic amendments to enhance microbial populations and nutrient availability.

Compost enrichment procedure: Addition of organic compost or manure serves to supply essential nutrients but the nutrient availability is very less. Hence a careful and scientific approach to applying manures, enriched through specific measures, provides distinct advantages. For one ton of well-decomposed compost or vermicompost, the addition of one hundred kilograms of neem cake or mustard oil cake, along with one kilogram each of *Azospirillum*, *Pseudomonas*, *Frateruria*, *VAM*, *Trichoderma*, *Metahizium*, and *Paecilomyces* is required for enriching the compost. Upon incorporating biofertilizers and biopesticides into the compost, it should be covered with gunny bags and stored in a cool, dry place. Sprinkling water is essential to facilitate the multiplication of microorganisms and helps in enriching the compost (Nagarjun *et al.*, 2024) ^[40]. Jitendra *et al.*, 2025, based on the research finding suggest that integration of organic sources and biological amendments is an efficient organic nutrient management strategy for improving the growth, flowering, and yield of dragon fruit along with promoting sustainable agricultural practices by reducing dependence on chemical fertilizers.

After a period of ten days, the result is enriched compost ready for application. During planting, it is advised to apply approximately five kilograms per pillar, with subsequent applications of five to ten kilograms per pillar twice a year. To further enhance nutrient availability for plants, the monthly application of jeevanruta is recommended. Additionally, the quality of fruits can be elevated by spraying panchagavya during the flowering stage of the dragon fruit.

6. Water Management and Irrigation

6.1 Irrigation Requirements

Though dragon fruit belonging to the Cactaceae family, considerable water requirements exceeding those of typical desert cacti, necessitating careful irrigation management to maintain optimal soil moisture without inducing waterlogging. Successful dragon fruit cultivation requires right-timed water supply at proper volumes, considering soil moisture content and prevailing atmospheric conditions.

6.2 Drip Irrigation Systems

Drip irrigation is one of the most efficient irrigation method compared to other irrigation methods in dragon fruit cultivation, offering multiple advantages including water conservation, reduced weed growth, and minimized disease incidence. Drip systems deliver water directly to the root zone at low pressure, reducing water loss.

6.3 Drainage Management

It is very much essential for successful dragon fruit cultivation, as waterlogging induces root rot diseases, reduced nutrient availability in anaerobic soil conditions, and plant death. Field topography should be carefully designed to facilitate surface water drainage, with raised bed systems.

7. Weeds and pest management

7.1 Weed management

Controlling weeds poses a significant challenge in organic

dragon fruit cultivation, particularly during the early stages of plant growth. Therefore, it is crucial to employ careful strategies such as straw mulching, timely hand weeding, and the use of motor-operated weeders between dragon fruit poles. In the initial stages, special attention should be given to selecting well-decomposed compost (Ramesh *et al.*, 2010) ^[48], that is free from weed seeds for manuring the dragon fruit plants (Nagarjun, 2025) ^[41].

7.2 Pest and disease management

Dragon fruit is affected by comparatively lesser amount of pests and diseases. The pests like mealy bugs, aphids and termite have been found damaging the dragon fruit and diseases like stem rot caused by *Xanthomonas campestris* and brown spots on fruits caused by *Dothiorella* occur in some production areas (Nangare *et al.*, 2020) ^[43].

In organic farming care should be taken before infestation of any pest and diseases, frequent spraying of neem oil (Koul *et al.*, 2008) ^[27] helps to reduce the incidence of many pest. Furthermore, spraying of bio-pesticides like *Verticillium lecanii* and *Beauveria bassiana* helps to control sucking pest and *Metarhizium anisopliae* and Entomopathogenic nematodes (EPN) helps to controls termites and other soil bone pest (Lacey *et al.*, 2001 and Grewal *et al.* 2005) ^[32, 12]. Whereas, timely drenching with Trichoderma and Pseudomonas helps to reduce the incidence of fungal diseases (Kumar *et al.*, 2008) ^[30].

8. Marketing and Distribution Of Organic Dragon Fruit

8.1. Domestic Market Structure and Pricing Strategies

Organic dragon fruit commands premium prices in India's urban markets, with retail prices ranging from ₹250-600 per kilogram, representing a 20-30% premium over conventional cultivation (Krishibazaar.in, 2024) ^[29]. Market concentration in metropolitan centers (Mumbai, Delhi, Bengaluru, Hyderabad, Chennai) reflects health-conscious consumer preferences and organized retail infrastructure (Entrepreneurindia.co, 2025) ^[11]. Price fluctuation across channels indicates price ranging between ₹200-400/kg during peak harvest and ₹400-600/kg during off-season, with organized retail commanding premium prices (₹500-600/kg) compared to wholesale channels (₹250-350/kg) (Agrifarming.in, 2022) ^[2]. Price differentiation reflects organic certification credibility, quality attributes, and perceived health benefits driving consumer purchasing decisions (Willer *et al.*, 2024) ^[51]. Contractual arrangements with retailers and growers provide price stability and market certainty, enabling production planning and returns predicting (Volza, 2022) ^[52].

8.2. Distribution Channels and Market Access

Many distribution channels provide organic dragon fruit market to diverse consumer and better returns (Freshdi.com, 2025) ^[17]. Wholesale market channels like agricultural mandis, fruit markets, fruit agents facilitate bulk sales but capture 50-60% of retail prices through middle man commissions, reducing farmer profitability (Chand 2012, NIAM 2020 and Agrifarming.in, 2022) ^[4, 2]. Direct-to-consumer marketing through farmers' markets, farm-gate sales, own farm brand sale and producer cooperatives enables farmers to capture 70-80% of retail prices while establishing consumer relationships and obtaining valuable quality feedback (NABARD 2021) ^[38] (Entrepreneurindia.co, 2025) ^[11]. This is gaining much importance and demand in recent days especially in gated communities and big apartments where farmers brings his own produce setup a stall and sell the produce. Organized retail

supermarkets offer consistent customer base and professional merchandising (Pingali *et al.* 2019) ^[47] but require strict quality standards, consistent supply volumes, and standardized packaging compliance (Krishibazaar.in, 2024) ^[29]. E-commerce platforms like Nijacart have emerged as rapidly expanding distribution channels offering convenience, reduced intermediary costs, and direct consumer access, though requiring robust packaging, cold-chain logistics, and digital marketing expertise (Freshdi.com, 2025) ^[17]. Refreshment sector (restaurants, cafes, juice shops) command premium prices (₹400-600/kg) through incorporation into specialty beverages and wellness products (Entrepreneurindia.co, 2025, APEDA, 2023, NABARD, 2021 and NIAM 2020) ^[11, 3, 38, 1].

8.3. Export Market Opportunities and International Trade

Globally the demand for organic food is increasing, people are realizing the benefits of organic farming, products and adverse effect of chemical farming. Organic dragon fruit exports produce significant foreign exchange earnings, currently concentrated in Middle Eastern markets such as Qatar (66% of exports), Maldives (27%), and Saudi Arabia (3%), with export prices of USD 3.20-3.50 per kilogram (Volza, 2022) ^[52]. There is a significant export expansion potential in the European and North American markets where organic certification products substantial premiums reflecting health consciousness and regulatory emphasis on organic produce (Mordor Intelligence, 2025) ^[37]. Export market access requires compliance with international quality standards, food safety certifications (GlobalGAP, FSSC 2200), and recognized organic certifications (EU Organic Regulation, USDA National Organic Program) (Karunakaran *et al.*, 2019) ^[24]. Proper infrastructural facilities such as cold chain including pre-cooling facilities, refrigerated transport, and cold storage with good logistics is ideal for maintaining fruit quality and extending shelf-life during the transportation (Epubs.icar.org.in, 2024). Ideal Farmer Producer Organizations with export participation through collective aggregation, economies of scale in cold-chain utilization, and bulk contract can help to enhance the production and supply for organic farming to the global market (Agrifarming.in, 2022) ^[2].

8.4. Value Addition and Processed Products

Though Dragon fruit is having multiple benefits its shelf-life is limited (5-7 days at ambient temperature) this makes a way for value-addition opportunities achieving 3-10 times higher returns compared to sale of fresh fruits (ICAR 2022) ^[20]. Juice and pasteurized products are the most accessible processing option, which help in extending shelf-life to 3-6 months along with maintaining nutritional attributes (Epubs.icar.org.in, 2024). Syrups, crush squashes prepared from dragon fruit helps in addressing international juice industry demand with concentrate commanding premium prices (USD 5-8 per kg) compared to fresh fruit (USD 3.50 per kg) (Entrepreneurindia.co, 2025) ^[11]. Dragon fruits dried and powdered products served as functional food and nutraceutical markets, commanding premium pricing suitable for export to developed wellness markets (Willer *et al.* 2023) ^[51]. There is need to establish processing infrastructure development through FPOs, NGOs etc., and it requires modest capital investments (₹10-50 lakhs) enabling community processing facilities serving farmers groups (Epubs.icar.org.in, 2024). Government support through MOFPI (Ministry of Food Processing Industries) schemes provides financial help for processing infrastructure establishment (Ministry of Agriculture & Farmers Welfare, 2023) ^[35].

8.5. Policy Support Mechanisms and Marketing Infrastructure

Government policy outlines substantially enhance organic dragon fruit marketing viability through complete support mechanisms (Ministry of Agriculture & Farmers Welfare, 2024) ^[36]. Mission for Integrated Development of Horticulture (MIDH) provides 40-50% subsidies for infrastructure development including cold storage, processing facilities, and market-linkage activities (Ministry of Agriculture & Farmers Welfare, 2024) ^[36]. National Mission on Organic Farming supports organic certification, training programs, and infrastructure development, reducing transition barriers to organic production (Ministry of Agriculture & Farmers Welfare, 2023) ^[35]. Agricultural Market Information Systems provide real-time price data, demand forecasts, and market linkage opportunities, reducing information asymmetries and enabling informed farmer marketing decisions (Ministry of Agriculture & Farmers Welfare, 2024) ^[36]. Farmer Producer Organizations receive government subsidies and technical support for collective aggregation, quality standardization, bulk marketing, and bargaining power enhancement (Agrifarming.in, 2022) ^[2]. Export promotion schemes including Market Development Assistance, transport subsidies, and trade missions facilitate international market access (Ministry of Agriculture & Farmers Welfare, 2024) ^[36]. Cold-chain infrastructure development subsidies through PMKSY (Pradhan Mantri Krishi Sinchayee Yojana) address infrastructure constraints limiting market reach and export competitiveness (Ministry of Agriculture & Farmers Welfare, 2023) ^[35]. Quality assurance systems and certification support strengthen organic label reputation and support premium pricing realization (Krishibazaar.in, 2024) ^[29]. There is need to create an awareness regarding these facilities which will be very much helpful to farmers.

9. Conclusion and Policy Recommendations

In this review article a detailed information on organic dragon fruit cultivation along with tactical opportunity aligned with national development objectives including crop diversification, organic farming promotion, agricultural export expansion potential, and youth agricultural engagement as a employment opportunity along with future prospects are discussed. Organic dragon fruit cultivation and marketing in India represents a transformative agricultural opportunity which may help in generating substantial farmer income, contributing to environmental sustainability through organic farming adoption, creating rural employment and youth agricultural entrepreneurship opportunities, making the youth to comeback to agriculture and leading the nation as a significant global organic dragon fruit supplier. With ideal policy support, infrastructure investment, farmer capacity development, and institutional coordination, organic dragon fruit cultivation can become a intended crop enterprise contributing significantly to agricultural sustainability in all the aspects, farmer prosperity, rural development, and India's agricultural export competitiveness. The following are the evidence-based policy recommendations for the cultivation and marketing of organic dragon fruit:

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