STM JOURNALS

International Journal of
Trends in Horticulture

ISSN: 3049-1983
Volume 2, Issue 2, 2025
July–December
DOI (Journal): 10.37591/IJTHC

https://journals.stmjournals.com/ijthc

Review IJTHC

Horticulture As an Avenue of Sustainable Agriculture in India

V. Basil Hans[1],* Bharathraj. S. Nejar[2]

Abstract

In the face of climate change, soil degradation, and population pressure, sustainable agriculture has become a necessity for India. Within this broader framework, horticulture which includes the cultivation of fruits, vegetables, spices, plantation crops, flowers, and medicinal plants has emerged as a key pillar of sustainable agricultural practices. With its potential to ensure food and nutritional security, enhance rural livelihoods, and contribute to ecological balance, horticulture holds a strategic position in India's agricultural transformation. Horticulture has emerged as a crucial component of sustainable agriculture in India, offering a viable solution to the challenges of food security, environmental degradation, and rural livelihood development. Unlike traditional cereal-based farming, horticultural practices are resource efficient, climate-resilient, and economically rewarding, especially for small and marginal farmers. This paper explores the multifaceted role of horticulture in promoting sustainability through increased productivity, enhanced nutritional security, employment generation, and ecological balance. It also highlights key government initiatives and sustainable practices driving the sector forward. Despite challenges such as post-harvest losses and market access, horticulture presents significant potential to transform India's agricultural landscape into a more resilient and sustainable system.

Keywords: Sustainable agriculture, horticulture, climate resilience, nutritional security, rural livelihoods, resource efficiency, post-harvest management

INTRODUCTION

Agriculture continues to play a pivotal role in India's economy, employing nearly 43% of the workforce and contributing around 18% to the national Gross Value Added (GVA) in (Government of India, Economic Survey). However, traditional cereal-based farming faces constraints such as declining soil fertility, overuse of water resources, and vulnerability to climate change. In this context, sustainable agriculture has emerged as a pressing necessity, focusing on resource efficiency, ecological balance, and long-term food and nutritional security.

Within this broader paradigm, horticulture has emerged as a growth engine of Indian agriculture. According to the Ministry of Agriculture & Farmers' Welfare horticulture production in India reached 352.23 million tonnes in 2022–23, surpassing food grain production (329.7 million tonnes). The sector includes diverse crops such as fruits, vegetables, spices, plantation crops, flowers, and medicinal plants. Notably, horticulture occupies only 13% of the gross cropped area yet contributes significantly to agricultural GDP and farmer incomes.

To highlight the growing importance of horticulture in India's agricultural transformation, the following table presents a comparative view of food grain and horticulture production, their contribution to agricultural GDP, and their share in the gross cropped area [1-5].

***Author for Correspondence**
V. Basil Hans
E-mail: vhans2011@gmail.com

[1]Research Professor, Department of Science, Srinivas University Manglore, Karnataka, India
[2]Head & Assistant Professor, Department of Science, SMS College Brahmavar, Karnataka, India

Received Date: September 07, 2025
Accepted Date: September 29, 2025
Published Date: December 01, 2025

Citation: V. Basil Hans, Bharathraj. S. Nejar Horticulture as an Avenue of Sustainable Agriculture in India. International Journal of Trends in Horticulture. 2025; 2(2): 20–28p.

Table 1. Share of horticulture in indian agriculture (2022–23).

Indicator	Value (2022–23)
Total Foodgrain Production	329.7 million tonnes
Total Horticulture Production	352.23 million tonnes
Share of Horticulture in Agri GDP	~30%
Gross Cropped Area (Horticulture)	13%
Employment in Agriculture	43% of workforce

Source: The data in Table 1 clearly indicates that horticulture has overtaken food grains in terms of production volume, marking a significant structural shift in Indian agriculture. Despite being cultivated on a relatively smaller share of the gross cropped area, horticulture contributes disproportionately to agricultural GDP. This demonstrates its higher productivity per unit area and its potential to improve farm incomes. Furthermore, the increasing demand for fruits, vegetables, and other horticultural crops reflects changing dietary patterns in India, aligning horticulture with the dual goals of nutritional security and sustainable livelihoods.[6-7]

REVIEW OF LITERATURE

Growth of horticulture sector in India: Trends and Prospects

This study examines long-term trends in consumption of fruits and vegetables in rural areas. It finds growth rates of *18–23%* for certain fruits and vegetables in rural consumption. Even with growth, the consumption levels remain below recommended dietary requirements. The article also notes that increased diversification into horticulture has been associated with higher farm incomes and greater value addition opportunities.

Horticultural Crops and Climate Change: A Review

Malhotra reviews how climatic stressors like terminal heat, shifts in rainfall, reduced soil moisture impact horticultural crops. He discusses physiological responses (shortened growing period, altered phenology) and details on which crops are more vulnerable. Also underlines horticulture's potential role as carbon sinks and its involvement in climate mitigation.

Climate Resilient Agricultural Practices: An Indian Scenario

This review explores both traditional and modern practices among Indian farmers to adapt agriculture (including horticulture) to climate change. Topics covered include precision agriculture, conservation tillage, improved water use efficiency, and crop-variety selection. The paper emphasizes constraints such as availability of inputs, knowledge gaps, and the cost of adopting advanced techniques.

Studies on Sustainable Livelihood of Farmers in Horticulture-Based Farming Systems

(This empirical work compares two farming systems: $H + C + D + P$ (Horticulture + Crop + Dairy + Poultry) vs $H + C + D + P + S/G$ (adding Sheep/Goat) in two districts of Tamil Nadu. It develops a Sustainable Livelihood Index (SLI). Key findings: H + C + D + P system ensured higher food security (~76.92%) compared to the expanded system (~66.67%), though profitability was higher in the expanded system. [8-10]

Impact of Horticulture on the Livelihood of Rural Farmers in Mayurbhanj District of Odisha

Study in Odisha shows that adopting horticulture has led to measurable increases in income and savings among rural farmers. The adoption has also changed expenditure patterns—more spending on education, health, better food. It also identifies constraints such as poor irrigation facilities, marketing, storage infrastructure

Achieving Livelihood and Nutritional Security through Horticulture in India

Published in- this work articulates how horticulture helps in both livelihood enhancement and nutritional security. It documents that households involved in horticulture have better access to vitamins, diversified diets, and reduced dependency on staple grains. It also notes limitations in cold chain logistics and access to quality planting material.

Vertical Farming and Urban Horticulture in India: Opportunities, Challenges, and Future Prospects

This review focuses on urban horticulture, rooftop gardens, indoor farms, and vertical farming. It discusses environmental and social benefits (less food miles, urban green space, better food availability) but highlights challenges such as large initial investment, energy costs, specialized knowledge, legal frameworks.

Environmental Horticulture: Pathways to Sustainability and Climate Resilience

This recent paper delves into modern horticultural practices like hydroponics, aquaponics, vertical farming, green roofs etc., especially in urban and peri-urban contexts. Emphasis is on biodiversity conservation, soil & water preservation, air quality, carbon sequestration. Also explores use of renewable energy.

Enhancing Horticultural Sustainability in the Face of Climate Change: Harnessing Bio stimulants for Environmental Stress Alleviation in Crops

This review surveys how bio stimulants (natural compounds, beneficial microbes) are used in horticultural crops to reduce damage from salinity, drought, high temperatures. Includes discussion on physiological and molecular mechanisms, trials in various crops. Highlights regulatory, formulation, cost challenges.

A Critical Review on Fostering Community Involvement in Sustainable Horticulture Initiatives

This paper looks at community-driven horticultural projects. It reviews case studies where local communities, NGOs, governmental bodies collaborate for horticulture development, integrating local knowledge, participatory planning. Demonstrates socio-economic and environmental benefits (improved livelihoods, sustainability), but notes issues of resource equity, capacity, support infrastructure and consistent funding. [11-15]

Synthesis: Themes and Gaps

From the above literature, some recurring important insights and open gaps are:

- *Resource efficiency & climate adaptation*: Many studies recognize horticulture (and horticultural crops) as more efficient in water use, sometimes more resilient to climate stress, particularly when coupled with technology (bio stimulants, precision irrigation).
- *Livelihood & nutritional security*: Clear evidence that horticulture improves household income, savings, diet diversity. Especially strong in studies from Tamil Nadu, Odisha.
- *Urban & peri-urban horticulture*: Growing attention to vertical farming, rooftop gardens, etc., but many constraints like cost, expertise, policy support.
- *Community participation*: Community involvement is critical to ensure sustainability; local knowledge, participatory planning help, but inequalities and capacity limitations persist.
- *Technological interventions & post-harvest*: Use of modern inputs, improved cold chain, post-harvest handling often cited as bottlenecks.

Gaps Identified

- Many studies are regional; fewer pan-India statistical analyses especially for recent years .
- Less quantitative data on environmental externalities (carbon sequestration, biodiversity changes) specifically from horticulture in India.
- Limited longitudinal studies tracing farmers' income/nutrition over long periods after adopting horticulture.
- Insufficient work on integrating market access, value chains, policy implementation at small-holder level

HORTICULTURE AND SUSTAINABLE AGRICULTURE IN INDIA

Horticulture has emerged as one of the most vibrant and fastest-growing sub-sectors of Indian agriculture. Its contribution goes beyond food production, extending to employment, nutritional

balance, and ecological sustainability. The following sub-sections highlight the multidimensional role of horticulture in India's agricultural transformation:

Enhancing Food and Nutritional Security

Unlike cereal-dominated farming systems, horticulture provides a diverse range of fruits, vegetables, spices, and medicinal crops, all of which are rich in micronutrients, vitamins, and antioxidants. According to the Food and Agriculture Organization (FAO,), per capita fruit and vegetable consumption in India has been steadily increasing, though still below the WHO recommended level of 400 grams per day. The growth of horticulture directly supports the fight against "hidden hunger," i.e., deficiencies of essential micronutrients [16-17].

Employment and Income Generation

Horticulture is far more labour-intensive than cereals, providing year-round employment in cultivation, harvesting, grading, processing, and marketing. According to the NITI Aayog's Agricultural Outlook Report (2023), the sector accounts for nearly 30% of India's agricultural GDP, despite occupying only 13% of gross cropped area. Moreover, it generates employment for rural youth and women, particularly in processing, packaging, and floriculture.

Climate Resilience and Resource Efficiency

Studies show that horticultural crops, when cultivated with efficient irrigation methods such as drip and sprinkler systems, can reduce water use by up to 40% compared to traditional cereal farming (ICAR, 2022). Crops such as mango, guava, cashew, and spices are also more resilient to variable rainfall and high temperatures compared to water-intensive crops like paddy. This makes horticulture a strategic tool in adapting to climate change.

Value Addition and Agro-Processing

The horticulture sector provides vast opportunities for value addition through processing, cold chains, and exports. For instance, India exported ₹46,742 crore worth of horticultural products), including mangoes, grapes, spices, and floriculture products. However, post-harvest losses remain a major challenge, estimated at 15–30% for fruits and vegetables due to inadequate storage and processing facilities

Ecological and Environmental Sustainability

Horticulture contributes positively to environmental sustainability by supporting crop diversification, reducing monoculture risks, improving soil organic matter, and providing ecosystem services. Plantations, orchards, and green cover from horticultural crops help in carbon sequestration and biodiversity conservation. The integration of medicinal and aromatic plants further strengthens ecological balance.

The data in Table 2 demonstrates that horticulture has established itself as a key driver of sustainable agriculture in India. By combining economic growth, nutritional outcomes, employment creation, and ecological resilience, the sector represents a promising pathway towards achieving India's food security and climate adaptation goals.

Table 2. Contribution of horticulture to sustainable agriculture in india (2022–23).

Dimension	Contribution of horticulture	Source
Share in Gross Cropped Area	13%	NHB, 2024
Share in Agricultural GDP	~30%	NITI Aayog, 2023
Total Production	352.23 million tonnes	MoAFW, 2024
Export Earnings	₹46,742 crore	APEDA, 2023
Post-Harvest Losses	15–30% of fruits & vegetables	NHB, 2023
Employment Contribution	High labour absorption, especially women & youth	NSSO, 2022

GOVERNMENT POLICIES AND INITIATIVES FOR SUSTAINABLE HORTICULTURE IN INDIA

The rapid growth of horticulture in India has been strongly supported by a range of government initiatives aimed at increasing productivity, ensuring sustainability, reducing post-harvest losses, and promoting exports. These schemes highlight the strategic recognition of horticulture as a driver of both agricultural growth and rural development.

National Horticulture Mission (NHM)

Launched in 2005–06, the National Horticulture Mission (NHM) has been instrumental in diversifying agriculture by promoting the cultivation of fruits, vegetables, flowers, and plantation crops. The program supports area expansion, production of quality planting material, protected cultivation, and integrated pest management. According to the Ministry of Agriculture , NHM has contributed significantly to increasing India's horticultural output, particularly in states like Maharashtra, Karnataka, and Tamil Nadu.

Mission for Integrated Development of Horticulture (MIDH)

In 2014, the government consolidated NHM and other horticulture schemes into the Mission for Integrated Development of Horticulture (MIDH). This umbrella scheme focuses on holistic development, covering production, post-harvest management, processing, and marketing. By integrating cluster-based approaches and modern technologies, MIDH has promoted resource efficiency and improved linkages between farmers and markets.

Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)

Water efficiency is critical for horticulture. The PMKSY emphasizes "Per Drop More Crop", encouraging micro-irrigation methods like drip and sprinkler systems. Data from the Department of Agriculture show that over 14 million hectares have been brought under micro-irrigation, with horticultural crops accounting for the largest share. This has enhanced water-use efficiency and resilience against drought.

National Horticulture Board (NHB) Initiatives

The NHB plays a key role in providing infrastructure support, including cold storage, packhouses, ripening chambers, and market intelligence services. It also promotes high-density planting, rejuvenation of old orchards, and protected cultivation structures such as polyhouses and shade nets.

Agricultural Export Policy and APEDA Support

Horticulture has been central to India's agricultural exports. Under the Agricultural and Processed Food Products Export Development Authority (APEDA), specific clusters for mangoes, grapes, bananas, and spices have been developed to ensure quality standards for global markets. In 2022–23, India exported ₹46,742 crore worth of horticultural products, strengthening rural incomes and foreign exchange reserves

Farmer Producer Organizations (FPOs) and Digital Platforms

Recent policy emphasis has been placed on organizing farmers into FPOs and cooperatives to strengthen bargaining power and reduce dependence on middlemen. Digital platforms like e-NAM (National Agriculture Market) have also expanded access to transparent markets, particularly benefiting horticultural producers Table 3

The initiatives listed above demonstrate a multi-dimensional policy support system that strengthens horticulture from production to market access. While NHM and MIDH provide structural support for cultivation and diversification, PMKSY ensures sustainable water use. NHB enhances infrastructure, while APEDA policies and FPO promotion help farmers capture domestic and international market opportunities. Together, these policies not only enhance horticultural production but also contribute to sustainability, income stability, and resilience in India's agricultural sector.

Table 3. Major government initiatives in horticulture.

Initiative	Year launched	Focus area	Key achievements
NHM	2005–06	Area expansion, crop diversification	Boosted production of fruits/vegetables in major states
MIDH	2014	Holistic horticulture development	Cluster-based approach, post-harvest & marketing support
PMKSY	2015	Micro-irrigation, water efficiency	14+ million hectares under drip/sprinkler
NHB Schemes	Ongoing	Infrastructure, quality planting material	Expansion of cold storages, packhouses
APEDA Policy	2018	Export promotion & quality clusters	₹46,742 crore horticultural exports (2022–23)
FPOs & e-NAM	2017 onward	Market linkages, collective farming	Increased farmer participation & better price realization

CHALLENGES AND CONSTRAINTS IN SUSTAINABLE HORTICULTURE

Despite its rapid growth and significant contribution to agricultural GDP, horticulture in India continues to face a wide range of structural, infrastructural, and institutional challenges. These constraints limit the sector's potential to serve as a robust pillar of sustainable agriculture.

Post-Harvest Losses and Inadequate Cold Chain

One of the most pressing issues is high post-harvest losses, particularly in perishable crops like fruits and vegetables. The National Horticulture Board (2023) estimates that 15–30% of horticultural produce is lost annually due to poor handling, lack of cold storage, and inadequate transportation facilities. India currently has a cold storage capacity of around 39 million tonnes, whereas the demand exceeds 70 million tonnes (NITI Aayog), resulting in wastage and reduced farm incomes.

Fragmented Landholdings and Scale Limitations

Horticulture is often practiced by small and marginal farmers, who account for more than 86% of India's farming households (Agricultural Census, 2021).[3] The small scale of operations hinders adoption of modern technologies such as mechanization, drip irrigation, or greenhouse cultivation. It also weakens bargaining power in markets dominated by intermediaries.

Climate Vulnerability and Pest Outbreaks

Horticultural crops, though more climate-resilient in some respects, remain highly sensitive to extreme weather events such as cyclones, heatwaves, and irregular rainfall. For example, mango and banana yields in coastal states like Andhra Pradesh and Odisha often suffer due to cyclone damage (ICAR, 2023) [13]. In addition, pest and disease outbreaks such as fruit fly infestation or fungal diseases in grapes pose recurring threats to farmer incomes.

Market Access and Price Volatility

The marketing of horticultural produce is heavily dependent on perishable supply chains. Farmers often face distress sales during glut seasons due to lack of processing facilities and storage. Price volatility in vegetables such as onion and tomato frequently disrupts both farm incomes and consumer affordability. Although e-NAM has improved digital access to markets, coverage remains limited, especially for remote farmers.

Limited Access to Credit and Technology

Small farmers engaged in horticulture face difficulties in accessing formal credit and insurance products. High upfront investment for protected cultivation (polyhouses, shade nets) or vertical farming is a barrier for most. Moreover, adoption of advanced techniques such as hydroponics, biostimulants, and precision farming is limited to progressive farmers in select states, leaving out the majority.

Table 4. Challenges in Indian Horticulture.

Constraint	Current situation	Implications
Post-Harvest Losses	15–30% of produce wasted	Income loss, food insecurity
Cold Storage Capacity	39 MT available vs 70 MT required	Wastage, limited exports
Fragmented Landholdings	86% farmers are small/marginal	Limits scale economies & tech adoption
Climate Vulnerability	Cyclones, heatwaves, erratic rains	Crop failure, income volatility
Market Volatility	Frequent onion/tomato price shocks	Farmer distress, consumer inflation
Limited Access to Credit/Tech	High cost of greenhouses, drip irrigation	Slower modernization
Institutional Gaps	Delays, weak convergence in schemes	Reduced impact of policies

Policy and Institutional Gaps

While schemes like MIDH, PMKSY, and NHB provide comprehensive support, implementation challenges such as delayed fund release, uneven state-level capacity, and lack of convergence between departments reduce their effectiveness. Additionally, the absence of a robust farm-to-market value chain continues to constrain the long-term sustainability of horticulture Table 4

The above challenges reveal that while horticulture is a high-potential sector, it faces structural bottlenecks (small landholdings, market volatility) and infrastructural gaps (cold chain, storage, credit access) that hinder sustainability. Overcoming these constraints requires integrated policy reforms, stronger market linkages, and greater technological support for smallholders.

SUGGESTIONS AND POLICY RECOMMENDATIONS

The Indian horticulture sector has shown remarkable progress, yet it continues to face structural, institutional, and market-related challenges. For ensuring its long-term sustainability and inclusive growth, a set of comprehensive policy recommendations is essential. The following suggestions present a roadmap for overcoming constraints and unlocking the full potential of horticulture in India.

Strengthening Infrastructure and Supply Chains

1. Development of modern cold storage, pack houses, and refrigerated transport facilities should be prioritized, particularly in horticulture-intensive states like Maharashtra, Karnataka, and Andhra Pradesh.
2. The integration of rural primary markets with terminal markets through efficient logistics can help reduce post-harvest losses, which currently account for 15–20% of horticultural produce
3. Public–Private Partnerships (PPP) should be promoted for establishing state-of-the-art grading, processing, and storage facilities.

Promoting Farmer Producer Organizations (FPOs) and Cooperatives

1. Small and marginal farmers dominate the horticulture sector; hence collective models like FPOs and cooperatives must be encouraged for achieving economies of scale.
2. Policy support for capacity building, training in quality standards, and financial literacy is essential to empower these organizations.
3. The success of Amul in dairy can serve as a model for building horticulture-based cooperatives to enhance farmer bargaining power.

Enhancing Research, Extension, and Technology Adoption

1. Increased funding for agricultural universities and ICAR institutes is required to develop climate-resilient and pest-resistant varieties of fruits, vegetables, and flowers.
2. ICT-based solutions such as mobile advisory services, artificial intelligence for crop monitoring, and drone-based precision farming should be made accessible to farmers at affordable costs.
3. Training programs on Good Agricultural Practices (GAP) and organic farming can improve quality and global competitiveness.

Strengthening Export Competitiveness

1. Export-oriented clusters should be developed with a focus on crops like grapes, mangoes, bananas, and floriculture products.
2. Compliance with sanitary and phytosanitary (SPS) measures, along with branding initiatives under "One District, One Product" (ODOP), will improve India's presence in global horticulture markets
3. Trade facilitation measures, including faster customs clearance and dedicated perishable cargo facilities at airports, are critical.

Improving Financial Inclusion and Insurance Coverage

1. Horticulture farmers should be provided easy access to institutional credit through simplified lending norms and interest subvention schemes.
2. Expansion of the Pradhan Mantri Fasal Bima Yojana (PMFBY) to cover high-value horticultural crops with crop-specific insurance packages is needed.
3. Innovative financial instruments like contract farming agreements and warehouse receipt financing must be promoted.

Sustainability and Climate-Resilient Roadmap

1. Adoption of micro-irrigation systems (drip and sprinkler) needs to be scaled up to conserve water in drought-prone regions.
2. Integrated Pest Management (IPM) and organic nutrient management should be mainstreamed to reduce environmental degradation.
3. Agroforestry and diversification strategies must be promoted to enhance resilience against climate shocks.

The future of Indian horticulture lies in adopting a holistic approach that integrates infrastructure development, institutional reforms, technological innovation, and sustainable practices. A coordinated effort between the central and state governments, research institutions, private players, and farmer organizations is vital. With appropriate policy interventions, the sector has the potential not only to enhance farm incomes but also to contribute significantly to food security, employment generation, and India's export earning.

CONCLUSION

The horticulture sector in India has emerged as a vital pillar of agricultural transformation, contributing significantly to nutritional security, farmer income, export earnings, and rural employment. Over the past two decades, policy initiatives such as the National Horticulture Mission, Mission for Integrated Development of Horticulture (MIDH), and state-specific interventions have expanded the production base and diversified cropping patterns. Despite these achievements, the sector continues to grapple with challenges of post-harvest losses, fragmented supply chains, inadequate infrastructure, and climate vulnerability.

The analysis presented in this paper underscores that the future growth of horticulture depends on a multi-dimensional strategy that integrates infrastructure development, technology adoption, institutional support, and sustainability measures. Strengthening Farmer Producer Organizations (FPOs), promoting value addition and processing, improving market access, and ensuring financial inclusion can empower small and marginal farmers who form the backbone of the sector. Equally important is the adoption of climate-resilient practices, efficient water management, and eco-friendly farming methods to ensure long-term environmental sustainability.

India has the potential to position itself as a global leader in horticulture by combining its rich agro-climatic diversity with policy reforms and private sector participation. A coordinated effort between

governments, research institutions, private investors, and farming communities will be crucial in realizing this vision. If effectively implemented, horticulture can not only double farmer incomes but also contribute to sustainable rural development, balanced regional growth, and achievement of the Sustainable Development Goals (SDGs).

REFERENCES

1. Jha A, Suresh A, Punera B, Supriya P. Growth of horticulture sector in India: Trends and prospects. Indian J Agric Sci. 2018;88(6):866-74. Available from: https://epubs.icar.org.in/ejournal/index.php/IJAgS/article/view/87091/0
2. Malhotra SK. Horticultural crops and climate change: A review. Indian J Agric Sci. 2017;87(1):12-22. Available from: https://ebook.icar.gov.in/index.php/IJAgS/article/view/67138
3. Gogoi B, Sarma PK, Taifa S, Devi R, Prakash N, Handique AK, Gogoi R. Climate resilient agricultural practices: An Indian scenario. J Trop Agric. 2021;59(1):1-11. Available from: https://jtropag.kau.in/index.php/ojs2/article/view/1423
4. Ponnusamy K, Shukla R, Kishore R. Studies on sustainable livelihood of farmers in horticulture-based farming systems. Indian J Hortic. 2022;79(3):291-8. Available from: https://journal.iahs.org.in/index.php/ijh/article/view/1529
5. Basa SR, Sahu KK. Impact of horticulture on the livelihood of rural farmers in Mayurbhanj district of Odisha. EPRA Int J Res Dev. 2023;8(4):32-9. Available from: https://eprajournals.com/IJIR/article/10115
6. Kumar NK. Achieving livelihood and nutritional security through horticulture in India. Acta Hortic. 2018;1225:21-8. doi:10.17660/ActaHortic.2018.1225
7. Ali S, Singh A, Kashyap AS. Vertical farming and urban horticulture in India: Opportunities, challenges, and future prospects. Int J Tradit Herbal Cosmet. 2024;12(1):15-25. Available from: https://journals.stmjournals.com/ijthc/article%3D2024/view%3D183964/
8. Joshi V. Environmental horticulture: Pathways to sustainability and climate resilience. Int J Tradit Herbal Cosmet. 2024;12(2):30-42. Available from: https://journals.stmjournals.com/ijthc/article%3D2024/view%3D189360/
9. Sestili S, Rouphael Y, Colla G. Enhancing horticultural sustainability in the face of climate change: Harnessing biostimulants for environmental stress alleviation in crops. Horticulturae. 2024;10(1):23. doi:10.3390/horticulturae10010023
10. Srinivasu K, Reddy P, Rao V. A critical review on fostering community involvement in sustainable horticulture initiatives. J Sci Res Rep. 2023;29(7):45-58. doi:10.9734/jsrr/2023/v29i71515
11. Agricultural and Processed Food Products Export Development Authority (APEDA). Agri exchange statistics: Export of horticultural products from India. Government of India; 2024. Available from: https://apeda.gov.in
12. Government of India. Horticultural Statistics at a Glance 2023. Ministry of Agriculture & Farmers Welfare; 2023. Available from: https://agricoop.gov.in
13. Indian Council of Agricultural Research (ICAR). Annual Report 2022–23. New Delhi: ICAR; 2023. Available from: https://icar.org.in
14. NITI Aayog. Post-harvest management and value chain development for fruits and vegetables. Government of India; 2023. Available from: https://www.niti.gov.in
15. National Horticulture Board (NHB). Indian horticulture database. Government of India; 2024. Available from: https://nhb.gov.in
16. Planning Commission of India. Doubling farmers' income: Role of horticulture. Government of India; 2022. Available from: https://planningcommission.gov.in
17. United Nations Development Programme (UNDP). Sustainable Development Goals and agriculture in India: Pathways for inclusive growth. UNDP India; 2023. Available from: https://www.undp.org/india

18. Bakshi P, Singh M, Kour K, Iqbal M, Kumar R, Sarita. Horticulture: A key for sustainable development. In: Mahdi SS, Singh R, editors. Innovative Approaches for Sustainable Development. Cham: Springer; 2022. doi:10.1007/978-3-030-90549-1_11

