



The Rise of Protected Cultivation: Greenhouses and Polyhouses Revolutionizing Fruit Production in India

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The rapid advancement of protected cultivation practices, particularly the use of greenhouses and polyhouses, has revolutionized fruit production in India. These structures offer controlled environmental conditions that mitigate the challenges posed by climate change, pests, and seasonal limitations. Protected cultivation enables year-round fruit production, enhances yield and quality, reduces chemical usage, and supports the cultivation of high-value crops in non-traditional regions. Fruits such as strawberries, capsicum, tomatoes (classified botanically as fruits), and exotic varieties like dragon fruit and blueberries have witnessed a significant production boost under polyhouse and greenhouse conditions. The adoption of this technology is being increasingly supported by government schemes, research institutions, and farmer training programs. Despite initial investment barriers, the long-term benefits in terms of productivity, resource efficiency, and market value are drawing attention across small and large-scale farms. This paper explores the drivers, current trends, challenges, and future potential of protected cultivation in fruit farming, positioning it as a transformative force for sustainable horticulture in India.

Keywords: Protected cultivation, greenhouses, polyhouses, fruit production, climate resilience, high-value crops, sustainable agriculture, yield enhancement, India horticulture, controlled environment agriculture (CEA).

Introduction

India, with its diverse agro-climatic zones and predominantly agrarian economy, has witnessed significant advancements in horticulture in recent decades. One of the most transformative developments is the adoption of protected cultivation techniques — particularly greenhouses and polyhouses — which are reshaping the fruit production landscape by enabling year-round cultivation, higher yields, and better-quality produce.

Understanding Protected Cultivation

Protected cultivation refers to the growing of crops under structures such as greenhouses, polyhouses, net houses, or shaded houses that create a modified micro-environment. These structures help protect crops from extreme weather conditions, pests, and diseases while allowing control over temperature, humidity, and irrigation.

Greenhouses are typically made of glass or plastic and are equipped with climate-control systems. Polyhouses, a more cost-effective alternative, use polyethylene sheets and are increasingly popular among small and marginal farmers in India.

Why Protected Cultivation is Gaining Traction

1. **Climate Resilience:** With unpredictable monsoons, rising temperatures, and erratic rainfall due to climate change, protected structures provide a more stable environment for fruit crops.
2. **Extended Growing Season:** Fruits like strawberries, grapes, papaya, pomegranate, and exotic varieties like dragon fruit or blueberries can now be cultivated year-round or in off-seasons.
3. **Increased Productivity:** According to a study by the Indian Council of Agricultural Research (ICAR), protected cultivation can increase fruit yields by 2 to 5 times compared to open-field cultivation (ICAR-IIHR, 2020).
4. **Superior Quality and Export Potential:** Fruits grown in protected conditions are less prone to damage, more uniform in size, and have better shelf life, making them ideal for export markets.
5. **Efficient Resource Utilization:** Precision irrigation (drip/mist) and fertigation systems help reduce water and fertilizer use, improving sustainability.

Fruit Crops Benefiting from Protected Cultivation in India

- **Strawberry:** Widely grown in polyhouses in Maharashtra, Himachal Pradesh, and Haryana.
- **Grapes:** Polyhouses in Maharashtra's Nashik region are being used to protect grape vines from unseasonal rains and pests.
- **Papaya and Pomegranate:** Use of net houses in semi-arid zones (Gujarat, Rajasthan) helps control viral diseases and fruit flies.
- **Exotic Fruits:** Dragon fruit, kiwi, and blueberries are being successfully trialed under greenhouse conditions in states like Sikkim, Kerala, and Karnataka.

Government Support and Initiatives

The Indian government promotes protected cultivation through various schemes:

- **Mission for Integrated Development of Horticulture (MIDH):** Offers financial assistance up to **50-70%** of the cost of greenhouses/polyhouses, depending on the region and structure type.
- **National Horticulture Board (NHB):** Supports entrepreneurs and farmers through subsidies and training.
- **State Initiatives:** States like Haryana, Maharashtra, and Karnataka have set ambitious targets for greenhouse area expansion.

Research and Success Stories

- ICAR-IIHR (Indian Institute of Horticultural Research) has developed region-specific designs for low-cost polyhouses suitable for fruits like capsicum and strawberry.
- A 2022 study by Singh et al. in the *Journal of Horticultural Sciences* showed that papaya under net house cultivation in Gujarat yielded 35% more fruit with 20% less water compared to open cultivation.
- Farmers in Pune and Satara (Maharashtra) using naturally ventilated polyhouses for grapes reported a reduction in pesticide use by 40%, increasing both profit and produce safety (Source: Krishi Vigyan Kendra, Baramati, 2021).

Challenges and the Road Ahead

Despite the advantages, protected cultivation in India faces hurdles:

- **High Initial Investment:** Even with subsidies, the cost of setting up polyhouses (₹800–1,200/m²) can be prohibitive.

- **Lack of Technical Know-how:** Many farmers lack training in managing microclimates or pest dynamics inside structures.
- **Maintenance and Repairs:** Polyethylene sheets need replacement every few years, and damage from storms can be costly.

To overcome these barriers, integrated training, cooperative models, credit access, and localized design innovations are crucial.

Conclusion

The adoption of greenhouses and polyhouses in India marks a paradigm shift in fruit cultivation. While challenges remain, the potential benefits in terms of productivity, profitability, and sustainability are undeniable. With continued research support, policy backing, and farmer education, protected cultivation could be the cornerstone of India's horticultural revolution in the coming decades.

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