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Polyhouse Farming in India: A Sustainable Approach to Modern Vegetable Cultivation

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Abstract
This study explores the existing scope and future potential of polyhouse cultivation in Haryana, a state renowned for its strong agricultural base. Polyhouse structures provide a controlled environment for plant growth by adjusting temperature, humidity, and light, enabling year-round crop production regardless of climatic variations. Data was collected through structured interviews with district horticulture departments, focusing on cultivated area under polyhouses, types of structures, and financial assistance available. Findings reveal that 1,771,121 m² of land across Haryana is utilized for polyhouse farming, involving 1,956 growers. The construction cost for a 100 m² polyhouse is around ₹62,740, with a government subsidy of ₹43,416. An investment of ₹8,926 for plantation yields a return of ₹45,000 within three months. These insights emphasize substantial government incentives promoting polyhouse farming and its potential as a sustainable and lucrative agricultural practice in the region.

Key words: horticulture , substantial ,temperature ,financial

I. Introduction

Haryana stands as a leading agricultural state in India, producing diverse crops such as cereals, vegetables, pulses, fruits, and ornamental plants based on its varying climate and regional resources (Ghani et al., 2019). Traditional farming in the region relies heavily on monsoon rains and groundwater, which are increasingly threatened by climate change and water scarcity. In this context, protected cultivation methods have gained prominence.

Protected cultivation encompasses techniques such as polyhouses, mulch use, direct covers, windbreaks, and tunnel-based greenhouses (Petchsuk et al., 2019). Among these, polyhouses offer a highly controlled growing environment by regulating temperature, humidity, solar exposure, and airflow (Gopi et al., 2019). This technological innovation has transformed conventional farming, making it more resource-efficient and productive. Rising consumer demand for off-season produce has further enhanced the relevance of polyhouse farming. Haryana has seen growing adoption of this method, aided by supportive government policies aimed at encouraging sustainable and profitable agriculture.

This paper examines the current practices, economic advantages, institutional support, and implementation challenges associated with polyhouse farming in Haryana. It also evaluates its potential contribution to economic growth and agricultural sustainability.

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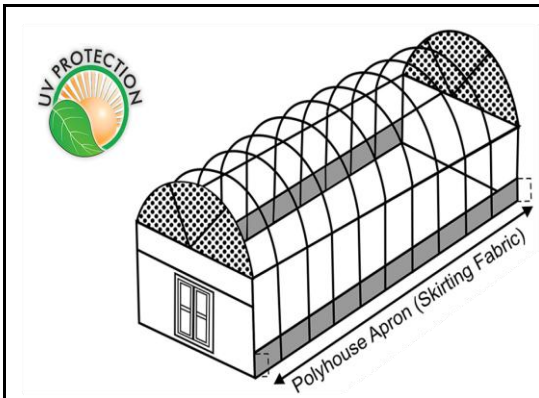
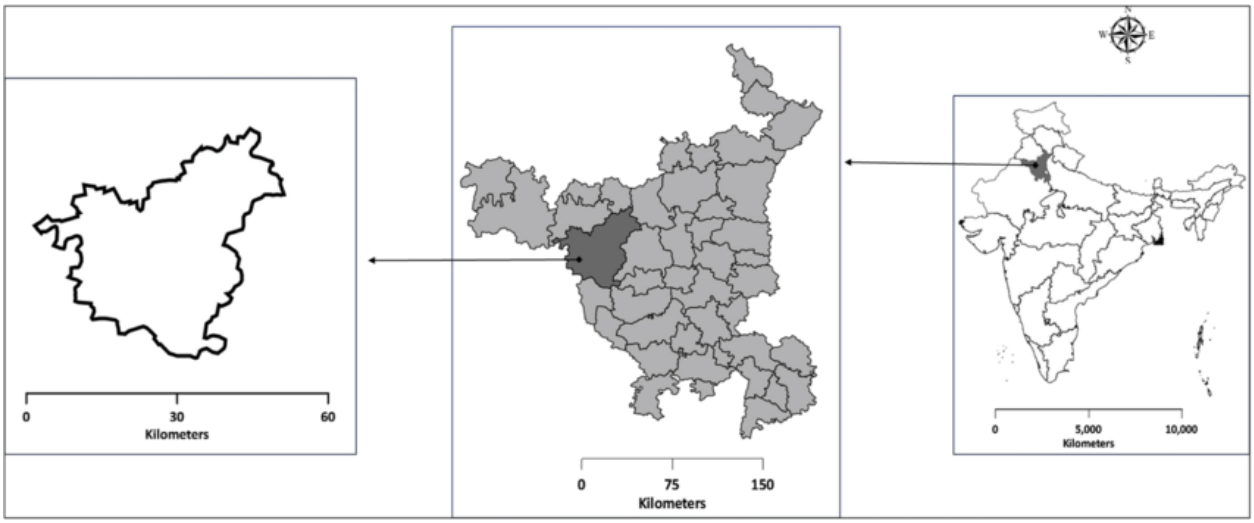
About Study Area





Advantages of Polyhouse Farming in Haryana

1. **Year-Round Cultivation** Polyhouses enable continuous farming regardless of seasonal variations. By creating ideal conditions for growth, farmers can cultivate crops even during unfavorable seasons, which typically offer better market prices and higher profits.
2. **Enhanced Yield and Quality** By protecting crops from harsh weather and pests, polyhouses lead to healthier plants, greater productivity, and superior produce quality. Research indicates that yields from polyhouse-grown crops are two to three times higher than those from conventional fields.
3. **Efficient Water Use** Given Haryana's water constraints, polyhouse systems integrate drip irrigation and rainwater harvesting to reduce water consumption. These systems improve water use efficiency and lessen reliance on groundwater.
4. **Reduced Use of Agrochemicals** A controlled environment minimizes the risk of pest infestations, thereby reducing the need for chemical pesticides and fertilizers. This leads to safer produce and promotes eco-friendly farming.
5. **Lower Labor and Input Costs** Automation of environmental control systems decreases the need for manual labor, reducing operational expenses while improving productivity.
6. **Higher Economic Returns** Consistent, high-quality production and reduced input costs enhance profitability. Small and marginal farmers benefit significantly, earning multiple times more than traditional farming income levels.

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7. **Environmental Sustainability**
   Polyhouse structures can be built with recycled materials and involve fewer chemical inputs, contributing to healthier soils and ecosystems. The system also supports organic farming methods, reinforcing its sustainability credentials.

Government Support and Initiatives

The Government of Haryana has been proactive in advancing polyhouse cultivation by implementing various subsidy programs and farmer-friendly schemes. Through the Department of Horticulture, financial support is extended to cover a substantial portion of construction expenses, thereby easing the financial burden on farmers. Notable initiatives include the National Horticulture Mission (NHM) and the Haryana Greenhouse Scheme, both offering subsidies up to 85% for small and marginal farmers. These programs also include training modules on polyhouse operations, loan accessibility, and dissemination of modern agri-technologies.

Particularly, the state administration aims to uplift the horticultural sector through these initiatives, enabling broader farmer participation in polyhouse farming. The focus is on democratizing access to advanced agricultural technologies, especially for resource-limited cultivators.

Economic Impact of Polyhouse Farming

Polyhouse cultivation has significantly altered the rural economic landscape in Haryana. By ensuring continuous and high-value production, it offers a stable income source, especially beneficial during off-peak seasons when crop prices rise. The decreased reliance on chemical treatments translates into savings and supports the transition toward organic farming, increasingly favored by health-conscious consumers.

Farmers practicing polyhouse-based vegetable cultivation, for instance, have reported threefold increases in earnings compared to traditional methods. This financial upliftment is critical for smallholders, providing a sustainable path out of poverty and debt cycles. Additionally, polyhouse cultivation has catalyzed the development of export-oriented agriculture. With the capability to grow premium-quality crops that meet international standards, Haryana's farmers are now exploring global markets, thus enhancing the state's role in national agricultural exports.

Challenges in Polyhouse Farming

Despite its numerous advantages, polyhouse farming in Haryana faces several barriers that need to be overcome for broader adoption:

1. **Pest and Disease Control Challenges**
   While polyhouses offer protection from many external threats, the enclosed environment can sometimes promote the rapid spread of pests and diseases. Proper training in integrated pest management and routine monitoring is essential to minimize such risks.
2. **Lack of Technical Knowledge**
   Effective management of polyhouse farming requires specialized expertise in areas such as climate control, pest management, and efficient irrigation. Farmers lacking adequate training may experience reduced productivity and financial returns.
3. **High Initial Costs**
   Even with available subsidies, the upfront cost of constructing and equipping a polyhouse remains considerable—especially for small and marginal farmers. Costs related to automation systems, irrigation units, and maintenance add to the financial load.

The Way Forward

To realize the full potential of polyhouse farming in Haryana, the following measures are recommended:

- **Capacity Building and Training**: Regular training programs should be conducted to enhance farmers' technical skills in managing polyhouse environments.
- **Research and Innovation**: Collaborative research between agricultural institutions and local farmers should focus on customizing solutions for pest management, crop planning, and efficient water use.
- **Enhanced Financial Access**: Streamlining the subsidy disbursement process and offering low-interest credit facilities can make polyhouse cultivation more financially viable for a larger section of farmers.

II. Conclusion

Polyhouse farming represents a viable and transformative agricultural approach in Haryana, promising enhanced productivity, better-quality output, and efficient use of natural resources. With growing governmental support and increased awareness among farmers, polyhouse farming holds the potential to reshape Haryana's agricultural

landscape. Addressing current challenges—especially those related to cost and capacity—will be crucial to unlocking its full benefits and achieving sustainable agricultural growth in the region.

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Here is the properly formatted reference list in consistent APA (7th edition) citation style for the sources you've provided, suitable for academic writing:

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