Protected Cultivation: A Boon for Indian Agriculture

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ABSTRACT

Protected farming is a contemporary agricultural method that entails cultivating crops in a regulated environment, safeguarded against unfavourable weather conditions. This approach provides several benefits, such as enhanced production, superior quality, and prolonged growing seasons. Farmers can enhance plant growth and minimise water consumption by controlling temperature, humidity, and light conditions. India, with by its varied environment and expanding population, offers substantial prospects for protected horticulture. Diverse buildings, including greenhouses, polyhouses, and net houses, are utilised to establish these regulated habitats. Nonetheless, obstacles such as substantial initial expenditures and the necessity for technical proficiency impede broad implementation. Notwithstanding these challenges, the prospective advantages of protected horticulture are considerable. It can assist India in attaining food security, enhancing rural lives, and diminishing its dependence on imports. Through investment in research and development, the promotion of sustainable practices, and the provision of comprehensive training to farmers, India can fully use the potential of protected agriculture and ensure a prosperous future for its agricultural industry.

INTRODUCTION

Protected agriculture is defined as a cropping method in which a regulated temperature affects how plants grow and develop. Innovations in agriculture have led to the widespread adoption of various protected cultivation strategies in commercial agriculture. Green houses, art fact houses, plastic houses, shade houses and internet houses are a few of these protective cultivation techniques that are helpful. While our nation is self-sufficient in manufacturing food grains, it is imperative to address the disparity between the rising demand for horticulture products and their supply to ensure nutritional security. This deficit cannot be addressed by conventional horticulture, which necessitates extensive land to enhance production for the burgeoning population.

Importance of protected cultivation

Global warming is an evolving global issue that cannot be neglected. The primary cause is created by humans, including the excessive utilization of fossil fuels, deforestation for industrial purposes, and growing population.

- The crop is protected from cold, wind, storms, rain, and frost.
- Controlled circumstances result in enhanced germination, accelerated plant growth, and expedited crop maturation.
- Enhanced quality and quantity of production over an extended duration.
- The utilisation of water is optimised, resulting in a 40-50% reduction in usage.
- Optimal utilisation of resources.
- The occurrence of disease and pests is diminished or eradicated.
- Crops will be mature year-round.
- Optimal technology for the industrial cultivation of high-value crops such as flowers and medicinal plants.
- Suitable for star drying in agricultural production.
- Crop cultivation amid adverse weather conditions (Sabir and Singh, 2013).

Protected cultivation structures

Protected cultivation structures comprise three primary components: the frame, cladding material, and ventilation/climate control systems. The structure's framework safeguards crop from several destructive elements, including wind, rain, snow, soil, climatic moisture, and both physical and chemical degradation. The cladding material is engineered to deliver the necessary photosynthetically active radiation (PAR), retain adequate heat during cold weather, and shield the crops from external factors. Ventilation or climate control systems create optimal environmental conditions for a plant's productive efficiency at a reasonable cost. The framework of protected cultivation is intended to ascertain its size, ventilation or climate control needs, and resilience against unfavourable conditions such as winds, snow, heavy rainfall, and hailstorms. The method entails calculating design load from multiple sources, including dead load, which encompasses service equipment such as heating, ventilation, air circulation, electrical systems, lighting, and irrigation. The live load comprising repair staff and suspended plants, among others. Additional factors include snow load and wind load.

Type of greenhouse based on cost of installation

Low-cost polyhouse/greenhouse: A 700-gauge polythene sheet is secured using bamboo ropes

and nails. The temperature within the greenhouse is 6-100°C greater than that of the exterior environment.

Medium cost greenhouse: It incurs greater expenses than a low-tech greenhouse. Galvanised Iron (GI) pipes are utilised in the framework of quonset-shaped polyhouses. The thickness of single-layered Ultra Violet (UV) stabilised polyethylene is 800 gauges. Exhaust fans are regulated by a thermostat. Frames and glazing materials possess a lifespan of 20 years and 2 years, respectively (Singh B, 2013).

High-tech greenhouse: The structure is constructed from iron or aluminium. Designs are either dome-shaped or cone-shaped. The growing mediums utilised in this sort of greenhouse, which are more durable and 5-6 times more expensive, include Peat, Perlite, Solarite, Vermiculite, and Rock wool. In India, coco fibres and rice husks are utilised as growing media due to their cost-effectiveness.

LOW-COST GREENHOUSE

HI-TECH GREENHOUSE

MEDIUM COST GREENHOUSE

PLASTIC TUNNELS

Miniature forms of greenhouses

Plastic low tunnels: Plastic low tunnels are diminutive greenhouses designed to shield plants from precipitation, wind, low temperatures, frost, and other climatic variations. The low tunnels are straightforward buildings that necessitate few skills for maintenance, are quick to construct, and provide numerous benefits. A 100-micron film would be adequate for the construction of low tunnels.

Net houses: Net homes are utilised for cultivating vegetable crops in areas with high precipitation. The structure's roof is adorned with appropriate cladding material. The sides consist of wire mesh of varying gauges. Such constructions are beneficial for the northeastern hilly terrain. Sweet pepper, a vegetable with significant economic potential, is typically cultivated at high altitudes (>1000 ft.). However, its cultivation is increasingly popular in the Northern Indian plains, where fruit size and productivity are adversely

affected by temperature fluctuations and insect pests (fruit borer, aphid, mite, and whitefly) in open field conditions.

Scope of protected cultivation in India

The potential in Indian horticulture is vast. If systematically organised, the prospective areas with significant potential for protected cultivation in India include:

1) Cultivation in challenging agro-climatic conditions: A substantial portion of uncultivated land in India exists in adverse conditions such as barren, uncultivated fallow lands and deserts. A small portion of this area utilised for greenhouse farming could yield significant benefits for the local population.

2) Greenhouses in large cities: There is a continuous demand for fresh vegetables and ornamental plants throughout the year in large urban areas. There is a significant demand for off-season and high-priced commodities in major urban areas.

3) Export of agricultural output: there exists substantial international demand for agricultural products, particularly cut flowers. The promotion of greenhouse and protected production of export-oriented commodities will significantly facilitate export enhancement (Jain *et al* 2023).

4) Greenhouse technology for biotechnology: Material produced by tissue culture must be grown in a controlled environment. Aquaculture, specifically the Nutrient Film Technique (NFT), requires regulated environmental conditions for plant cultivation.

CONCLUSION

The safeguarded production of high-value crops has become vital from both economic and environmental perspectives. It provides multiple benefits for cultivating crops of significant value with higher standards, regardless of adverse conditions. Nonetheless, the substantial training requirements of greenhouse cultivators and the prevalence of substandard food involving chemical residues have raised significant concerns. These difficulties can be effectively resolved by incorporating diverse output and safety methodologies, such as tailored design and construction of polyhouses for the best resource utilisation (Singh *et al*, 2024). Raising knowledge among greenhouse cultivators regarding the prudent application of herbicides could be pivotal in delivering superior goods while minimising environmental pollution.

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