Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 06, Issue: 02 (MAR-APR, 2026)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Production Technology of High-Value Vegetables in Greenhouses

*Sunil Khant and Mr. Tikam Das Vaishnav
RNT College of Agriculture, Kapasan, District-Chittorgarh (MPUAT - Udaipur)
*Corresponding Author's email: sunilkhant000@gmail.com

Greenhouse Introduction

1. What is a Greenhouse?

A greenhouse is a specially designed structure covered with transparent materials such as polyethylene sheets, glass, or polycarbonate panels. These materials allow sunlight to enter and trap heat inside, creating a controlled environment for plant growth.

The main purpose of a greenhouse is to provide favorable conditions for plants, regardless of external weather conditions. It helps in maintaining optimum temperature, humidity, light, and ventilation, which leads to better growth and higher yields.

2. Principle of Greenhouse (Greenhouse Effect)

A greenhouse works on the principle of the Greenhouse Effect.

Sunlight (shortwave radiation) enters the greenhouse through transparent covering.

It is absorbed by plants, soil, and other surfaces.

These surfaces re-emit heat as longwave radiation.

The covering material traps this heat inside, increasing the internal temperature.

This process keeps the greenhouse warmer than the outside environment, especially during cold conditions.

3. Objectives of Greenhouse Cultivation

To protect crops from adverse weather (frost, rain, wind, heat).

To produce off-season vegetables and flowers.

To increase yield and quality of produce.

To ensure efficient use of water and fertilizers.

To reduce damage from pests and diseases.

4. Types of Greenhouses

Greenhouses can be classified in different ways:

(A) Based on Structure

Lean-to Greenhouse – Attached to a building wall.

Even-span Greenhouse – Free-standing structure with equal roof slopes.

Uneven-span Greenhouse – Built on hilly areas.

Ridge and Furrow Greenhouse – Connected structures for large-scale farming.

(B) Based on Covering Material

Glasshouse – Durable and high light transmission.

Polyhouse – Covered with polyethylene sheets (most common in India).

Shade Net House – Used for partial protection.

(C) Based on Temperature Control

Naturally Ventilated Greenhouse – Uses natural airflow.

Climate Controlled Greenhouse – Equipped with fans, cooling pads, heaters, etc.

5. Components of a Greenhouse

Frame/Structure – Made of steel, aluminum, or wood.

Covering Material – Glass, polyethylene, or polycarbonate.

Ventilation System – Fans, vents, and cooling pads.
Irrigation System – Drip irrigation or sprinkler system.
Shading System – Shade nets to control sunlight.
Heating/Cooling System – Maintains temperature balance.
6. Advantages of Greenhouse
Higher crop productivity and quality.
Year-round cultivation possible.
Efficient use of water and fertilizers.
Protection from extreme weather conditions.
Reduced weed growth and pest attack.
7. Disadvantages of Greenhouse
High initial investment cost.
Requires technical knowledge and management skills.
Risk of disease spread if not properly managed.
Maintenance cost can be high.
8. Importance in Modern Agriculture
Greenhouses play a vital role in modern agriculture, especially for growing high-value crops like tomato, capsicum, cucumber, flowers, and exotic vegetables. They help farmers achieve higher income, better quality produce, and efficient resource

Abstract
Greenhouse cultivation has revolutionized the production of high-value vegetables like tomato, bell pepper, and cucumber by providing a controlled environment. This technology ensures year-round availability, high yield, and superior quality compared to open-field farming. However, successful production requires precise management of nutrients, water, and pests. This article explores the cultivation practices, benefits, and challenges of growing these crops under protected structures.

Introduction
Greenhouse technology, or protected cultivation, involves growing crops in structures covered with transparent or translucent material. In India, the horticulture sector is expanding rapidly, and greenhouses offer a way to tackle climate unpredictability. High-value vegetables such as tomato, bell pepper (capsicum), and cucumber are ideal for this system due to their high market demand and responsiveness to controlled environments.

Advantages of Greenhouse Cultivation
• Off-season Production: Vegetables can be grown throughout the year, fetching higher prices during the off-season.
• High Yield and Quality: Controlled conditions lead to 3–5 times higher productivity and uniform fruit size.
• Water Efficiency: Use of drip irrigation reduces water consumption by 40–50%.
• Pest and Disease Control: The physical barrier of the greenhouse reduces the entry of many insect pests.

Cultivation of Key Vegetables
 Tomato Cultivation in Greenhouse (Polyhouse)
Greenhouse tomato cultivation is an advanced farming method where environmental factors like temperature, humidity, and light are controlled to achieve higher yield and better quality fruits.
 1. Suitable Varieties: Hybrid varieties are best for greenhouse cultivation:
Arka Rakshak
Arka Samrat
Nunhems Hybrids
Syngenta Hybrids
 2. Nursery Raising: Seed rate: 100–150 g/ha

Seeds are sown in pro-trays filled with cocopeat
Seedlings become ready in 25–30 days
 3. Bed Preparation: Prepare raised beds
Width: 1 meter, Height: 20–25 cm
Soil sterilization by solarization or chemicals
Install drip irrigation system
 4. Transplanting
Spacing: 60 × 45 cm
Transplant in evening time
Light irrigation after transplanting
 5. Irrigation & Fertilization
Use drip irrigation
Apply fertilizers through fertigation
Follow weekly nutrient schedule (NPK)
 6. Climate Control
Day temperature: 22–28°C
Night temperature: 16–18°C
Humidity: 60–70%
 7. Plant Training & Pruning
Follow single stem system
Provide support (staking/trellising)
Remove side shoots (suckers) regularly
 8. Pest & Disease Management
Major pests: Whitefly, Thrips, Aphids
Use yellow sticky traps
Diseases: Leaf curl, Blight
Apply integrated pest management (IPM)
 9. Harvesting
Fruits are ready in 70–80 days after transplanting
Harvest every 3–4 days
 10. Yield
Greenhouse yield: 100–150 tons/ha
3–4 times higher than open field cultivation
 Chilli (Capsicum) Cultivation in Greenhouse
Greenhouse cultivation of chilli (especially capsicum / bell pepper) is a modern method where temperature, humidity, and light are controlled to obtain higher yield and better quality produce.
 1. Suitable Varieties
Hybrid varieties perform best:
Indra (Green capsicum)
Orobelle (Yellow capsicum)
Bomby (Red capsicum)
California Wonder (for protected cultivation)
 2. Nursery Raising
Seed rate: 200–250 g/ha
Seeds are sown in pro-trays filled with cocopeat
Seedlings are ready in 30–35 days
 3. Bed Preparation
Raised beds (1 m width, 20–25 cm height)
Soil sterilization by solarization/formalin
Apply FYM (well decomposed)
Install drip irrigation system
 4. Transplanting

Spacing: 60 × 45 cm
Transplant in evening hours
Irrigate immediately after planting
 5. Irrigation & Fertilization
Use drip irrigation
Fertigation with NPK fertilizers
Maintain balanced nutrients (Nitrogen, Phosphorus, Potassium, Calcium)
 6. Climate Control
Day temperature: 20–25°C
Night temperature: 16–18°C
Humidity: 60–70%
 7. Training & Pruning
Follow 2-stem system
Provide staking/trellising support
Remove side shoots and old leaves
 8. Pest & Disease Management
Major pests: Aphids, Thrips, Whitefly
Use sticky traps
Diseases: Powdery mildew, Leaf curl
Follow IPM (Integrated Pest Management)
 9. Harvesting
First harvest after 60–70 days
Picking at green, yellow, or red stage depending on market demand
 10. Yield
Yield: 80–120 tons/ha
Much higher than open field cultivation
 Cucumber (Cucumis sativus) Cultivation in Greenhouse
Greenhouse cultivation of cucumber is highly profitable due to controlled environment and use of parthenocarpic hybrids (seedless fruits without pollination). It ensures higher yield, better quality, and year-round production.
 1. Suitable Varieties
Parthenocarpic (seedless) hybrids are best:
Kian
Multistar
Pusa Uday (protected conditions)
Hilton, Terminator (private hybrids)
 2. Nursery Raising
Seed rate: 1.0–1.5 kg/ha
Sow seeds in pro-trays with cocopeat
Seedlings ready in 12–15 days
 3. Bed Preparation
Raised beds (Width: 1–1.2 m, Height: 20–25 cm)
Mix FYM/compost properly
Soil sterilization by solarization
Install drip irrigation system
 4. Transplanting
Spacing: 60 × 30–45 cm
Transplant in evening
Light irrigation after planting
 5. Irrigation & Fertilization
Drip irrigation is essential
Fertigation with NPK
Maintain regular supply of nutrients (especially Nitrogen & Potassium)

□□ 6. Climate Control
Day temperature: 25–30°C
Night temperature: 18–20°C
Humidity: 70–80%
□ 7. Training & Pruning
Follow single stem system
Provide vertical support (trellis)
Remove side shoots up to 5–6 nodes
Allow fruiting on upper nodes
□ 8. Pest & Disease Management
Major pests: Aphids, Whitefly, Mites
Use sticky traps
Diseases: Powdery mildew, Downy mildew
Follow IPM practices
□ 9. Harvesting
First harvest: 35–40 days after transplanting
Harvest at tender stage regularly (every 2–3 days)
□ 10. Yield
Yield: 150–200 tons/ha
Much higher than open field
□ 11. Advantages
Seedless fruits (parthenocarpic)
High yield and uniform quality
Off-season production possible
High market demand and profit

Nutrient and Water Management

Drip irrigation and fertigation are the backbones of greenhouse vegetable production.
• Fertigation: Water-soluble fertilizers (NPK) are provided based on the crop's growth stage.
• Micronutrients: Regular application of Calcium, Magnesium, and Boron prevents physiological disorders like Blossom End Rot in tomatoes.

Constraints in Greenhouse Cultivation

• High Initial Investment: Building the structure and installing climate control systems is expensive.
• Technical Skill: Requires knowledge of fertigation, pruning, and climate management.
• Pest Pressure: While many pests are kept out, certain insects like Whiteflies, Thrips, and Mites can multiply rapidly inside.
• Market Risk: High production costs mean farmers must have access to premium markets to be profitable.

Integrated Pest Management (IPM)

To reduce chemical residues in high-value vegetables, IPM is crucial:
• Microbial Control: Using Trichoderma for soil-borne diseases and Beauveria bassiana for insect control.
• Botanical Extracts: Neem-based formulations to repel pests.
• Sticky Traps: Yellow and Blue sticky traps for monitoring and mass-trapping flying insects.

Conclusion

High-value vegetable cultivation in greenhouses is a highly remunerative enterprise for farmers in Rajasthan and beyond. By adopting modern production technologies and integrating biopesticides, farmers can ensure sustainable and residue-free produce for consumers. Overcoming the constraints of high cost and technical gaps will lead to the widespread adoption of this technology.