

Introduction to Greenhouse Management

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Key concepts, essential practices, and practical tips for running a productive greenhouse.

1. What Is a Greenhouse?

Aspect	Description
Definition	A controlled environment structure that modifies temperature, humidity, light, and airflow to optimize plant growth.
Primary Goals	• Extend growing seasons • Increase yields • Protect crops from pests, weather, and diseases
Common Types	• Glass – high light transmission, expensive • Polycarbonate – durable, good insulation • Plastic film (PE, polyfilm) – inexpensive, replaceable • High-tech (hydroponic, vertical) – integrated climate and nutrient systems

2. Core Environmental Parameters

Parameter	Ideal Range (varies by crop)	Control Methods
Temperature	Day: 18-30°C; Night: 10-18°C (cool season) Warm season: 20-35°C day, 15-20°C night	• Heating (gas, electric, hot water) • Cooling (ventilation, evaporative pads, shade cloth)
Relative Humidity (RH)	50-80% (most vegetables)	• Ventilation, fogging, dehumidifiers
Light / Solar Radiation	12-16h photoperiod for most veg; supplemental light 200-400 µmol/m²s¹ when needed	• Shade cloth, blackout curtains, LED/HID supplemental lighting
CO₂ Concentration	400-1200 ppm (enhanced growth)	• CO₂ generators, bottled CO₂, compost respiration
Airflow	Gentle, uniform circulation; avoid stagnant zones	• Fans, circulation ducts, inlet/outlet vents

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3. Structural Components & Their Functions

1. **Covering Material** – transmits light, provides insulation, resists UV degradation.
 2. **Frame** – metal (galvanized steel, aluminum) or wood; must support wind loads and snow weight.
 3. **Foundation** – concrete slab, buried footing, or ground-level pad for stability.
 4. **Ventilation System**
 - *Passive*: roof vents, side louvres, automatic vent openers.
 - *Active*: exhaust fans, intake louvers, circulation fans.
 5. **Heating System** – boilers, electric heaters, heat exchangers; often paired with thermostatic controls.
 6. **Cooling System** – evaporative pads, misting, shading, fogging, and sometimes refrigeration units for high-value crops.
 7. **Irrigation & Fertigation**
 - *Drip, micro-sprinklers, nutrient film technique (NFT), aeroponics.*
 - Integration with sensors for automated water & nutrient delivery.
 8. **Control & Monitoring**
 - Sensors (temperature, RH, CO₂, PAR, soil moisture).
 - Controllers (PLC, Arduino, commercial greenhouse management software).
 - Data logging and remote access (mobile app, cloud platform).
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4. Basic Management Practices

4.1. Crop Planning

- **Select crops** suited to your climate zone and market demand.
- **Stagger planting** to smooth labor and resource use.
- **Rotate families** (e.g.,