



ROHINI
COLLEGE OF ENGINEERING & TECHNOLOGY
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(AUTONOMOUS)

Department of Agricultural Engineering

Course Name : **Protected Cultivation**
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Faculty : **Mr. ARUNPANDIAN N (Asst. Professor)**

UNIT - II

PROTECTED CULTIVATION OF VEGETABLE CROPS

PART 2 : HI-TECH CULTIVATION TECHNIQUES – CROP-SPECIFIC MASTERY

TOMATO – The Gold Standard of Protected Cultivation

1. Complete Growth Cycle Management:

- Phase I – Establishment (0-30 DAP):
 - Plant density: 2.5-3 plants/m² (single row) or 3.5-4 plants/m² (double row staggered)
 - Training: Remove lower leaves up to 30cm height for air circulation
 - Temperature regime: Day: 22-25°C, Night: 16-18°C
- Phase II – Vegetative Growth (30-60 DAP):
 - Pruning: Maintain 1-2 stems only, remove suckers when 2-3cm long
 - Leaf pruning: Remove 1-2 leaves/week after first cluster sets
 - EC management: 2.0-2.5 mS/cm in root zone
- Phase III – Generative Phase (60-150 DAP):
 - Cluster management: 4-6 fruits per cluster, thin deformed fruits
 - EC adjustment: 3.0-3.5 mS/cm for fruit quality
 - Temperature shift: Increase night temp to 18-20°C for fruit maturity

2. Advanced Pollination Techniques:

- Bumblebee colonies:
 - *Bombus terrestris* colonies of 50-100 workers
 - Introduction: 1 box/1000m² when 10% plants flowering
 - Activity window: 6-8 hours/day optimal
- Electrostatic pollinators: Vibrating wands at 100-200 Hz frequency
- Hormonal treatment: 4-CPA (20-30 ppm) or tomato set sprays

3. CO₂ Enrichment – The Photosynthesis Booster:

- Target concentration: 800-1000 ppm during daylight hours
- Sources: Pure CO₂ cylinders, combustion generators, biologicaldecomposition
- Economics: 30-40% yield increase at investment of ₹50-100/m²

CAPSICUM – The Colorful Cash Crop

1. Architectural Pruning Systems:

- Dutch system: 4 stems/plant, V-shaped orientation
- Spanish system: 2 stems/plant, umbrella shaped
- Pruning schedule:
 - Week 3-4: Select 2-4 strong stems, remove others
 - Weekly: Remove inward-growing shoots and leaves below 30cm
 - Flower leveling: Remove first flower to establish strong framework

2. Color Development Technology:

- Temperature triggers:
 - Green to red: 18-25°C optimal
 - Green to yellow: 20-27°C optimal
 - Light requirement: 800-1000 $\mu\text{mol}/\text{m}^2/\text{s}$ for anthocyanin development
- Ethylene management: Use Ethephon (500-1000 ppm) for uniform ripening

3. Specialized Training Methods:

Capsicum Training Timeline:

Week 1-2: Establishment

Week 3-4: Select 3-4 main stems

Week 5-6: First bifurcation support

Week 7-8: Second bifurcation, remove lower leaves

Week 9-12: Regular side shoot removal

Week 13+: Maintain canopy, remove old leaves

CUCUMBER & GHERKINS – The Vertical Champions

1. Training Systems Comparison:

System	Plant Density	Stems/Plant	Yield Potential	Labor Requirement
Umbrella	2-2.5/m ²	1	40-50 kg/m ²	High
V-cordon	1.5-2/m ²	2	35-45 kg/m ²	Medium
Lower & Lean	2.5-3/m ²	1	45-55 kg/m ²	Medium-High

2. Sex Expression Management:

- Environmental control:
 - Low temps (15-18°C nights) and short days promote female flowers
 - Ethylene releasing compounds (Ethephon 100-150 ppm) increase femaleness
 - Silver ions (AgNO₃) suppress ethylene, promoting male flowers for seed production

3. Gherkin-Specific Protocols:

- Harvest window: 2-3 days after flowering (fruit length 3-7cm)
- Grading standards:
 - Grade 1: 3-5cm, straight, uniform color
 - Grade 2: 5-7cm, slight curvature acceptable
 - Pickle grade: 7-9cm for specific products

STRAWBERRY – The Soilless Marvel

1. Hydroponic System Designs:

- Vertical stacking: 5-7 levels, 30cm vertical spacing
- NFT channels: 1% slope, 1.5-2 L/min flow rate
- Substrate bags: Coir slabs with 2-3 plants/slab

2. Photoperiod Manipulation:

- Day-neutral varieties: 'Albion', 'San Andreas' – fruit continuously under any day length
- Flower induction:
 - Short-day treatment: 10 hours light for 20 days
 - Chilling requirement: 200-300 hours at 0-7°C for June-bearing types

3. Pollination Precision:

- Bee density: 1 hive/500m² for greenhouse strawberries
- Vibration frequency: 100-120 Hz for 2 seconds per flower
- Fruit quality metrics: Commercial berries require 400-500 fertilized achenes

MELONS – The Sweetness Engineering

1. Grafting Technology:

- Rootstocks:
 - Cucurbita maxima hybrids for vigor and Fusarium resistance
 - Lagenaria siceraria for cold tolerance
- Grafting methods:
 - Hole insertion: 7-10 days old rootstock, 3-5 days old scion
 - Success factors: 25-28°C, 95% RH for 3-5 days healing

2. Sugar Accumulation Management:

- Stress induction: Mild water stress (50% irrigation) 7-10 days before harvest
- Potassium boosting: Increase K to 350-400 ppm during ripening
- Temperature differential: Day/night difference of 10-12°C enhances sweetness

3. Net Development Protocol:

- Critical period: 15-25 days after fruit set
 - Environmental needs:
 - Day temperatures: 28-32°C
 - Humidity: 60-70%
 - Air movement: Gentle, consistent breeze
 - Cultural practice: Light rubbing with soft cloth to initiate netting
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