3 Production steps

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Topics

1. Plant production timelines: lettuce and tomatoes
2. Seedling production
3. Making nutrient solutions
4. Hydroponic crop production Leafy greens and vine crops
   • Taking care of lettuce crops
   • Taking care of tomato crops
5. Monitoring nutrient solutions and pests
Hydroponic lettuce production timeline

- Place seeds on propagation trays
- Place seedlings in the hydroponic system
- Constantly monitor pH, EC, and DO
- Adjust pH when needed
- Constantly monitor for insect and diseases
- Harvest
Hydroponic tomato production timeline

- Place seeds on propagation trays
- Transplant
- Use stage 1 nutrient solution
  - Weeks 0 to 6
- 2 true leaves
- 1st flower cluster
- Use stage 2 nutrient solution
  - Weeks 6 to 12
- Prune lower leaves as needed
- Constantly monitor pH and EC
- Harvest ripe fruit as needed
  - Beyond week 12
  - Use stage 3 nutrient solution
  - Fruit ripening
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Media for seedling production

- Rockwool
- Compressed peat or coconut coir pellets
- Synthetic materials
Seedling production

1. Saturate the media with water (no fertilizers)
2. Place the seeds on the media
3. Cover the seeds for 24-48 hours (or place in a dark room)
4. Remove the cover and place seeds under light and keep them moist using a 75 ppm N nutrient solution
5. Seedlings will be ready when the first pair of true leaves are **fully expanded**
6. Place the seedling in the system on the net pots
Seedling production

Photo by Dr. Rosa Raudales-UConn
Seedling production in the Netherlands

Foto por Dr. Rosa Raudales-UConn
System prep before transplant

• Clean debris from previous crop
• Inspect system for leaks and broken parts
• Make sure you have all meters and materials in stock
  • Fertilizers
  • Acid and base (adjust pH)
  • Conductivity and pH meters (with calibrating solutions)
  • Air pumps with air diffusers (DWC system)
• Mix fertilizer with water then adjust pH
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Lettuce

- For every 10 gallons add
  - 1.34 oz (40 grams) of 5-12-26 fertilizer
  - 0.87 oz (25 grams) of 15.5-0-0 fertilizer
- Dilute the fertilizers separately each in 5 gallons then combine the dissolved fertilizers
- Measure pH and EC
- Adjust the pH between 5.5 to 6.0

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<th>Required ppm</th>
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Tomato Stage 1

- Use until you see the first cluster of flowers (approx. 6 weeks)
- For every 10 gallons add:
  - 0.8 oz (23 grams) of 5-12-26
  - 1 oz (29 grams) of 15.5-0-0
  - 0.4 oz (11 grams) of Epsom salts
- Dilute fertilizers separately
- Measure pH and EC
- Adjust pH

<table>
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<tr>
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Tomato Stage 2

- Use until you see the fourth cluster of flowers (weeks 6 to 12)
- For every 10 gallons add:
  - 1.5 oz (43 grams) of 5-12-26
  - 1.2 oz (34 grams) of 15.5-0-0
- Dilute fertilizers separately
- Measure pH and EC
- Adjust pH

<table>
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<th>Element</th>
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Tomato Stage 3

- Use when you see the fruits ripening (plants older than 12 weeks)
- For every 10 gallons add:
  - 2 oz (57 grams) of 5-12-26
  - 1.4 oz (39 grams) of 15.5-0-0
- Dilute fertilizers separately
- Measure pH and EC
- Adjust pH

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<thead>
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<th>Element</th>
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Hydroponic lettuce production timeline

- Place seeds on propagation trays
- Cover the seeds or place in the dark
- Place seedlings in the hydroponic system
- Constantly monitor pH, EC, and DO
- Adjust pH when needed
- Constantly monitor for insect and diseases
- Harvest
Systems adequate for leafy greens

Floating raft/Deep water culture (DWC)

- Air pump
- Diffusor
- Floating raft
- Nutrient solution

NFT

- Submergible pump

Aeroponic

- Sprinkler/fogging nozzle
Taking care of lettuce plants

• Place sticky traps near vents, doors, and at the canopy level of the crops to scout for insects

• Scout for insect damage, diseases, yellowing or abnormal growth

• Measure pH, EC, and DO (DWC systems) every two days. Adjust pH when necessary

• Use summer heat resistant varieties in the summer

• Top off with fresh nutrient solution when needed

• Replace nutrient solution after 3 crop cycles
Hydroponic tomato production timeline

- **Weeks 0 to 6**: Use stage 1 nutrient solution
  - Place seeds on propagation trays
  - Transplant
  - Prune lower leaves as needed

- **Weeks 6 to 12**: Use stage 2 nutrient solution
  - Constantly monitor pH and EC

- **Beyond week 12**: Use stage 3 nutrient solution
  - Harvest ripe fruit as needed

- **Events**:
  - 0: First true leaves
  - 1st flower cluster
  - Harvest ripening

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Systems adequate for vine crops

- **Growing media** (potting mix, coir, perlite, etc.)
- **Dripper**
- **Ebb and flow**
- **Dutch or Bato bucket**
- **Submersible pump**
- **Nutrient solution**
- **Fiber mat**
- **Mat**
Taking care of tomato plants

• Place sticky traps near vents, doors, and at the canopy level of the crops to monitor for insects
• Measure pH and EC every two days and adjust pH when necessary
• Walk through and observe the plants for insect damage, diseases, yellowing or abnormal growth
• Prune lower leaves and adjust plant on the trellis
• Tomatoes need pollination!
• Replace nutrient solutions when needed
Pollinating tomatoes

• There are no pollinators inside a greenhouse or a vertical farms
• Pollination is needed to increase yield and fruit size
• You can order a box of bumblebees that will last for 12 weeks, and it is good for 1,400 to 5,700 sq ft (too many can damage flowers)
• Tap the trellis wire twice a day at least 3 days a week
• Use electric air blowers every day for 5 seconds
Trellis system
Pruning

Improved air circulation = Less disease pressure

Makes it easy to train the tomato plants
Remove any suckers

Remove lower leaves no longer needed for production: all leaves under the first fruit cluster
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Measuring pH and EC
Cheap meters can take wrong readings that can result in costly mistakes.
A meter is as precise as the last time it was calibrated.
## Needed meters

<table>
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<tr>
<th>Parameter</th>
<th>NFT &amp; Dutch Bucket</th>
<th>DWC</th>
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<td>✔</td>
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<td>Electric conductivity (EC)</td>
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<td>Temperature</td>
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<td>✔</td>
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<tr>
<td>Dissolved oxygen (DO)</td>
<td>☠️</td>
<td>✔</td>
</tr>
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</table>

**Combo meters**
Monitoring for pests

• Use sticky traps to scout for insects
  • At plant height
  • Yellow: fungus gnats, aphids, thrips, whiteflies, and leaf miners
  • Blue: whiteflies
  • One trap per 1,000 square feet
  • Additional traps as needed near vents and doors
  • Always inspect the plants

• Identify the pests and the damage they cause (some transmit plant diseases)
Sticky traps
Insect pests

• Indoor/greenhouse: thrips, aphids, whiteflies, fungus gnat, and shoreflies

• Cultural control: resistant varieties, prevention measures, insecticidal soaps, horticultural oils, neem oil.

• Chemical control: Read the label! The label is the law!

• Biological control: predatory insects and beneficial fungi
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