4 Common problems

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Topics

1. Environmental problems
2. Plant diseases
3. Insect pests
4. Algae
5. Organic production
Abiotic vs biotic

• Biotic problems: caused by a living organism (develops over time with sporadic occurrence)

• Abiotic problems: caused by the environment (instant and general occurrence)
Abiotic vs biotic

- Biotic problems: caused by a living organism (develops over time with sporadic occurrence)
- Abiotic problems: caused by the environment (instant and general occurrence)
What is wrong with these lettuce plants?

Both caused by high temperature!
Temperature

- Lettuce: root 75°F; air → Day 68°F-75°F (never over 77°F) → Night 60°F-65°F
- Tomatoes 77°F
- Spinach: root 72°F; air 61°F - 91°F

(Thompson et al., 1998; Tindall et al., 1990; Lee and Takakura, 1995, )
Temperature and diseases

20-30% of losses happen during summer
Dissolved oxygen in nutrient solution

- $O_2$: Root growth and nutrient uptake depend on respiration.
- Low $O_2$: stunts growth, increases production of ethylene (stress).
- Optimum level no less than 6 ppm
Temperature and dissolved oxygen

↑ Temperature = ↓ solubility of oxygen

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Oxygen Solubility (mg/L)</th>
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<tbody>
<tr>
<td>0</td>
<td>14.6</td>
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<tr>
<td>5</td>
<td>12.8</td>
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<tr>
<td>10</td>
<td>11.3</td>
</tr>
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<td>15</td>
<td>10.2</td>
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<tr>
<td>20</td>
<td>9.2</td>
</tr>
<tr>
<td>25</td>
<td>8.6</td>
</tr>
<tr>
<td>100</td>
<td>0</td>
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Temperature affect plant health directly and indirectly.
Abiotic disorders

• Leggy plants with pale green/yellow foliage and long internodes: Poor lighting or overcrowding.

• Burned tips: high salinity (high EC), excessive fertilizers (improper mixing and preparation)

• Yellow foliage: lack of nutrients
Not a disease!

Blossom end rot

Caused by environmental conditions that limit the absorption of calcium. Even when calcium levels are adequate in the soil!

Calcium enters the roots with water!

Factors that will limit water uptake include days with high relative humidity and inconsistent watering.

Extension
University of Missouri
Not a disease!

How to prevent blossom end rot?

• If growing indoors make sure you have a fan exchanging air around the plants to avoid stagnant humid air.

• Open the greenhouse/high tunnel vent to allow for air exchange and lower air humidity.

• Remember to keep the soil moist but not saturated when watering.

• Avoid prolonged periods of drought, specially when the fruits are growing.
Not a disease!

Caused by high temperatures and intense sunlight exposure can affect fruit development and ripening.

**Solutions**

- Increase airflow to lower air temperature
- Use of shade cloth rated between 20 to 50% shade.
- Shade cloth will lower air temperature between 6 to 9 °F and should be installed when temperatures are going to be over 85°F.
Topics

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BIOTIC ISSUES

Caused by living organisms

Insects

Plant pathogens (diseases)
Plant pathogen dispersal

Fig. 4. Mortality of pepper plants on the inoculated and noninoculated side of a two-sided ebb-and-flow cultural system in the (A) absence or (B) presence of a surfactant in the recirculating nutrient solution. X = the inoculated plants that served as the source of secondary inoculum.
Common pathogens in hydroponics

- *Pythium* spp.
- *Phytophthora* spp.
- *Thielaviopsis basicola*
- *Xanthomonas*
- *Sclerotinia*
- *Botrytis*
- Powdery and downy mildew
Biocontrol of waterborne diseases: Still not compatible with hydroponic production

Cora McGehee, PhD Student, UConn
Get to the Root of the Problem: Diagnosis and Biocontrol of Root Rot in Leafy Greens

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PhD Student

Webinar Series
December 3, 2019

• https://youtu.be/ODCVqnjou58
Diseases

• Damping-off and root rots: Use high quality water or consider treating the water. Use a *Trichoderma* drench as preventive biocontrol.

• Mildews and white mold (Sclerotinia): Increase air circulation especially horizontal flow. Increase plant spacing. If growing indoors, consider a dehumidifier.

• Botrytis (gray mold): likes cool and wet weather. Avoid watering at night. Remove affected plants and improve air circulation.

• Leggy plants with yellow foliage: Lack of light, overcrowding or lack of nutrients.
Preventing diseases: Environment

• Keep plants in their comfort zones: pH, dissolved oxygen, temperature, and proper fertility

• Use good quality water
  • Municipal water ($$$) or well water ($)

• Consider water treatment if you don’t have access to good quality water
  • Solid separation → Filtration → Sanitation

• Use certified disease-free seeds and resistant varieties

• Ensure good air circulation: spacing and pruning
Preventing diseases: Equipment

• Keep the outside perimeter free of weeds
• Avoid reusing potting mixes
• Start with clean surfaces
  • Wash off debris, scrub with soap, and rinse
  • Sanitize (follow label instructions): quaternary ammonium (Green-Shield®, Physan 20®, and Triathlon®), hydrogen dioxide (ZeroTol®, Oxidate®) and chlorine dioxide (Selectrocide™)
• Keep floors clean
Preventing diseases: Control

• When in doubt contact your Extension Specialist

• Use chemical pesticides as last resort
  • Read the pesticide label: This is a binding contract
  • Do you have a pesticide applicator license?
  • Is it labeled for the crop?
  • Is it labeled for use indoors or in greenhouse?
  • Is it labeled to control the intended pest?
  • Do you have the required protective and application equipment?

• Consider biocontrol options:  
Insect 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)

• LIMITED REGISTERED PESTICIDES
• HIGH RISK OF DEVELOPING RESISTANCE
• SHORT CROP CYCLE (PREHARVEST INTERVALS)
• Biocontrol options
• CHEMICAL ROTATION
Monitoring for insect pests

• Use sticky traps to scout for insects
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• Identify the pests and the damage they cause (some transmit plant diseases)
  • Identity will help you identify proper control
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! Rotate products (IRAC code)
- Biological control: predatory insects and beneficial fungi
Chemical control

• You need training to get a private pesticide applicator training

• Always rotate pesticides with different FRAC or IRAC codes to prevent resistance development

• Read the label: this is a legal binding contract
  • Intended pest, for the specific crop, and adequate personal protective equipment
  • Ensures the responsible use of chemical pesticides

• Re entry and pre harvest intervals
Tripping hazard
Foul smell
Host insect pests
Toxic to humans
Compete for nutrients
Algae accumulation
Algae in indoor farming facility
Algae control

Factors that affect algae growth:

- Nutrients
- Water
- Light

Algicides will also kill plants
Sanitation: Lower initial inoculum
Sanitation: Lower initial inoculum
Organic production: Clogging
Organic fertilizer

3-1-1

GUARANTEED ANALYSIS
Total Nitrogen (N) .........................................................3%
  2.55% Water Soluble Nitrogen
  0.45% Water Insoluble Nitrogen
Available Phosphate (P₂O₅) .............................................1%
Soluble Potash (K₂O) ......................................................1%
Derived From: Fermented Oilseed Extract
10 lbs. per gallon at 68°F

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Food safety considerations

• Learn how to identify risk of contamination and how to minimize them
• Rodent control
• Worker training
• Quality of the production and postharvest water
• Packing house cleanliness
• Pets
• Visitors
Food safety considerations

• Learn how to identify risk of contamination and how to minimize them
• Rodent control
• Worker training (hygiene, health, illness, or injury)
• Quality of the production and postharvest water
• Cleanliness of buildings, equipment, tools, and surfaces
• Pets
• Visitors
• Fertilizers (organic source)
• Provide equipment, training, policies, practices and facilities to minimize risks
Contamination Sources

Humans

Animals

Produce

Buildings

Equipment

Tools

Soil

Water