Comparing Greenhouse and High Tunnel Biocontrol

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Western Lettuce Now Inc.,

6 acres

8 acres

Wiediger high tunnel
High Tunnel Temp. Profile

- **Summer**
  - Highest temperature: 95°F
  - Temperature range: 23°F to 95°F

- **Spring, fall**
  - Temperature range: 59°F to 95°F

- **Winter**
  - Temperature range: 41°F to 95°F

Temperature (°C) vs. Hour

- **Outside**
- **Inside**
Greenhouse pests

- Aphids
- Caterpillars
- Spider mites
- Thrips
- Whiteflies
Greenhouse pests

- Aphids
- Caterpillars
- Spider mites
- Thrips
- Whiteflies

- Suck plant juices
- Spread diseases
- Develop winged form when crowded
- Reproduce rapidly (live birth)
- Lay eggs on trees/shrubs to overwinter
Greenhouse pests

- Aphids
- **Caterpillars**
- Spider mites
- Thrips
- Whiteflies

- Chewing mouthparts
- Immature moths and butterflies
  - European cornborer
  - Imported cabbageworm
  - Diamondback moth
  - Cabbage looper
  - Asian armyworm
  - Tobacco hornworm
Greenhouse pests

- Aphids
- Caterpillars
- **Spider mites**
- Thrips
- Whiteflies

- Pierce and suck plant cells
- Outbreaks in warm, dry conditions
- Difficult to see with naked eye
- Webbing, brown speckled leaves
Greenhouse pests

- Aphids
- Caterpillars
- Spider mites
- **Thrips**
- Whiteflies

- Pierce and suck plant cells and eat pollen
- Spread disease
- Difficult to see with naked eye
- Yellow spots on leaves; silvery sheen
Greenhouse pests

• Aphids
• Caterpillars
• Spider mites
• Thrips
• Whiteflies

• Winged adult
• Immobile nymph
• Sucks sap from plant
• Leaves yellow and drop
Generalist Predators: Ladybeetle
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- Store in fridge
- Release in evening
- ½ pint (~4,500) treats 2500 sq. ft. and costs ~$20
- Quick clean-up
- Disperses quickly
Generalist Predators: Lacewing
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© Ron Hemberger, Fullerton Arboretum
Generalist Predators: Lacewing

- Shipped as eggs in bran
- 10,000 eggs treats 2,000 sq. ft and costs ~$60
- Larvae eat soft-bodied insects
- Adults eat pollen and nectar
Generalist Predators: Minute Pirate Bug

Jack Dykinga, USDA
Generalist Predators: Minute Pirate Bug

- Shipped as adults
- 500 adults treats 100-500 plants and costs ~$90
- Suck juice from soft-bodied insects, and eat pollen and nectar
Generalist Predators: Spined soldier bug

W. Sterling, Texas A&M Univ.
Generalist Predators: Spined Soldier Bug

- Predatory stink bugs
- Eat beetle larvae and caterpillars, including large caterpillars
- Shipped as eggs
- 250 eggs treats 25-250 plants and costs ~$110
- Very mobile
- Cannibalistic
Aphid Controls: *Aphidius* spp.
Aphid Control: *Aphidius* spp.

- Wasp parasitoid lays eggs inside aphids
- Each female lays 300 eggs
- Shipped as parasitized aphids
- 500 treats 7,500 sq. ft. - 1 ac. and costs ~$50
- Adults eat nectar and honeydew
Aphid Control: *Aphidoletes aphidimyza* W. Sterling, Texas A&M Univ.
Aphid Control: *Aphidoletes aphidimyza*

- Fly larva eats aphids
- Adult eats pollen, nectar
- Shipped as pupae
- Require multiple releases to establish
- 250 treats 2,500 sq. ft. and costs ~$16
Caterpillar Control: 
*Bacillus thuringiensis* var. *kurstaki*
Caterpillar Control: *Bacillus thuringiensis* var. kurstaki

- Bacterium
- Brand names include
  - Dipel
  - Thuricide
  - Bt Caterpillar killer
- Available as dust, wettable powder or liquid
- Long shelf life
- Only kills caterpillars
Spider mite control: Predatory mites
Spider mite Control: Predatory mites

- Several species
  - *Phytoseiulus persimilis*
  - *Amblyseius fallacis*
  - *Galendromus occidentalis*

- Eat eggs and adults of other mites
- Most need humid conditions
- 5,000 treats 2,500 sq. ft. and costs ~$90
Thrips control: Predatory mites
Thrips Control: Predatory mites

- Predatory mites
  - Amblyseius cucumeris
  - Hypoaspis miles
- Shipped as adults in bran
- Need moderate temperature and humidity
- 10,000 treats 100 plants and costs ~$15
Whitefly control: Wasp parasitoids
Whitefly Control: Wasp Parasitoids

• Wasp parasitoids
  – Encarcia formosa
  – Eretmocerus nr. californicus

• Shipped as parasitized whitefly nymphs

• Weekly releases for ~8 weeks to establish

• 1,000 treats 250 plants and costs ~$20
Beneficial insect releases

• Commonly used in large greenhouses
  – Weekly releases
  – Maintenance, plus extras based on monitoring

• Often too expensive for small greenhouses, due to shipping costs

• Incompatible with most pesticide use

• Need to release before outbreaks
Beneficial insect conservation

• More compatible with small operations

• Key tactics
  – Recognize friends
  – Avoid pesticide use (pests recover more quickly than beneficials)
  – Have flowering plants nearby for pollen, nectar
  – Diverse plantings
  – Tolerate some pest presence
IT'S A BUGGY GARDEN

MEET THE HEROES OF THE CITY FARMER COMPOST DEMONSTRATION GARDEN......

I AM A GARDEN TREASURE.. A REAL JEWEL BEE!

PLANT SOME FLOWERS AND I'LL HOVER OVER!

IF YOU'VE GOT APHIDS THEN I AM A TRUE BLUE FRIEND!
OH NO FELLOW APHIDS! LOOKS LIKE WE'VE BEEN SPOTTED!

LEAFCUTTER BEES LIKE FLOWERS TOO!

LACEWING LARVAE? ...WHEN WILL I GET MY WINGS?

... MMM.. NECTAR MAKES GOOD HONEY!

AND A FEW PESTS TOO!

WEEVILS ARE EVIL!

WHO ARE THESE LITTLE CRITTERS AND WHAT ARE THEY DOING HERE? ....STAY TUNED TO FIND OUT.

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