



## Observations on Insect Management in Purdue University's High Tunnel Systems

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## Advantages of Season Extension

- Produce available for sale for a longer period
- Produce available for sale when prices are higher

### Season Extension Techniques

- Transplants
- Plastic mulch
- Row covers floating or with hoops
- Low tunnels
- Greenhouses
- High tunnels

#### Row Covers for Early Season Melons

Treatment	Rate/A	SCB – 5/10	SCB – 6/3	% Stand	% Wilt
Untreated		1.75	1.00	90	20.8 ab
Brigadier	12.8 fl. oz.	0.50	2.50	95	5.3 c
Brigadier	25.6 fl. oz.	0.25	1.00	95	2.5 c
Diazinon	2 pt.	3.50	0.25	95	20.8 ab
Admire Pro	7 fl. oz.	3.50	2.00	98	15.0 bc
Coragen	5 fl. oz.	1.75	4.25	98	7.8 bc
Coragen	7.5 fl. oz.	0.75	1.50	98	5.0 c
Row Covers			4.50	98	33.3 a

### Row Covers for Early Season Melons Fruit/Row

Treatment	Rate/A	Early Harvest	Main Harvest	Late Harvest	Total Harvest
Untreated		2.25	14.00	3.50	19.75
Brigadier	12.8 fl. oz.	3.00	11.00	1.50	15.50
Brigadier	25.6 fl. oz.	5.50	12.25	2.25	20.00
Diazinon	2 pt.	3.00	12.25	2.25	17.50
Admire Pro	7 fl. oz.	3.25	14.75	3.00	21.00
Coragen	5 fl. oz.	4.50	11.75	0.75	17.00
Coragen	7.5 fl. oz.	5.00	11.52	1.50	18.00
Row Covers		4.75	6.50	2.75	14.00

Transplanted April 20

## **High Tunnel Research**

- Six high tunnels established at the Meigs Research Farm near Lafayette.
- Cooperative project with Steve Weller
- Most of work described here done by graduate students Sarah Thompson and Iqbal Habibi



#### **High Tunnels**

- o AKA Hoop House or Cold Frame
- o 1940s, Dr. Emery M. Emmert
- Structure Similar to a Greenhouse
  - Large Ribbed Frame
  - Stretched Covering
  - No supplemental Heat
  - Tall enough to work inside
    - Low Tunnels







### High Tunnel Disadvantages

• Soil Fatigue

Temp (°F)

• Soil-Born Diseases





- Wide Temperature Fluctuations
- Little Frost Protection





#### High Tunnel Advantages

- Season Extension
  - 3-5 weeks earlier in the Spring and later in the Fall
  - Possible Year-round Production
  - Economic Timing Benefits
- Increased Yield
- Improved Quality
- Pest Management
  - Insect Deterrence
  - Reduce Plant Diseases
  - Decrease Weed Competition



## Insects in High Tunnels

- Hightunnels.org
  - "...decreased incidence of pest and disease problems"
- Vermont High Tunnel Guide
  - "Insect pests generally cause less damage in high tunnels than they do in the field..."

### Why High Tunnels Might Have Fewer Insect Problems

- Exclusion by walls
- Diffused light might cause orientation problems during flight
- Change in microclimate might be less favorable for pests or more favorable for natural enemies

## Insects in High Tunnels

- Hightunnels.org
  - "...decreased incidence of pest and disease problems"
- Vermont High Tunnel Guide
  - "Insect pests generally cause less damage in high tunnels than they do in the field..."
- Most literature says that aphids, mites, and whiteflies will be the most problematic insect pests in high tunnels



Reasons Aphids, Mites and Whiteflies Might be More Common in High Tunnels

- More uniform climatic conditions
- Fewer natural enemies
- Lack of rainfall

### **Research Hypothesis**

 Insect pest densities within the high tunnels will be lower than that in the field



## Research Methods

- 3 Crops
  - Early Girl Hybrid Tomatoes
    - Indeterminate
  - Premium Hybrid Broccoli
  - Lider Hybrid Cucumber
    - Indeterminate
    - Parthenocarpic
- Black Plastic Mulch & Drip Irrigation
- Randomized Complete Block Design,
  - 3 Replications, Tunnels
- Control: Field Plots





# **Data Collection**

- Remote Monitoring System
  - Temperature
  - Relative Humidity
  - Photosynthetically Active Radiation
  - Dew Point
- Solar Powered
- Website Data Monitoring
- Alerts





### **Data Collection**



• Whole Plant Counts

• Sticky Traps





#### **Results-Tomatoes**





Measurement	p-value
Hornworm Density	0.25



#### **Results-Tomatoes**

Measurement	p-value
Percent Parasitism / Plant	0.18







#### **Results- Broccoli**



Caterpillar	p-value	Significance
Imported Cabbageworm	0.560	Not Significant
Diamondback Moth	0.005	Significant
Cabbage Looper	0.035	Significant
All Caterpillars	0.013	Significant

#### Results- Broccoli





# High Tunnel Pests- 2010

- Expected Greenhouse Pests
  - Mites
  - Aphids
  - Whiteflies
- Additional Pests
  - Hornworms
  - Yellow Striped Armyworm
  - Imported Cabbageworm
  - Cabbage Looper
  - Diamondback Caterpillars
  - Zebra Caterpillars
  - Cucumber Beetles



## Conclusions

- Insect densities are as high or higher in high tunnels than in field grown vegetables
- Insect pests in high tunnels need to be managed
- Integrated Pest Management Techniques
  - Cultural
  - Biological
  - Chemical





# Pesticide Use in High Tunnels

- States vary in how they regulate pesticide use in high tunnels
- In Indiana, a high tunnel is considered a greenhouse
- If a pesticide label prohibits use in a greenhouse, it cannot be used in a high tunnel
- If a pesticide label specifically lists use in greenhouses, it can be used in a high tunnel
- If a pesticide label doesn't mention greenhouses, it can be use in a high tunnel
- Midwest Vegetable Production Guide has a new section this year related to greenhouse and high tunnel pesticide use

## **Continuing Research**

- Microclimate Management
  - Side walls
  - Row covers





- Integrated Pest Management
  - Developed for field production
  - Optimization for high tunnels

