

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

Transplanted April 20

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



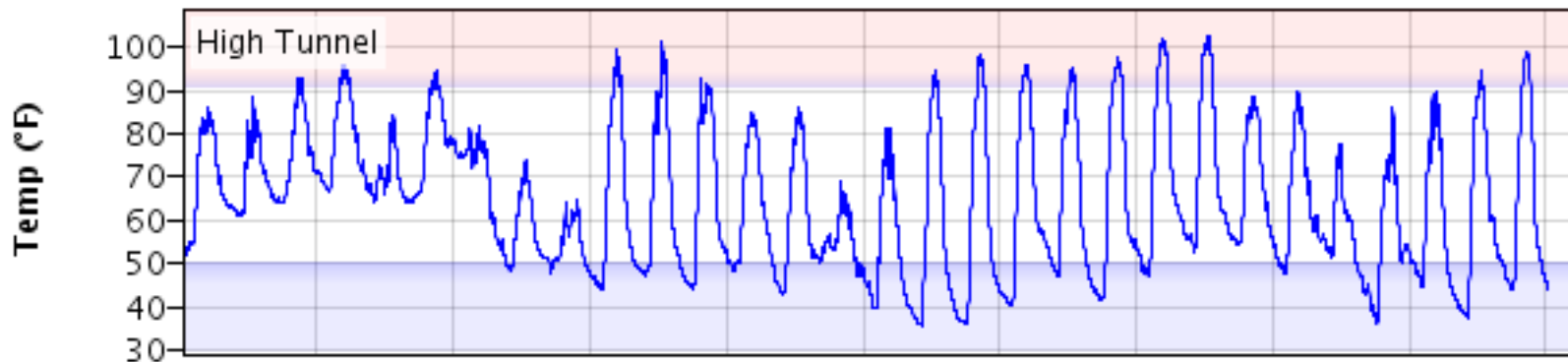
High Tunnels

- AKA Hoop House or Cold Frame
- 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
- 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



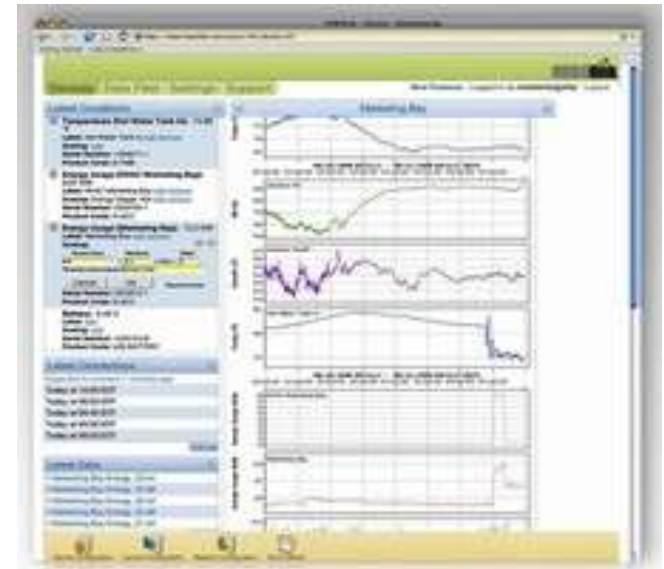
Research Methods

- 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



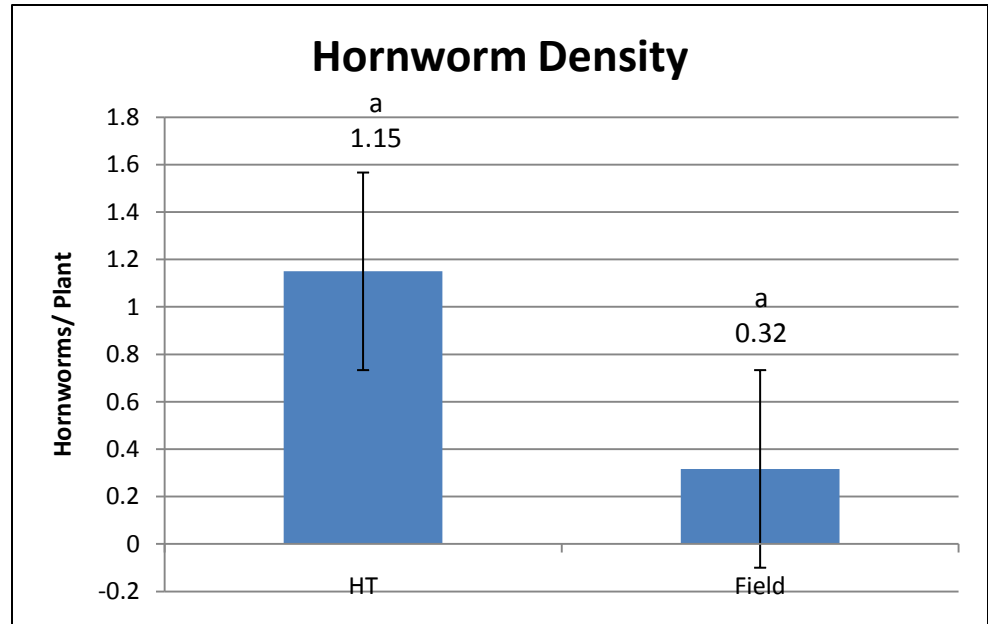
- Whole Plant Counts
- Sticky Traps



Results- Tomatoes

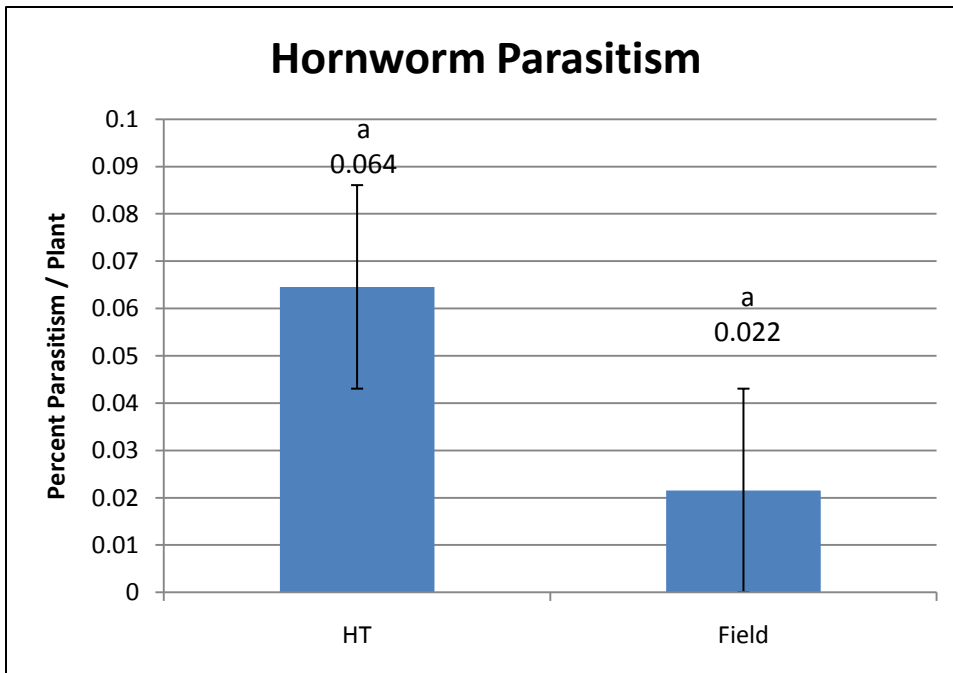


Measurement	p-value
Hornworm Density	0.25



Results- Tomatoes

Measurement	p-value
Percent Parasitism / Plant	0.18

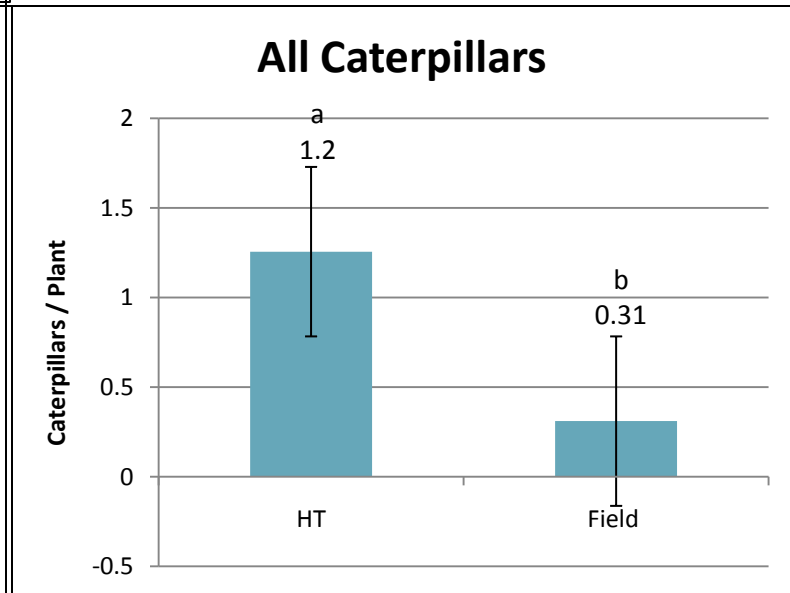
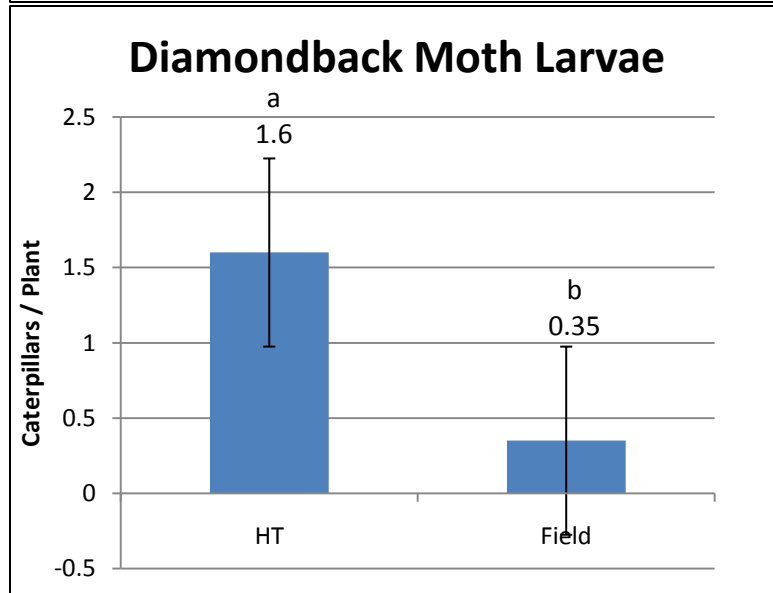
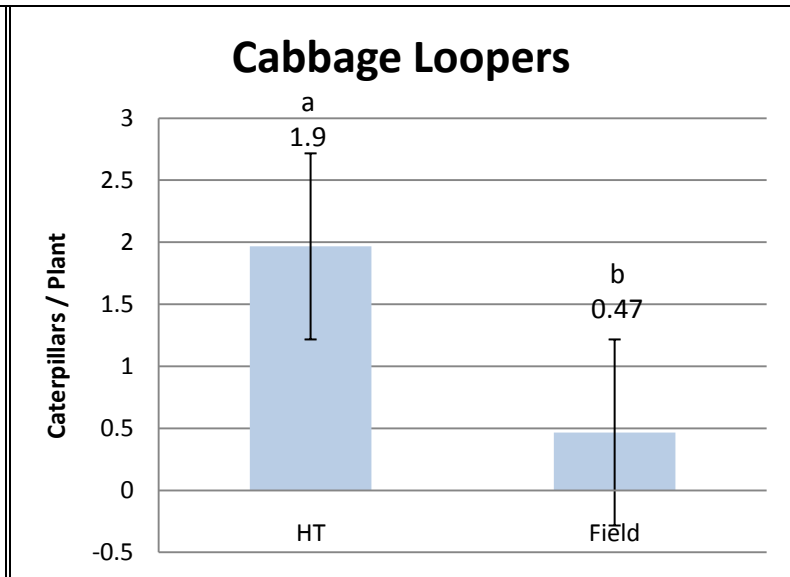
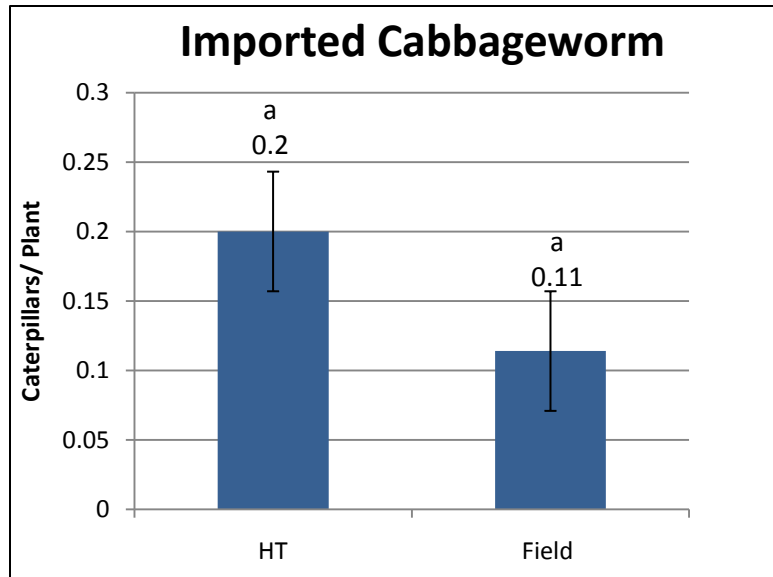


Results- Broccoli



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

