Managing Common Insect Pests in Organic Squash and Pumpkin

Wisconsin Fresh Fruit and Vegetable Conference
January 26, 2016
Wisconsin Dells, WI

Russell L. Groves
groves@entomology.wisc.edu

Department of Entomology
University of Wisconsin
### Process of an IPM program

<table>
<thead>
<tr>
<th>Component</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>monitoring and sampling</td>
<td>inspect crop</td>
</tr>
<tr>
<td>pest identification</td>
<td>what pest(s)?</td>
</tr>
<tr>
<td>decision-making</td>
<td>what action(s)?</td>
</tr>
<tr>
<td>Intervention</td>
<td>take action(s)</td>
</tr>
<tr>
<td>follow-up</td>
<td>re-inspect crop</td>
</tr>
<tr>
<td>record-keeping</td>
<td>write it down</td>
</tr>
<tr>
<td>education</td>
<td>review and learn</td>
</tr>
</tbody>
</table>

- For all farm sizes and *any* management approach (e.g. conventional, agro-ecological, or organic)
Organic pest management tactics for squash & pumpkin

Use all available tools to manage pest damage in the most economic, socially, and environmentally sound way

- Host plant resistance
- Transgenic plants
- Reduced-Risk Insecticides
- Entomopathogens
- Population disruption
- Baits and baiting systems
- Natural enemies
- Cultural controls
- Squash IPM

Use all available tools to manage pest damage in the most economic, socially, and environmentally sound way.
Insect pests of cucurbits

- **April**: Seed maggots
- **May**: Pollination
- **June**: Squash crop, Squash bugs, Cucumber beetles
- **July**: Squash vine borer, Thrips, Leaf miners
- **August**: Leaf miners
- **September**: Leaf miners

The diagram illustrates the seasonal presence of various pests affecting cucurbits from April to September, highlighting the critical period of pollination and squash crop development.
Key insect pests of cucurbits

- **Squash bug**  
  *(Anasa tristis)*

- **Squash vine borer**  
  *(Melittia cucurbitae)*

- **Seed maggots**  
  *(Delia spp.)*

- **Striped cucumber beetle**  
  *(Acalymma vittatum)*
Seed maggots: lifecycle and damage

Occurrence

- Overwinter in soil as pupa
- Adults emerge in early spring
- 4-5 generations per year. 2\textsuperscript{nd} adult peak in May or June most serious

Damage

- Tunnel germinating seeds
- Severely distort seedlings
- Cool weather delays plant emergence increases severity
Seedcorn maggot activity in Wisconsin

Number of females/trap/3 days

Date

4/17  5/1  5/15  5/29  6/12  6/26  7/10  7/24  8/7
Seedcorn maggot activity in Wisconsin

High risk of damage in early plantings

Low risk of damage in late plantings after ~ June 21
Seed maggots: non-chemical management

**Cultural**
- Prevent egg laying and accelerate germination with row cover
- Speed up germination: mulch and warm soil
- Avoid green manure
- Transplants
- Plant during ‘fly-free periods’

**Biological**
- Predacious soil beetles
- Fungal epidemics
Seed corn maggot: DD$_{39}$ Calculations

http://agwx.soils.wisc.edu/uwex_agwx/thermal_models/degree_days

<table>
<thead>
<tr>
<th>Pest</th>
<th>Method</th>
<th>Base Temp</th>
<th>Upper Temp</th>
<th>Biofix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple Scab</td>
<td>Simple</td>
<td>32F</td>
<td>None</td>
<td>Bud break</td>
</tr>
<tr>
<td>Alfalfa Weevil (DD Map)</td>
<td>Sine</td>
<td>48F</td>
<td>86F</td>
<td>January 1</td>
</tr>
<tr>
<td>Black Cutworm</td>
<td>Sine</td>
<td>50.7F</td>
<td>86.0F</td>
<td></td>
</tr>
<tr>
<td>Cabbage Maggot</td>
<td>Simple</td>
<td>43F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Colorado Potato Beetle</td>
<td>Simple</td>
<td>52F</td>
<td>None</td>
<td>When eggs are first scouted</td>
</tr>
<tr>
<td>Common Asparagus Beetle</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Corn plant development (DD Map)</td>
<td>Modified</td>
<td>50F</td>
<td>86F</td>
<td>Emergence</td>
</tr>
<tr>
<td>Corn Rootworm Adults</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Cranberry plant development DD Map</td>
<td>Modified</td>
<td>45F</td>
<td>86F</td>
<td>Ice off</td>
</tr>
<tr>
<td>European Corn Borer (DD Map)</td>
<td>Modified</td>
<td>50F</td>
<td>86F</td>
<td>January 1</td>
</tr>
<tr>
<td>Seedcorn Maggot (DD Map)</td>
<td>Sine</td>
<td>39F</td>
<td>84F</td>
<td>January 1</td>
</tr>
<tr>
<td>Flea beetles (Beet, Cole crops, Potato)</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Imported Cabbage weevil</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Onion Maggot</td>
<td>Simple</td>
<td>40F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Squash Vine Borer</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>January 1</td>
</tr>
<tr>
<td>Stalk Borer (DD Map) (Sweet Corn, Field Corn, Potato, Snap Bean)</td>
<td>Sine</td>
<td>41F</td>
<td>86F</td>
<td>January 1</td>
</tr>
<tr>
<td>Tree and shrub pests (DD Map)</td>
<td>Modified</td>
<td>50F</td>
<td>86F</td>
<td>January 1</td>
</tr>
<tr>
<td>Western Bean Cutworm (More information)</td>
<td>Simple</td>
<td>50F</td>
<td>None</td>
<td>May 1</td>
</tr>
</tbody>
</table>

Note: These parameters are usually specific for a particular crop and pest. Make sure you are using the right ones for your particular situation. Some values for common pests in our area are listed below.
OMRI-approved insecticides registered in Wisconsin

Seed treatments

Commercially applied to most varieties

  Spinosad – Regard™ OI 100 (registration 2017-18 ),
  (pending OMRI approval)

Broadcast applications

Applied as banded applications to seed
furrows or transplant row or as a soil drench

  Azadirachtin – Aza-Direct® (1-2pts/acre)
Striped cucumber beetle

(Acalymma vittatum)
Cucumber beetle damage

Defoliation

Pollination interference

Feeding scars

Rindworms
Striped cucumber beetle – Lifecycle

- Overwinters as an adult in protected non-crop areas
- Colonizes fields in early spring
- Adults feed on plants and mate
- Lays eggs at base of host plant
- Two generations per year
Cucumber beetle – Bacterial wilt

- Most damage is from bacterial wilt, *Erwinia tracheiphila*
- Closely associated with the beetle, vectored via posterior-station
- No cure for bacteria, control through vector
- Susceptibility:
  - Melons (not watermelon) > Cucumbers > butternut and hubbard squash
Cucumber beetle – management

Cultural

• Later planting (second week of June)
• Transplants
• Early border trap crops
  (transplant Blue Hubbard)
Cucumber beetle – management

Cultural

- Eliminate weeds, weedy edges (non-crop sanitation)
- Crop rotation
- Early season row cover
...cultural control trade-offs

**Cultural control drawbacks**

Non-crop sanitation may eliminate alternate floral resources – impacts on pollinators?

• Row cover is only effective until plants begin to bloom – pollinator access
Cucumber beetle – Sampling and thresholds (foliar)

**Sampling**
- Yellow sticky cards
- Plant counts
- Colonization times critical

**Action thresholds**
- 1 beetle/plant for melons, cucumbers, and young pumpkins
- 5 beetles/plant for watermelon, squash, and older pumpkins

**Caution with pollinators**
Cucumber beetle – insecticides

Types of insecticide delivery tactics

• Broadcast foliar applications:
• Pyrethrum applications:
  - Pyganic 1.4 or 5.0EC
  - acidic pH (<6.0)
  - apply in low light
  - re-application warranted

• Foliar sprays (thresholds) – “caution with pollinators”!!
Squash bug, *Anasa tristis*

**Occurrence**
- Adults are large brownish/black
- Bugs aggregate in high numbers
- Adults prefer larger, more mature plants
- Round eggs laid in neat rows
- Nymphs are white/grey (5 instars)
- One generation per year
Squash bug - Damage

- Phytotoxic saliva causes wilting
- Cucurbit yellow vine decline
  - Now identified in MA & VA
  - Bacterium overwinters in adult bugs
  - Hubbard and winter affected
  - Brown phloem ring
Squash bug – management thresholds

Seedling stage
• Treat if wilting and squash bugs are observed

Flowering stage
• Treat if >1 egg mass is found per plant

Control
• Often difficult to kill
• Pyrethrum-based products
• Foliar pyrethrum
• Destroy crop residue
• Non-crop sanitation

![Wilting on pumpkin](image1)

![Squash bug egg mass](image2)
Squash bug – overwintering habitats

- Clean cultivation
- Crop rotation common
- Less overwintering habitat

Damage

- Crop debris and old fruit harbor adults into autumn
- Many sheltered areas
- Small scale annual production builds populations
Squash vine borer, *Melittia cucurbitae*

### Occurrence

- Day-flying clearwing moth
- Adults have rusty brown abdomens
- Wingspan ~ 1-1.5 inches
- Females can lay 150-200 eggs
- Larvae $\frac{3}{4}$ - 1 inch in length
- Appear around 1,000 growing degree days
- One generation per year
Squash vine borer - management

Damage
• Single eggs laid at plant base
• Frass and entry hole very apparent
• Advanced damage may look like bacterial wilt
Squash vine borer - management

Monitoring

- Scout crop around 1,000 DD$_{50}$ threshold
- Water pans for adults in crop
- Pheromone lures available through Great Lakes IPM

Control

- Rarely an issue in commercial production. Serious garden pest
- Insecticides often difficult to time & apply properly
- *Bacillus thuringiensis* subsp. *kurstaki*
- pyrethrin + azadiractin
Season long management plans

- Early season control with seed treatment or cultural methods
- Timing of foliars dependent on flowering stage of the crop
- Scouting for pests will save money and reduce extra sprays
- Read labels and active ingredients

How does pest management fit into the broader sustainability picture?
Balancing trade-offs, improving sustainability

Pest control and pollination services

• Insecticides remain a cornerstone of cucurbit production

• Exposure of several pollinator guilds to agro-chemicals are thought to reduce beneficial insect health

Growers can adjust management to reduce exposure

• Avoid applying to crops in bloom or blooming
• Apply late in the day/evening
• Choose short residual products
• Insecticide formulations are not equal: $EC > WP, WSP, D$
Questions?