Best Management Practices for Cucurbit Insect Pests

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West Madison Research Station
Organic Field Day

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## Wisconsin Vegetable Production Statistics
(Wis. Ag. Stats. 2008)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Nat. Rank</th>
<th>Acres</th>
<th>% of U.S.</th>
<th>$ Value (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major crops</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>3</td>
<td>64,500</td>
<td>6</td>
<td>$242</td>
</tr>
<tr>
<td>Sweet corn (Proc)</td>
<td>1</td>
<td>88,900</td>
<td>21</td>
<td>$81</td>
</tr>
<tr>
<td>Sweet corn (Fresh)</td>
<td>--</td>
<td>7,700</td>
<td>--</td>
<td>$14</td>
</tr>
<tr>
<td>Snap beans</td>
<td>1</td>
<td>82,300</td>
<td>38</td>
<td>$62</td>
</tr>
<tr>
<td>Peas</td>
<td>3</td>
<td>40,200</td>
<td>21</td>
<td>$20</td>
</tr>
<tr>
<td><strong>Minor crops</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumbers (pickles)</td>
<td>4</td>
<td>7,100</td>
<td>8</td>
<td>$9</td>
</tr>
<tr>
<td>Cabbage (fresh)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage (kraut)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onions (storage)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beets (table)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Small-acreage fresh market production continues to expand. Anecdotal statistics estimate ca. 1,900 small-acreage producers that grow over 50 crops in Wisconsin.
Wisconsin Vegetable Pest Management

Options for Insect Pest Management – *More than ever before!*

- Cultural controls*
- Natural enemies
- Baits and baiting systems
- Host plant resistance
- Population disruption
- Transgenic plants IR traits
- Reduced-Risk Chemical Insecticides*
- Entomopathogens

Vegetable IPM
Research Objectives

- To determine combinations of best management practices to mitigate losses associated with key insect pests of cucurbits including seed corn maggot and cucumber beetles.

- To evaluate the efficacy of novel insecticides, applied as seed and in-furrow treatments, compared with cultural management practices.
## Calendar of Insect Pests

<table>
<thead>
<tr>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aphids</td>
<td></td>
<td>Cucumber Beetles</td>
<td>Squash Bug</td>
<td>Pickleworm</td>
<td>Squash Vine Borer</td>
<td>Whiteflies</td>
</tr>
<tr>
<td>Leafminers</td>
<td></td>
<td>Seed maggots</td>
<td>Thrips</td>
<td>Aphids</td>
<td>Mites</td>
<td>Thrips</td>
</tr>
<tr>
<td>Flea beetles</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Flea beetles</td>
</tr>
</tbody>
</table>

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**Leafminers**
## Calendar of Insect Pests

<table>
<thead>
<tr>
<th>April</th>
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<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Squash Bug</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cucumber Beetles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Squash Vine Borer</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mites</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Seed maggots</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **April:** Squash Bug, Cucumber Beetles, Seed maggots
- **May:** Squash Bug, Cucumber Beetles
- **June:** Squash Bug, Cucumber Beetles, Squash Vine Borer, Mites
- **July:** Squash Bug, Cucumber Beetles, Squash Vine Borer, Mites
- **August:** Squash Bug, Cucumber Beetles, Squash Vine Borer, Mites
- **September:** Squash Bug, Cucumber Beetles, Squash Vine Borer, Mites
- **October:** Squash Bug, Cucumber Beetles, Squash Vine Borer, Mites
Seed corn maggot, *Delia platura*

**Adult**
- Small grey/black fly
- Similar to housefly

**Eggs**
- Small, white
- Laid in soil at base of plants

**Larvae**
- White, legless maggots
- 4 instars; up to 1/4”
- 3-4 weeks per generation
- 3-5 generations per year

**Pupa**
- Brown, oval shaped
- In soil
# Seed corn maggot, Host range

- Wide host range
- Can develop on organic matter

## Crop Susceptibility

<table>
<thead>
<tr>
<th>High</th>
<th>Moderate</th>
<th>Low</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucurbits (squash, cucumber, melon)</td>
<td>Peas</td>
<td>Corn</td>
</tr>
<tr>
<td>Beans (lima, snap)</td>
<td>Beans (soy, kidney)</td>
<td></td>
</tr>
<tr>
<td>Brassica roots (radish)</td>
<td>Brassica (broccoli, cauliflower)</td>
<td></td>
</tr>
</tbody>
</table>
Seed corn maggot: Seedling damage

**Occurrence**

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

**Damage**

- Larvae hatch and tunnel germinating seeds
- Larvae feed in seed and developing plant and prevent emergence or severely distort plant.
- Cool weather, which delays plant emergence increases severity of damage
Seed corn maggot: Management

Cultural
- Prevent egg laying with row cover
- Speed up germination:
  - pre-sprout, mulch, warm soil
- Avoid green manure

Biological
- Predacious soil beetles
- Fungal epidemics

Chemical
- In-furrow, insecticides (neonicotinoids*, bifenthrin)
- Commercial seed treatments (Lorsban 50W)

*Not registered for target
Striped cucumber beetle

*(Acalymma vittatum)*
Striped and Spotted Cucumber Beetles

**Lifecycle**

- Adult beetles ca. 1 cm length and 3-4 mm wide
- Striped cucumber beetles overwinter in protected areas as adults and become active in mid-spring (late Apr).
- Appear early, lay eggs at the base of cucurbits, and have 2 generations / year
- Striped is most severe – because it overwinters here!!
Cucumber Beetles: Damage

- Defoliation
- Pollination Interference
- Feeding Scars
- Rindworms
Cucumber Beetles – Bacterial Wilt

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

Avoidance of bacterial wilt is accomplished through effective cucumber beetle control.
Cucumber beetles: Management

Cultural
- Later planting
- Eliminate weeds, weedy edges
- sanitation - pollinators
- Row cover early
- Crop rotation
- Transplants
- Trap crops on plastic mulches

Biological
- None effective

Chemical
- Avoid flowering to protect bees (late afternoon sprays)
- At-plant systemic (nicotinyls), foliar insecticides (pyrethroids, carbaryl), and new technologies (seed trt’s)
Systemic Neonicotinyl Insecticides

Beneficial Attributes

- Broad spectrum
  - Cucumber beetles, squash bugs, aphids
- Flexible
  - Furrow, drench, foliar
- Long residual
  - Rate dependant
  - Excessive rain may impact
- Low toxicity
  - Soil applied

Disadvantages

- Same chemical class (Group 4 MoA)
- Pollinator impact as foliar applications
Cucumber Beetle & Seed Maggot Seed Treatment and In-Furrow Trials, 2009

**Cultural**

- Row cover early
- Transplants
- Trap crops on plastic mulches

**Locations / Crops**

- Sparta, WI – pumpkin
- Cashton, WI – cucumber
- Westby, WI – cantaloupe
- Tomah, WI – watermelon

**Chemical**

- At-plant, in-furrow systemic (neonicotinoids)
- Seed treatments (new technologies)
# Cucumber Beetle & Seed Maggot Seed Treatment and In-Furrow Trials, 2009

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Insecticide</th>
<th>Rate</th>
<th>Application Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Untreated control</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>2</td>
<td>Lorsban 50W</td>
<td>2.0 oz / cwt</td>
<td>Seed</td>
</tr>
<tr>
<td>3</td>
<td>clothianadin + imidacloprid</td>
<td>1 mg + 0.33 mg a.i. / seed</td>
<td>Seed</td>
</tr>
<tr>
<td>4</td>
<td>(Supresto**)</td>
<td>0.75 + 0.25 mg a.i. / seed</td>
<td>Seed</td>
</tr>
<tr>
<td>5</td>
<td>imidacloprid (AdmirePro®)</td>
<td>10.5 fl oz / acre</td>
<td>In-furrow</td>
</tr>
<tr>
<td>6</td>
<td>thiamethoxam (Cruiser®)</td>
<td>0.75 mg a.i. / seed</td>
<td>Seed</td>
</tr>
<tr>
<td>7</td>
<td>(Platinum®)</td>
<td>11.0 fl oz / acre</td>
<td>In-furrow</td>
</tr>
<tr>
<td>8</td>
<td>row cover + thiamethoxam</td>
<td>0.75 mg a.i. / seed</td>
<td>Seed</td>
</tr>
<tr>
<td>9</td>
<td>row cover</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

**Note: not currently registered**
Percent Pumpkin Seedlings Damaged by Seedcorn Maggot  
Sparta, WI  2009

Mean % damaged seedlings

Untreated  Lorsban 50W  Supresto (1.33 mg)  Supresto (1.0 mg)  Cruiser (0.75mg)  Admire Pro  Platinum  Row Cover (Cruiser)  Row Cover

P = 0.0267, N=4

Seed treatments

In-furrow treatments

P = 0.0267, N=4

Treatments
Percent Cucumber Seedlings Damaged by Seedcorn Maggot  Cashton, WI  2009

Mean % damaged seedlings

- Untreated
- Lorsban 50W
- Supresto (1.33 mg)
- Supresto (1.0 mg)
- Cruiser (0.75 mg)
- Admire Pro
- Platinum
- Row Cover (Cruiser)
- Row Cover

Treatments

Seed treatments
In-furrow treatments

P = 0.0597, N=4

Note: Treatments marked with the same letter (a, b) are not significantly different.
Adult Cucumber Beetles per Pumpkin Plant
Sparta, WI  2009

Mean adult cucumber beetle / plant

Treatments

- Row Cover
- Row Cover (Cruiser)
- Platinum
- Admire Pro
- Cruiser (0.75mg)
- Supresto (1.0 mg)
- Supresto (1.33 mg)
- Lorsban 50W
- Untreated

In-furrow treatments
Seed treatments

P < 0.0001, N=4

July 2-29, 2009
Percent Bacterial Wilt / Pumpkin Plot
Sparta, WI  2009

Treatments

- Row Cover
- Row Cover (Cruiser)
- Platinum
- Admire Pro
- Cruiser (0.75mg)
- Supresto (1.0 mg)
- Supresto (1.33 mg)
- Lorsban 50W
- Untreated

In-furrow treatments
Seed treatments

P = 0.0084, N=4
Aug 29, 2009

Mean percent bacterial wilt / plot
Adult Cucumber Beetles per Cucumber Plant
Cashton, WI  2009

Treatments

- Row Cover
- Row Cover (Cruiser)
- Platinum
- Admire Pro
- Cruiser (0.75mg)
- Supresto (1.0 mg)
- Supresto (1.33 mg)
- Lorsban 50W
- Untreated

Mean adult cucumber beetle / plant

In-furrow treatments
Seed treatments

P < 0.0001, N=4

July 2-29, 2009
Percent Bacterial Wilt / Cucumber Plot
Cashton, WI 2009

- Treatments:
  - Row Cover
  - Row Cover (Cruiser)
  - Platinum
  - Admire Pro
  - Cruiser (0.75mg)
  - Supreto (1.0 mg)
  - Supreto (1.33 mg)
  - Lorsban 50W
  - Untreated

- In-furrow treatments:
  - Seed treatments:

- Mean percent bacterial wilt / plot:
  - P = 0.0109, N=4

- Aug 29, 2009

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Cucumber Beetle & Seed Maggot 2009 Summary

- Neonicotinoid seed treatment and in-furrow uses have activity against seedcorn maggot and cucumber beetles.

- Lorsban 50W seed treatments effectively controlled seedcorn maggot, but provided no control of cucumber beetles or bacterial wilt.

- Neonicotinoid in-furrow uses consistently reduced cucumber beetle populations and lowered final incidence of bacterial wilt in all crops.

- Similar patterns in cucumber seed corn maggot and cucumber beetle control were observed row cover treatments and trap cropping.
Insects Impact Cucurbit Production

Pollinators...

European honey bee

...and Devastators

Striped cucumber beetle
Factors Harming Honey Bee Populations

- **Insecticides:**
  - Do not apply to crops in bloom
  - Application timing: apply in the late afternoon or early evening
  - Choose short residual products
  - Adjust spray to weather conditions
    ** low temps extend residual
    ** protract foraging times
  - Application formulation (s):
    EC > WP, WSP, D
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Chris Hershberger, Westby, WI
Joe Kauffman, Cashton, WI
Mike and David Warzynski, Almond, WI

QUESTIONS