Systemic seed treatments & soil insecticides for pumpkin insect management

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Ohio State University
January 2007
Cucumber beetles

Important damage:
• Chew seedlings
• Transmit bacterial wilt
• Chew on fruit surface

Less critical damage:
• Chew on flowers
• Larvae chew on roots
Bacterial wilt of cucurbits

- Vectored by cucumber beetles
  - Transmitted in feces
  - Enters via wound in plant
- Hosts:
  - Well-known killer of cukes & melons
  - Recently adapted to kill squash & pumpkins, but slower to kill
- Cotyledon stage most susceptible
Soil-applied systemic insecticides for cucurbit crops

• Furadan since mid-1980’s
• New group: the neonicotinoids
  – Admire in 2000
  – Platinum in 2001
Neonicotinoid insecticides

First a.i.: imidacloprid

• **Soil applied:** Admire
  – First: 1995 for potato
  – Cucurbits added in 2000

• **Foliar sprays:** Provado
  – First: 1995 for potato
  – Not for cucurbits

• **Commercial seed treatment**
  – **Gaucho**, 2001 (corn, snap bean)
  – Not for cucurbits

• **Hopper-box seed treatment**
  – **Latitude** & **Concur**, 2003 (corn)
  – Not for cucurbits
## Neonicotinoid products on veg/fruit

<table>
<thead>
<tr>
<th>A.I.</th>
<th>Soil</th>
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<tr>
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<td>-</td>
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### Neonicotinoid products on cucurbitis

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Admire applied in-furrow provides excellent control of striped cucumber beetle on pumpkin seedlings
Admire 2F on cucurbits

• Label rate = 16 - 24 fl. oz. per acre ($74 - 110/A)

• **row spacing** | **Rate (fl. oz.) /1000 ft.**
  | 8 ft | 6 ft | 4 ft | 3 ft |
  8 ft | 2.9 - 4.4 | 2.2 - 3.3 | 1.5 - 2.2 | 1.1 - 1.7
Pumpkin Trial, 2002

**Early seeded (23 May):** Significant difference in beetle damage & beetle density at 1-3 leaf stages

**Late seeded (11 June):** No significant differences

<table>
<thead>
<tr>
<th>Date, stage</th>
<th>Trtmt</th>
<th>Damage (scale 1-4)</th>
<th>Number beetles/ plant</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Live</td>
<td>Dead</td>
</tr>
<tr>
<td>6/5 1-leaf</td>
<td>check</td>
<td>3.7 A</td>
<td>3.0 A</td>
</tr>
<tr>
<td></td>
<td>Admire at-plant</td>
<td>2.1 B</td>
<td>0.3 B</td>
</tr>
<tr>
<td>6/13 3-leaf</td>
<td>check</td>
<td>4.0 A</td>
<td>0.55 A</td>
</tr>
<tr>
<td></td>
<td>Admire at-plant</td>
<td>2.2 B</td>
<td>0.23 A</td>
</tr>
</tbody>
</table>
Use of at-plant soil systemic insecticide on pumpkin

• **Recommended:**
  – If plant early
  – If yours is only cucurbit field in area

• **Not recommended:**
  – If plant late
  – If field later than other cucurbits
## Neonicotinoid products on veg/fruit

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Cruiser rates tested  
(a.i. = thiamethoxam)

<table>
<thead>
<tr>
<th>mg a.i. per seed</th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>0.25</td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>0.40</td>
<td>√</td>
<td>√</td>
</tr>
<tr>
<td>0.75</td>
<td></td>
<td>√</td>
</tr>
</tbody>
</table>
Trials 2005 & 2006

- **Field**
  - Pumpkin
  - Pickle
  - Zucchini (2005 only)

- **Lab**
  - Germination
  - Beetle bioassays
Seeds 2005

‘Vlaspi’ & ‘Eureka’ pickling cucumber

‘Hybrid Pam’ pumpkin

‘Spineless Beauty’ zucchini
Pumpkin, two-leaf stage, Columbus, 6/8/05
Pumpkin, two-leaf stage, Columbus, 6/8/05
Pumpkin, two-leaf stage, Columbus, 6/8/05
Zucchini, two-leaf stage, Columbus, 6/8/05
Pumpkin, 1- to 2-leaf stage, Clark County, 6/20/05
Pickles, one-leaf stage, Fremont, 6/14/05
Pumpkin, four-leaf stage, Columbus, 6/14/05 (22 days after seeding)
Lab Bioassay

- Greenhouse plug plants
- Small cage (2 qt deli dishes)
- 1 rep = 1 plant & 3 - 5 beetles
- 5 - 8 replicates per treatment
- Damage & mortality evaluated after 48 hours
Bioassay

- Damage rating: scale 0 to 3

1 = light  
2 = moderate  
3 = heavy
Bioassays on pickles: striped cucumber beetle

$P = 0.0001$
Bioassays on pickles: striped cucumber beetle

- **No Fungicide**
- **No Cruiser**
- **Cruiser Low**
- **Cruiser Medium**
- **Cruiser High**

**Damage rating (scale 0 to 3)**

- **P = 0.008**

**% Mortality**

- **P = 0.0001**

- **A**
- **AB**
- **B**
Bioassays: striped vs spotted cucumber beetle

P = 0.008

P = 0.0001

P = 0.008

P = 0.04
Conclusions, 2005

• Cruiser seed treatment looks promising; as good as Admire for cotyledon to 2-leaf stage pumpkin

• Concern that control not lasting past 2-leaf stage at rates tested

• Rate higher than 0.4 mg AI/seed should be tested
Seeds 2006

‘Gold Bullion’ pumpkin

‘Vlaspik’ pickling cucumber
Seed insecticides tested in 2006

<table>
<thead>
<tr>
<th>A.I.</th>
<th>Mfr.</th>
<th>mg a.i. per seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>thiamethoxam (Cruiser)</td>
<td>Syngenta</td>
<td>0.40, 0.75</td>
</tr>
<tr>
<td>L-1497-A</td>
<td>Bayer</td>
<td>0.565, 0.75, 1.13</td>
</tr>
<tr>
<td>fipronil (Regent)</td>
<td>BASF</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Note, tests coordinated & supported by IR-4
Pumpkin trial at Columbus

• Direct seeded 5/23/2006

• Treatments:
  – 2 in-furrow insecticide treatments: Admire & Platinum
  – 5 seed insecticide treatments
  – No-insecticide control

• All treatments with Thiram on seed

• Spacing 1’ in-row, 7.5’ between rows

• Thinned to 3’ in-row at vine-tip
Pumpkin trial at Columbus

• Split emergence, before & after hot dry spell in late May
  – **Early** emerging plants: low beetle pressure
  – **Late** emerging plants: moderate beetle pressure

• Damage evaluated at cotyledon & 2-leaf stage

• Yield measured in September
Field Trial 2006: Pumpkin ‘Gold Bullion’, late-emerging plants, 2-leaf stage, 6/19/06
Field Trial 2006: Pumpkin ‘Gold Bullion’, late-emerging plants, 2-leaf stage, 6/19/06
Field Trial 2006: Pumpkin ‘Gold Bullion’, early-emerging plants, 2-leaf stage, 6/12/06
Field Trial 2006: Pumpkin ‘Gold Bullion’, early-emerging plants, 2-leaf stage, 6/12/06

<table>
<thead>
<tr>
<th>Insecticide Type</th>
<th>Damage Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdmirePro in-furrow</td>
<td>D</td>
</tr>
<tr>
<td>Platinum in-furrow</td>
<td>ABCD</td>
</tr>
<tr>
<td>Cruiser 0.75 mg/seed</td>
<td>CD</td>
</tr>
<tr>
<td>L-1497A 1.13 mg/seed</td>
<td>ABCD</td>
</tr>
<tr>
<td>Cruiser 0.4 mg/seed</td>
<td>BCD</td>
</tr>
<tr>
<td>L-1497A 0.75 mg/seed</td>
<td>A</td>
</tr>
<tr>
<td>Regent 0.75 mg/seed</td>
<td>AB</td>
</tr>
<tr>
<td>no insecticide</td>
<td>ABC</td>
</tr>
</tbody>
</table>

Number of beetles per plant

- Live
- Dead

Damage rating: 0 to 0.8

Number of beetles per plant: 0.2 to 0.8

Significance: P = 0.04
Conclusions, Pumpkins

• Damage least in Admire (in-furrow) plots
• Cruiser at high rate similar to Admire
• L-1497-A better at high than low rate
• Regent not effective
Pickle trial
Pickle trial at Fremont

- **Direct seeded 6/6/2006 (2nd try)**
  - 2 in-furrow insecticide treatments: Platinum & Furadan
  - 6 seed insecticide treatments
  - Untreated control
- **Spacing** 4” in-row, 30” between rows
- **Beetles & damage** evaluated 6/15 & 6/24
- **Bacterial wilt** evaluated 7/18 after blocking
Field Trial 2006: Pickling Cucumber ‘Vlaspike’

![Graph showing % of plants damaged with different treatments and significant differences indicated by letters C, BC, AB, and A.]

Significance level: $P = 0.0005$
Field Trial 2006: Pickling Cucumber ‘Vlaspik’

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% of Plants Damaged</th>
<th>Number of Beetles per Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cruiser 0.75 mg/seed</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>L-1497A 0.565 mg/seed</td>
<td>C</td>
<td></td>
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<td>Furadan in-furrow</td>
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<tr>
<td>Platinum in-furrow</td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>Regent 0.75 mg/seed</td>
<td>A</td>
<td></td>
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<tr>
<td>No insecticide</td>
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P = 0.0005

P = 0.03
Field Trial 2006: Pickling Cucumber ‘Vlaspiik’

![Graph showing the effect of different insecticides on the percentage of plants with symptoms of Bacterial Wilt. The graph compares Cruiser 0.75 mg/seed, L-1497A 0.565 mg/seed, L-1497A 0.75 mg/seed, L-1497A 1.13 mg/seed, Cruiser 0.4 mg/seed, Furadan in-furrow, Platinum in-furrow, Regent 0.75 mg/seed, and No insecticide. The x-axis represents the percentage of plants with symptoms of Bacterial Wilt, and the y-axis lists the different treatments. The treatments are ranked based on their effectiveness, with 'A' being the most effective and 'C' being the least effective. P = 0.042 indicates the statistical significance of the results.]
Conclusions, Pickles

• Damage from beetle feeding:
  – Least in Cruiser high & L-1497-A plots
  – Not much rate effect for L-1497-A
  – Similar to untreated check in Platinum & Regent plots

• Bacterial wilt
  – Least in L-1497-A high plots
  – Most in Platinum plots
Germination Tests

![Germination Test Diagram]

- **Pumpkin**
  - **L-1497-A 1.13 mg**
  - **Untreated**
  - **Cruiser 0.75 mg**
  - **Fungicide only**
  - **Regent 0.75 mg**
  - **L-1497-A 0.75 mg**
  - **Cruiser 0.4 mg**

- **Soil 14-day**
- **Paper 7-day**

- **P = 0.011**
- **P < 0.0001**

% Germination
Germination Tests

![Germination Test Graph]

- L-1497-A 0.565 mg
- L-1497-A 1.13 mg
- untreated
- L-1497-A 0.75 mg
- Regent 0.75 mg
- Cruiser 0.75 mg
- Fungicide only
- Cruiser 0.4 mg

**Legend:**
- **Soil 14-day**
- **Paper 7-day**

**Significance Levels:**
- $P = 0.10$
- $P = 0.026$
Bioassays 2006: Striped Cucumber Beetle on Pumpkin ‘Gold Bullion’
Bioassays 2006: Striped Cucumber Beetle on Pickling Cucumber ‘Vlaspik’
Conclusions

• Insecticide seed treatment looks promising
  – As good as in-furrow, pumpkins
  – Better than in-furrow, pickles

• Products vary:
  – L-1497-A looks excellent; higher rate somewhat better than low rate
  – Cruiser at higher rate (0.75 mg/seed) better than lower rate (0.40 mg/seed)
  – Regent not as effective as others
Conclusions

• Advantages of seed treatment
  – Convenience; easier application
  – Much lower rate of A.I. per acre
    • Cruiser 0.75 mg/seed vs Platinum 8 fl oz/A:
      • ~25 times less (pumpkins at 3,000 seeds/A)
      • ~2 times less (pickles at 45,000 seeds/A)

• Concern that control not lasting past 2-leaf stage, but control during critical cotyledon to 2-leaf stage is good
Acknowledgements

• Collaborators Jim Jasinski, Mark Bennett, & Michele Giovannini
• Jack Norton at IR-4
• Alan Taylor at Cornell University
• Field establishment & maintenance by Matt Hofelich, Glenn Mills, Mark Schmittgen
• Technical assistance from Elaine Grassbaugh, Gretchen Sutton, Liz Ike
• Syngenta, Bayer, BASF, & FMC
• Seminis Seeds
• Funding from Ohio Vegetable & Small Fruit Research & Development Program