Efficacy & Cost Comparisons of Using Insecticide Seed Treatments on Cucurbits

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Ohio State University
December 2009
Cucumber beetles: key pests of cucumbers, pumpkins & squash

Feeding damage

Vectors of bacterial wilt disease
Trials on seed insecticides with Ohio cucurbita

<table>
<thead>
<tr>
<th>Crop</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickling cucumber</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Zucchin</td>
<td>✔</td>
<td></td>
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</tbody>
</table>
## Seed insecticide rates tested in Ohio cucurbits

<table>
<thead>
<tr>
<th>Product &amp; rate in mg AI/seed</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>thiamethoxam 0.05</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>thiamethoxam 0.25</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>thiamethoxam 0.40</td>
<td>✓</td>
<td>✓</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>thiamethoxam 0.50</td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>thiamethoxam 0.75</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>thiamethoxam 0.75 + A14024</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>thiamethoxam 0.75 + A9180, 9625</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>fipronil 0.75</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clothianidin + β-cyfluthrin 0.565</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clothianidin + β-cyfluthrin 0.75</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clothianidin + β-cyfluthrin 1.13</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clothianidin + imidacloprid 0.75</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>clothianidin + imidacloprid 1.0</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>clothianidin + imidacloprid 1.3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
## a.i.s tested on Ohio cucurbits

<table>
<thead>
<tr>
<th><strong>Common name</strong></th>
<th><strong>Trade name</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>thiamethoxam</td>
<td>Cruiser, FarMore DI 400</td>
</tr>
<tr>
<td>fipronil</td>
<td>Regent</td>
</tr>
<tr>
<td>L-1497-A (clothianidin + beta-cyfluthrin)</td>
<td>Poncho Beta (= Poncho + Baythroid XL)</td>
</tr>
<tr>
<td>L-1778-A (clothianidin + imidacloprid)</td>
<td>Sepresto (= Poncho + Gaucho)</td>
</tr>
</tbody>
</table>
Rates given per seed

pickling cucumber  pumpkin
thiamethoxam

• **Active ingredient in:**
  - Actara (foliar sprays)
  - Platinum (soil treatment)
  - Cruiser (seed treatment, corn & beans)
  - FarMore DI 400 (seed treatment, veg.)

• **Made by Syngenta**
‘FarMore Technology’

• A registered trademark for several commercial seed treatments
  ➢ Available from Rupp, Seminis, Harris-Moran, & selected seed companies

• Existing FarMore packages:
  ➢ FarMore D 200
  ➢ FarMore D 300
  ➢ FarMore DI 400
‘FarMore Technology’ packages

- **FarMore D 200**
  - 2 components: 2 fungicides

- **FarMore D 300**
  - 3 components: 3 fungicides
  - Heading Brassica, carrot, onion, tomato, pepper, spinach

- **FarMore DI 400**
  - 4 components: 3 fungicides + 1 insecticide
  - Cucurbitis, lettuce
FarMore DI 400

• Registered for cucurbits 2009

• Contains:
  ➢ 3 fungicides: Apron, Maxim, Dynasty
  ➢ 1 insecticide: thiamethoxam
Field trials

• How seed treatment compares with standard in-furrow treatment, for:
  ➢ Beetle feeding damage to plants
  ➢ Presence of live & dead beetles
  ➢ Incidence of bacterial wilt
  ➢ Yield
Cucumber beetle feeding damage: rated on scale 0 to 3

1 = light  
2 = moderate  
3 = heavy
Zucchini, 2-leaf stage
Columbus 6/8/2005

- Admire
- Cruiser 0.40
- Cruiser 0.25
- Cruiser 0.05
- No Cruiser

Damage rating (scale 0 to 3)

P = 0.0006

Pumpkin, 2-leaf stage
Columbus 6/8/2005

- B
- B
- B
- A

Damage rating (scale 0 to 3)

P = 0.03
Pickling cucumber, 4th true-leaf stage, 7/1/08, Fremont Ohio

Cruiser (seed)  C
Admire (in-furrow)  BC
Sepresto (seed)  ABC
untreated  AB
Platinum (in-furrow)  A

P = 0.0498
Pumpkins, 2\textsuperscript{nd} true-leaf stage, 6/16/08, Columbus Ohio

Admire (in-furrow)

Sepresto (seed)

Platinum (in-furrow)

Cruiser (seed)

untreated

\begin{itemize}
\item Admire (in-furrow): D
\item Sepresto (seed): CD
\item Platinum (in-furrow): BC
\item Cruiser (seed): B
\item Untreated: A
\end{itemize}

\(P < 0.0001\)
Pickles 2009, first true-leaf stage (22 June)

- seed FarMore+A9180: C
- seed FarMore+A14024: BC
- seed FarMore+A9625: BC
- seed FarMore DI-400: ABC
- in-furrow Admire: ABC
- in-furrow Brigadier: AB
- untreated: A

$P = 0.04$
Pumpkins 2009, Columbus Ohio second true-leaf stage

- in-furrow Admire
- seed FarMore+A9180
- seed FarMore DI-400
- seed FarMore+A14024
- seed FarMore+A9625
- untreated

$P = 0.0001$

Damage rating

0 0.2 0.4 0.6 0.8 1 1.2 1.4
Pumpkins 2009, Columbus Ohio first true-leaf stage (20 June)

- in-furrow Admire
- seed FarMore+A9180
- seed FarMore DI-400
- seed FarMore+A14024
- seed FarMore+A9625
- untreated

Number of live beetles per plant

$P = 0.007$
Pumpkins 2009, Clark County, Ohio first true-leaf stage

- seed FarMore+A9625
- in-furrow Admire
- seed FarMore DI-400
- seed FarMore+A9180
- seed FarMore+A14024
- untreated

$P = 0.14$
Pumpkins 2009, Clark County, Ohio fourth true-leaf stage (19 June)

- seed FarMore+A9625
- in-furrow Admire
- seed FarMore DI-400
- seed FarMore+A9180
- seed FarMore+A14024
- untreated

Number of dead beetles per plant

$P = 0.013$
How long does beetle control by insecticide seed treatment last?

- Control evaluated at several stages
  - In field trials
  - In lab bioassays
- Control usually good through 2nd leaf stage
- Control usually poor by 4th leaf stage
- Control most important at cotyledon stage, when plants most susceptible to bacterial wilt
Cost of FarMore DI 400

• Environmental: rate a.i./acre
• Economic: $/acre
## Rate of in-furrow treatment

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate for cucumbers in 30” rows</th>
<th></th>
<th>Rate for pumpkins in 7.5’ rows</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per 1000’</td>
<td>Per acre</td>
<td>Per 1000’</td>
<td>Per acre</td>
</tr>
<tr>
<td>Furadan 4F</td>
<td>2.4 fl oz</td>
<td>41.8 fl oz</td>
<td>2.4 fl oz</td>
<td>13.9 fl oz</td>
</tr>
<tr>
<td>Admire Pro (4.6F)</td>
<td>0.4 fl oz</td>
<td>7 fl oz</td>
<td>1.2 fl oz</td>
<td>7 fl oz</td>
</tr>
<tr>
<td>Platinum 2SC</td>
<td>0.6 fl oz</td>
<td>11 fl oz</td>
<td>1.9 fl oz</td>
<td>11 fl oz</td>
</tr>
</tbody>
</table>
## Compare a.i./acre thiamethoxam

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate</th>
<th>Rate of a.i. for pickles (58,000 seeds/A)</th>
<th>Rate of a.i. for pumpkins (3,000 seeds/A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-furrow Platinum 2SC</td>
<td>11 fl oz/A</td>
<td>0.172 lb a.i./A</td>
<td>0.172 lb a.i./A</td>
</tr>
<tr>
<td>Seed trtmt FarMore DI 400</td>
<td>0.75 mg a.i./seed</td>
<td>0.096 lb a.i./A</td>
<td>0.005 lb a.i./A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Difference</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.8 x</td>
<td>34 x</td>
</tr>
</tbody>
</table>
Cost of FarMore DI 400

• Pumpkins & squash
  ➢ + $2.30/1000 seeds

• Cucumbers
  ➢ + $0.50/1000 seeds
## PUMPKINS Large

<table>
<thead>
<tr>
<th>Variety</th>
<th>Days</th>
<th>Diameter</th>
<th>Weight</th>
<th>Skin</th>
<th>Vine</th>
<th>Spacing Category</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phat Jack</td>
<td>125</td>
<td>25</td>
<td>25</td>
<td>50 lbs.</td>
<td>Orange</td>
<td>1 or 2</td>
<td>A very large Jack O Lantern pumpkin from Siegers. Tall with a thick handle.</td>
</tr>
<tr>
<td>Solid Gold</td>
<td>100</td>
<td>25</td>
<td>25</td>
<td>Deep Orange</td>
<td>Orange</td>
<td>2</td>
<td>A new Rupp hybrid that has performed very well in trials. Has excellent color, handles and yields.</td>
</tr>
<tr>
<td>Sorcerer</td>
<td>105</td>
<td>12 x 14&quot;</td>
<td>15 - 25</td>
<td>Deep Orange</td>
<td>Semi Full</td>
<td>2</td>
<td>An AAP winner from Harris Moran. Deep orange, firmly rooted handle, heavily ribbed, round shape. Produces 15 - 25 lb. round to oblong shaped fruit that has a deep orange color with moderate ribs and very thick, long and firmly attached handle. The flesh thickness is excellent which helps to prevent against flat sided fruit and makes them deceivingly heavy for their size. Wolf will produce a range of sizes and shapes but all will have its trademark handle.</td>
</tr>
<tr>
<td>Wolf</td>
<td>120</td>
<td>15 - 25</td>
<td>Large</td>
<td>Deep Orange</td>
<td>Large</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

## PUMPKINS Large - Standard Treatment

<table>
<thead>
<tr>
<th>Variety</th>
<th>1 in.</th>
<th>3 in.</th>
<th>5 in.</th>
<th>7 in.</th>
<th>9 in.</th>
<th>11 in.</th>
<th>13 in.</th>
<th>15 in.</th>
<th>17 in.</th>
<th>19 in.</th>
<th>21 in.</th>
<th>23 in.</th>
<th>25 in.</th>
<th>27 in.</th>
<th>29 in.</th>
<th>31 in.</th>
<th>33 in.</th>
<th>35 in.</th>
<th>37 in.</th>
<th>39 in.</th>
<th>41 in.</th>
<th>43 in.</th>
<th>45 in.</th>
<th>47 in.</th>
<th>49 in.</th>
<th>51 in.</th>
<th>53 in.</th>
<th>55 in.</th>
<th>57 in.</th>
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</thead>
<tbody>
<tr>
<td>Appalachian</td>
<td>2.50</td>
<td>2.95</td>
<td>3.20</td>
<td>3.55</td>
<td>3.90</td>
<td>4.35</td>
<td>4.80</td>
<td>5.25</td>
<td>5.70</td>
<td>6.15</td>
<td>6.60</td>
<td>7.05</td>
<td>7.50</td>
<td>7.95</td>
<td>8.40</td>
<td>8.85</td>
<td>9.30</td>
<td>9.75</td>
<td>10.20</td>
<td>10.65</td>
<td>11.10</td>
<td>11.55</td>
<td>12.00</td>
<td>12.45</td>
<td>12.90</td>
<td>13.35</td>
<td></td>
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<tr>
<td>Phantom</td>
<td>2.00</td>
<td>2.25</td>
<td>2.50</td>
<td>2.75</td>
<td>3.00</td>
<td>3.25</td>
<td>3.50</td>
<td>3.75</td>
<td>4.00</td>
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<td>8.00</td>
<td>8.25</td>
<td>8.50</td>
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<td></td>
</tr>
<tr>
<td>Sorcerer</td>
<td>1.50</td>
<td>1.75</td>
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<td>2.25</td>
<td>2.50</td>
<td>2.75</td>
<td>3.00</td>
<td>3.25</td>
<td>3.50</td>
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<td>7.50</td>
<td>7.75</td>
<td>8.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Kent Gold</td>
<td>1.00</td>
<td>1.25</td>
<td>1.50</td>
<td>1.75</td>
<td>2.00</td>
<td>2.25</td>
<td>2.50</td>
<td>2.75</td>
<td>3.00</td>
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<td>7.25</td>
<td>7.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gold Challenger</td>
<td>0.50</td>
<td>0.75</td>
<td>1.00</td>
<td>1.25</td>
<td>1.50</td>
<td>1.75</td>
<td>2.00</td>
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<td>6.25</td>
<td>6.50</td>
<td>6.75</td>
<td>7.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## PUMPKINS Large - Di More Treatment

| Quantity | 1 oz. | 2 oz. | 3 oz. | 4 oz. | 5 oz. | 6 oz. | 7 oz. | 8 oz. | 9 oz. | 10 oz. | 11 oz. | 12 oz. | 13 oz. | 14 oz. | 15 oz. | 16 oz. | 17 oz. | 18 oz. | 19 oz. | 20 oz. | 21 oz. | 22 oz. | 23 oz. | 24 oz. | 25 oz. | 26 oz. | 27 oz. | 28 oz. | 29 oz. | 30 oz. | 31 oz. | 32 oz. |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Appalachian | 1 oz. | 2 oz. | 3 oz. | 4 oz. | 5 oz. | 6 oz. | 7 oz. | 8 oz. | 9 oz. | 10 oz. | 11 oz. | 12 oz. | 13 oz. | 14 oz. | 15 oz. | 16 oz. | 17 oz. | 18 oz. | 19 oz. | 20 oz. | 21 oz. | 22 oz. | 23 oz. | 24 oz. | 25 oz. | 26 oz. | 27 oz. | 28 oz. | 29 oz. | 30 oz. | 31 oz. | 32 oz. |

## Rupp Seeds Inc.

A-Z For Prog
Cost of FarMore DI 400

• Pumpkins & squash
  - $2.30/1000 seeds
  - If buy 3000 ‘Betternut’ seeds from Rupp
    - $23.90/1000 seeds with FarMore
    - $21.00/1000 seeds without FarMore
Cost of FarMore DI 400

- Pumpkins & squash
  - $2.30/1000 seeds
  - If buy 25 lbs of ‘Gold Rush’ from Rupp
    - $62.20/lb with FarMore
    - $54.00/lb without FarMore
Options for Pumpkins
if 3000 seeds/lb, 1 lb seed/A;
Admire Pro: 7 fl oz/A, ~$8.20/fl oz

<table>
<thead>
<tr>
<th>Item</th>
<th>With FarMore DI 400 (&amp; no Admire)</th>
<th>With Admire (&amp; no FarMore DI 400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed cost/A</td>
<td>$62</td>
<td>$54</td>
</tr>
<tr>
<td>Admire cost/A</td>
<td>$0</td>
<td>$58</td>
</tr>
<tr>
<td>Total cost/A</td>
<td>$62</td>
<td>$102</td>
</tr>
</tbody>
</table>
Options for Pickles
if 58,000 seeds/A;
15,000 seeds/lb; 4 lb seed/A

<table>
<thead>
<tr>
<th>Item</th>
<th>With FarMore DI 400 (&amp; no Admire)</th>
<th>With Admire (&amp; no FarMore DI 400)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed cost/A</td>
<td>$244</td>
<td>$214</td>
</tr>
<tr>
<td>Admire cost/A</td>
<td>$0</td>
<td>$58</td>
</tr>
<tr>
<td>Total cost/A</td>
<td>$244</td>
<td>$272</td>
</tr>
</tbody>
</table>
Conclusions

• Efficacy of seed treatment
  ➢ As good as in-furrow treatment
  ➢ Control is good during the critical cotyledon to 2-leaf stage
  ➢ Control is not consistently lasting past the 2-leaf stage
Conclusions

• **Advantages of seed treatment**
  - Convenience; easier application
  - Lower rate of a.i. per acre (2-34 x)
  - Lower cost
Acknowledgements

• Funding: IR-4 Project, Bayer, Syngenta, Ohio Vegetable & Small Fruit Research & Development Program, Vlasic Foods

• Products: Seminis, Harris-Moran, Harris Seeds, Syngenta, Bayer, BASF, FMC

• Field operations: Matt Hofelich, Glenn Mills, Mark Schmittgen, Clarence Renk, Joe Davlin

• Technical assistance: Gretchen Sutton

• Collaborators: Alan Taylor, Jim Jasinski, Joanne Whalen, Tom Kuhar, Brian Nault, Jerry Brust, Mark Bennett, Michele Giovannini, Jack Norton