Seed treatments for control of onion and seed corn maggots.

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Alan G. Taylor
Holland Marsh, Ontario, Canada
44° 15’ N, 79° 35’W
Ontario: long day yellow bulb onions
Most grown on muck soil with 45-70% organic matter.
Seeded late April - mid May,
harvested mid August-September

Approx. 50% are put into cold storage and sold over the winter, until April
Onion maggots and seed corn maggots are very damaging to onions - 70 to 100% loss.
Onion maggot (Delia antiqua) life cycle

- Eggs oviposited at onion base
- Adult emergence
- Overwinter as pupae
- Eggs hatch into maggots
- Maggots feed on onions causing seedling death and unmarketable bulbs

Three generations per year in Ontario, Canada
Onion maggot fly (Delia antiqua)

- First generation damage -
  - Females deposit eggs in groups at base of onion plant

- Second generation damage
Onion Maggot

Third generation damage

Onion maggot pupae on onion from storage
Seed corn maggot fly (Delia platura)

- Overwinter as pupae in the soil
- Adults emerge in spring- March to May depending on location
- Damage highest in cool years (active at temp of 40 °F and above) and in soils with high organic matter
- 3-5 generations a year in most of U.S.
- The first generation is most damaging to onion seedlings
Yellow sticky traps are used to monitor the adult flies of seed corn maggots and onion maggots.
Maggot flies on yellow sticky traps, monitored 2 x a week

There are high populations of onion maggot flies in the Holland Marsh area.

Onion fly counts have decreased over last 25 years-
Good control reduces populations over time?
Onion maggot and Seed Corn Maggot

- Onion maggot fly
- Seed corn maggot fly
Populations of seed corn maggot flies and onion maggot flies caught on sticky traps-2011
Seed Treatments for Onion Maggot and Seed Corn Maggot

- Seed treatments are important for control of maggots and smut:
- Onion maggot flies in Ontario have about 7 x resistance to Lorsban (chlorpyrifos)
- Treatments applied in Al Taylor’s lab at NYSAES - Film coat
- 2010: Seeded 3-4 May, harvested 20 Sept,

Fungicides to control onion smut applied to all seed:
Raxil (tebuconzole) 250 mg/100 g seed and thiram, in 2010, penflufen and mefanoxam in 2011
Insecticide trials: maggot damage in onions

- Randomized complete block with 4 reps per treatment
- Shortly after onions emerge, 2 m sections are staked out in each plot
- Stand counts 3 times after emergence
- Maggot (and onion smut) damage assessed visually each week
- Onion maggot assessed after each generation (1\textsuperscript{st} generation - 30 June, 2\textsuperscript{nd} generation - 19 Aug, and harvest)- 13 Sept., 2010
- 2 m of row harvested and all plants assessed for damage
## Insecticide treatments -2010

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active ingredient</th>
<th>Rate (100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aria</td>
<td>50% flonicamid</td>
<td>5.13</td>
</tr>
<tr>
<td>Avicta 400</td>
<td>37% avermectin</td>
<td>5.13</td>
</tr>
<tr>
<td>Avicta+ Cruiser</td>
<td>37% avermectin +47.6% thiamethoxam</td>
<td>5.13 +5.13</td>
</tr>
<tr>
<td>Cyazapyr</td>
<td>47 % cyantraniliprole</td>
<td>5.13</td>
</tr>
<tr>
<td>Dermacor-X</td>
<td>50% chlorantraniliprole</td>
<td>5.13</td>
</tr>
<tr>
<td>Entrust</td>
<td>80% spinosad</td>
<td>5.13</td>
</tr>
<tr>
<td>Entrust +Cruiser</td>
<td>80% spinosad + 47.6% thiamethoxam</td>
<td>5.13 +5.13</td>
</tr>
<tr>
<td>Exp-3</td>
<td>thiodicarb</td>
<td>5.13</td>
</tr>
<tr>
<td>Sepresto</td>
<td>56.25% clothianidin + 18.75% imidicloprid</td>
<td>6.15</td>
</tr>
<tr>
<td>Trigard</td>
<td>75% cyromazine</td>
<td>5.0</td>
</tr>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
New in 2011

• Compared seed treatments to a drench of Lorsban (15% chloryrifos) applied 6 days after seeding (2x rate)

• Added a treatment with Movento (spirotetromat) plus surfactant (Sylgard) applied when second generation onion flies emerge.

• If we are spraying Movento for thrips control, will it reduce 2^{nd} generation onion maggot damage?
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active ingredient</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Movento + Sylgard</strong></td>
<td>24% spriotetromat + syloxilated polyether 76%</td>
<td>375 ml +0.375%</td>
</tr>
<tr>
<td>Avicta 400</td>
<td>37% avermectin</td>
<td>4.55</td>
</tr>
<tr>
<td>Cyazapyr</td>
<td>47% cyantraniliprole</td>
<td>4.55</td>
</tr>
<tr>
<td>Cyazapyr</td>
<td>47% cyantranilipole</td>
<td>6.82</td>
</tr>
<tr>
<td>Dermacor-X</td>
<td>50% chlorantraniliprole</td>
<td>4.55</td>
</tr>
<tr>
<td>Dermacor-X</td>
<td>50% chlorantraniliprole</td>
<td>6.82</td>
</tr>
<tr>
<td>Entrust</td>
<td>80% spinosad</td>
<td>4.55</td>
</tr>
<tr>
<td>Entrust +Cruiser</td>
<td>80% spinosad + 70% thiamthoxam</td>
<td>4.55 +4.55</td>
</tr>
<tr>
<td><strong>Lorsban</strong></td>
<td>15% chlorpyrifos</td>
<td><strong>32 kg/ha</strong></td>
</tr>
<tr>
<td>Sepresto</td>
<td>56.25% clothianidin + 18.75% imidicloprid</td>
<td>5.45</td>
</tr>
<tr>
<td>Trigard</td>
<td>75% cyromazine</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Untreated</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Harvest assessment of cumulative maggot damage - 2010

Percent damage

- Untreated
- thiocarb
- Cyazypyr
- Dermacor
- Aria
- Entrust
- Avicta + Cruiser
- Avicta
- Trigard
- Sepresto
- Entrust + Cruiser
Effect of insecticide seed treatment on marketable yield - 2010

Tonnes/ha

58 t/ha = 1044 bu/acre
Cumulative maggot damage on onions at harvest - 2011

Percent damage

- Untreated
- Dermacor-X
- Lorsban
- Movento (2nd)
- Trigard
- Dermacor-X (H)
- Cyazapyr (H)
- Cyazapyr (L)
- Entrust
- Avicta
- Sepresto
- Entrust+Cruiser

Legend:
- c
- b
- ab
- a
Cumulative maggot damage on onions at harvest -2011

Percent damage

2010 untreated
Marketable yield of onions at harvest - 2011

No differences in yield

Tonnnes/ha

Untreated, Dermacor-X, Lorsban, Movento, Trigard, Dermacor, Cyazapyr (H), Cyazapyr (L), Entrust, Avicta, Sepreto, Entrust+Cr..
Populations of seed corn maggot flies and onion maggot flies caught on sticky traps-2011
Populations of onion maggot flies caught on sticky traps - 2010 and 2011

- **2011 high seed corn maggot**

- **onion fly 2010**
- **seed corn maggot**
- **onion fly 2011**
Conclusions: Maggot control

• Seed treatments can provide effective control of maggot damage
  - At least as effective as a Lorsban drench
• Entrust plus Cruiser, Sepresto, Trigard and Avicta were very effective
• Highest yields were obtained with Entrust, Entrust plus Cruiser, Avicta, Avicta plus Cruiser, Trigard and Sepresto (2010)
Conclusions: Maggot control

• Maggot damage was much lower in 2011.
• No effect on yield in 2011, probably because of low maggot pressure
• Yield was related to first generation maggot damage \( (r^2 = 0.65, \ P = 0.00) \) in 2010 when there was high maggot pressure:
What next? Maggot control

• Controlling maggots is essential
• Some new registered seed treatments work very well
The seed treatments are proprietary

Sepresto is now registered

(clothianidin and imidicloprid)

“available now only on onion seed from Nunhems”
FarMore F1500 contains spinosad and thiamethoxam (Entrust and Cruiser)

Plus fungicides Mefanoxam, fludioxonil and azoxystrobin

“Spinosad will be available exclusively as part of FarMore F1500”
What next? Maggot control

• New products for n furrow application
  – Capture (biflenthrin)
  – Force (tefluthrin)
    Singly and with seed treatments

• Continue work on
  – Avicta
  – Movento foliar sprays

• Compare to standard treatments:
  Sepresto, FarMore F1500, Trigard, Entrust, Lorsban drench
All research trials are summarized in the Annual Report

Download at the Muck Station web site:

www.uoqueldph.ca/muckcrop

The 2011 data will be available in March 2012

Includes work on onion thrips and Allium white rot
Acknowledgements

Funding for this research was provided by the California Garlic and Onion Research Advisory Board, and the Holland Marsh Growers Association through the Bradford Coop.
Questions?
Relationship between first generation maggot damage and yield - 2010

\[ MktYield = 55.525 - 0.6719 \times OM1perMag \]

\[ r^2 = 0.65, \quad P = 0.00 \]
Seed corn maggot fly (Delia platura)

- Overwinter as pupae in the soil
- Adults emerge in spring - March to May depending on location
- Females deposit eggs on or near seeds and rotting vegetation (ave. 270 eggs/female)
- Eggs hatch (7-9 days) and larvae feed on the seeds and seedlings
- Damage highest in cool years (active at temp of 40 °F and above) and in soils with high organic matter
- 3-5 generations a year in most of U.S.
- The first generation is most damaging to onion seedlings
# Insecticide seed treatments for onion maggot control - 2008

<table>
<thead>
<tr>
<th>Product</th>
<th>Rate</th>
<th>1st gen damage(%)</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sepresto</td>
<td>0.147</td>
<td>5.0 a</td>
<td>41.2 a</td>
</tr>
<tr>
<td>Entrust</td>
<td>0.2</td>
<td>13.0 ab</td>
<td>43.7 a</td>
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<tr>
<td>Sepresto</td>
<td>0.1</td>
<td>14.3 ab</td>
<td>42.0 a</td>
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<tr>
<td>Entrust</td>
<td>0.15</td>
<td>18.0 ab</td>
<td>48.3 a</td>
</tr>
<tr>
<td>Entrust</td>
<td>0.1</td>
<td>22.2 b</td>
<td>30.0 a</td>
</tr>
<tr>
<td>Check</td>
<td></td>
<td>70.0 c</td>
<td>13.1 b</td>
</tr>
</tbody>
</table>

Rate is mg ai/seed

48.3 tonnes/ha = 860 bu/acre
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active ingredient</th>
<th>Rate</th>
</tr>
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<tbody>
<tr>
<td>Aria</td>
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<td></td>
</tr>
<tr>
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</tr>
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</table>
### Evaluation of Poncho for onion maggot control - 2006

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Rate (mg ai/100 g seed)</th>
<th>First gen damage (%)</th>
<th>Yield (t/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poncho + Thiram</td>
<td>188 + 250 + 4880</td>
<td>1.3 a²</td>
<td>34.2 ns³</td>
</tr>
<tr>
<td>+ Raxil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thiram</td>
<td>188</td>
<td>58.0 b</td>
<td>25.2</td>
</tr>
</tbody>
</table>

Poncho = clothianidin, Raxil = tebuconazole
Tonnes/ha x 17.8 = bushels per acre  34.2 t/ha = 609
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Chemical name and concentration</th>
<th>Rate (g a.i./ 100 g seed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIA</td>
<td>50% flonicamid</td>
<td>5.13</td>
</tr>
<tr>
<td>AVICTA 400</td>
<td>37% avermectin</td>
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</tr>
<tr>
<td>CYAZYPYR</td>
<td>cyantraniliprole</td>
<td>5.13</td>
</tr>
<tr>
<td>DERMACOR X-100</td>
<td>50% chlorantraniliprole</td>
<td>5.13</td>
</tr>
<tr>
<td>ENTRUST</td>
<td>80% spinosad</td>
<td>5.13</td>
</tr>
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<td>SEPRESTO</td>
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<td>6.15</td>
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<td>TRIGARD</td>
<td>75% cyromazine</td>
<td>5.0</td>
</tr>
<tr>
<td>Untreated check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Populations of onion maggot flies caught on sticky traps - 2010
Onion fly females locate onions sites through onion volatiles such as diallyl disulfide (Dindonis and Miller 1980) and visual cues. They are attracted to rotting onions because larvae can enter and feed more easily on rotting bulbs. Larvae may only be able to feed on damaged or rotten bulbs after the seedling stage (Finch et al. 1986).
Field plots for onion maggot trials, Muck Crops Research Station
Onion maggot fly
(Delia antiqua Meigen)

- Major insect pest of onion
- 3 generations per year in Ontario