Insecticide seed treatments and in furrow applications reduce damage by onion and seed corn maggots.

Mary Ruth McDonald
Laura Riches, Kevin Vander Kooi
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

13,800 acres of onions in Canada.
6,500 acres in Ontario
New in 2012

- **Two in-furrow treatments:**
  - **Force** (tefluthrin) granular 37.5 g/ 100m row
  - **Capture** (bifenthrin) drench 0.3 fl oz/1000 ft row
  - cv.Pulsar

- **Commercial seed treatments**
- **FarMore Fi500** on cv. Trekker
- **Sepresto** on cv. Hendrix
  - The pellet was gently crushed to remove it from the seed for the check treatments

- Also, **Movento** (spirotetramat) applied at the emergence of the second generation of onion flies (if we are spraying Movento for onion thrips, will it also suppress onion maggots?)
Onion maggots        Seed corn maggots

Many similarities
Both damage
seedling onions
**Onion maggot**
(Delia antiqua)
- Attacks seedling onions
- Attracted by scent of rotting onions
- 3 generations a year, most damage in the spring
- Overwinter as pupae in soil
- Damage is higher in cool, wet seasons and in high organic matter soils

**Seed corn maggot**
(Delia platura)
- Attacks many crops, including onions and corn
- Attracted by rotting plant material
- 3 – 5 generations per year, most damage in spring
- Overwinter as pupae in soil
- Damage is higher in cool, wet seasons and in high organic matter soils
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-2012

Seed corn maggot flies were approx. 25% of the population
Seed Treatments for Onion Maggot and Seed Corn Maggot

• Seed treatments are important for control of maggots and smut:
• Treatments applied in Al Taylor’s lab at NYSAES - Film coat
• 2010: Seeded 3-4 May, harvested 20 Sept,
• 2011: Seeded 10 May, harvested 12 Sept.
• 2012: Seeded 10 May, harvested 13 Sept.
• Cv. Pulsar

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 (1st generation - 30 June, 2nd generation - 19 Aug, and harvest) - 13 Sept., 2010
- 2 m of row harvested and all plants assessed for damage

Damage from first generation, first plus second, and total cumulative damage, plus separate yield sections
# Insecticide seed treatments - 2010

<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>
<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>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>
<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 check</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
First generation maggot damage - 2010

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

58 t/ha = 522 cwt/acre
Furrow insecticides: Pyrethroid insecticides
Registered for seed corn maggot in corn

Capture (Bifenthrin)

- Spray directly over the seed
- Creates a “zone of protection”
- Increased root mass
- Healthier plant stand
- Also controls wireworms, cutworms, grubs
Furrow insecticides: Pyrethroid insecticides registered for seed corn maggot in corn

Force 3 G (tefluthrin)

• “The unique vapor action of FORCE® permeates the soil and penetrates the insect cuticle, disrupting nerve conductance and causing cessation of feeding and death. Strong repellence gives additional protection to young plants”

• Granular formulation

• Also controls cutworms, wireworms, grubs
Onion growers in Ontario apply Lorsban 15 G (5% chlorpyrifos) as a granular formulation in the furrow at seeding. The registered rate is 15.7 kg/ha Lorsban (2.4 kg ai/ha). Onion flies have a 7x resistance to chlorpyrifos.

Seed treatment Trigard (cyromazine) is also registered for maggot control.
# Insecticide treatments on Pulsar -2012

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Active ingredient</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capture</td>
<td>bifluthrin</td>
<td>0.38 g/m</td>
</tr>
<tr>
<td>Force</td>
<td>tefluthrin</td>
<td>0.46 ml/m</td>
</tr>
<tr>
<td>Lorsban</td>
<td>15% chlorpyrifos</td>
<td>32 kg/ha</td>
</tr>
<tr>
<td>Movento + Sylgard</td>
<td>24% spriotetromat + syloxilated polyether 76%</td>
<td>375 ml +0.375%</td>
</tr>
<tr>
<td>Avicta 400</td>
<td>37% abamectin</td>
<td>4.55</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>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>Untreated</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
First generation maggot damage - 2012

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>c</td>
</tr>
<tr>
<td>Lorsban</td>
<td>bc</td>
</tr>
<tr>
<td>Movento</td>
<td></td>
</tr>
<tr>
<td>Capture</td>
<td>a</td>
</tr>
<tr>
<td>Force</td>
<td>a</td>
</tr>
<tr>
<td>Entrust</td>
<td>a</td>
</tr>
<tr>
<td>Avicta</td>
<td>a</td>
</tr>
<tr>
<td>Sepresto</td>
<td>a</td>
</tr>
<tr>
<td>Entrust+Cruiser</td>
<td>a</td>
</tr>
<tr>
<td>Trigard</td>
<td>a</td>
</tr>
</tbody>
</table>
Cumulative maggot damage - 2012

Percent damage

- Untreated
- Lorsban
- Movento
- Capture
- Force
- Entrust
- Avicta
- Sepreto
- Entrust+Cruiser
- Trigard

Legend:
- d
- bcd
- abc
- abc
- cd
- a
- ab
- ab
- a
- a
Onion yield - 2012

No significant differences (range from 60 to 82 tonnes/ha or 540 cwt to 740 cwt/acre)
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”

Variety Trekker
The seed treatments are proprietary

Sepresto is now registered

(clothianidin and imidicloprid)

variety Hendrix
First generation maggot damage - commercial seed treatment - 2012

Percent damage

- Sepresto Ck
- Sepresto pellet
- FarMore Ck
- FarMore pellet

Comparison: b > a > B > A
Cumulative maggot damage - commercial seed treatment - 2012

Percent damage

- Sepresto Ck
- Sepresto pellet
- FarMore Ck
- FarMore pellet

Values with different letters (a, b, A, B) indicate significant differences.
Yield of onions with commercial seed treatment - 2012

No significant differences in yield

58 t/ha = 1044 bu/acre
Conclusions: Maggot control

- In-furrow applications of Capture and Force reduced damage
- Capture was effective for the entire season
- Uncertain if Movento had an effect
- Seed treatments provided effective control of maggot damage
- Entrust, Entrust plus Cruiser, Sepresto, Trigard and Avicta all reduced maggot damage.
Conclusions: Maggot control

• Maggot damage was much lower in 2011 and 2012, than in 2010.
• No effect on yield in 2011 and 2012, probably because of lower maggot pressure (however 20 tonnes/ha differences)
• Yield was related to first generation maggot damage ($r^2 =0.65$, $P = 0.00$) in 2010 when there was high maggot pressure
Also in 2012

- Spinosad bait to kill adult flies and reduce maggot damage in onions.
- The bait is formulated with a sugar to attract the flies.
- Bait was in a granular form
- Applied 3 times – twice for first generation onion flies and once for second generation. Spread by hand evenly on the plots.
- 2 rates: 22.4 kg/ha and 49.3 kg/ha
- Compared to in-furrow Lorsban granular at 32 kg/ha
First generation maggot damage - spinosad bait - 2012

Percent damage

Check  Bait Low  Bait High  Lorsban

b  b  b  a
Cumulative maggot damage - spinosad bait - 2012

Percent damage

Check: c
Bait Low: b
Bait High: c
Lorsban: a
Yield of onions treated with spinosad bait - 2012

70 tonnes/ha = 630 cwt/acre
Spinosad bait

• Uncertain about the optimum rate and timing of application. Perhaps the bait should be applied earlier.

• If the bait is attracting the flies, try applying it to the edges of the field to attract flies from the main crop?
Maggot control

• Controlling maggots is essential
• New, registered seed treatments work very well
• Furrow application of Capture is effective, Force works well for first generation damage – good for seed corn maggot?
  – Only one year of data
What next? Maggot control

- Continue to evaluate in furrow application
  - Capture (bifenthrin)
  - Force (tefluthrin)
    - Singly and with seed treatment
  Movento foliar sprays
  Spinosad bait, field perimeter only?

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

Download at the Muck Station web site:

www.uoquelp.ca/muckcrop

The 2012 data will be available in March 2013

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 Co-op.
Questions?
Onion maggot (Delia antiqua) life cycle

- Eggs oviposited at onion base
- 210 day degrees, base 4°C (38°F)
- Eggs hatch into maggots
- Adult emergence
- Overwinter as pupae
- Maggots feed on onions causing seedling death and unmarketable bulbs

Three generations per year in Ontario, Canada