Onion maggot management in fresh-market onion

Last updated January 2016

Brian A. Nault
Professor

Department of Entomology, Cornell University, New York State Agricultural Experiment Station, Geneva, NY
Onion Production in New York

- Fresh-market acreage ranks 6\textsuperscript{th} in the US (8,500 acres [5-yr average])
- Value of crop $36 million (5-yr average)
- Cultivars mature in 90 to 120 days
- Planted in April and May and harvested from July to September
- Sold immediately or stored and sold later

USDA NASS (2015)
Onion Production in Muck Soils in New York
Onion Maggot
*(Delia antiqua Meigen)*

- Overwinters in NY as a pupa in soil
- Adults emerge in late April and May
- Three generations per year
- First-generation maggots cause the most damage
First-generation larvae are most destructive
Cultural and chemical control effective

Onion maggot in onion

Plant Resistance

Chemical Control

Behavioral Control

Cultural Control

Biological Control

Martinson et al. (1988); Nault et al. (2006)
Effective Onion Maggot Management Options

Cultural Control
- Crop rotation (difficult on muck)
- Precautions at harvest
- Sanitation

Chemical Control
- Insecticide at planting
  - FarMore Fl500
  - Trigard + chlorpyrifos drench (e.g., Lorsban)
  - Sepresto*

* low pressure situations
Onion rotation rarely occurs in New York

Elba Muck

- Muck land is a relatively small, finite area
- Growers maximize area planted with onions
Chemical control is principal tactic

Onion maggot in onion

Chemical Control

Plant Resistance

Behavioral Control

Cultural Control

Biological Control

Nault et al. (2006)
### Insecticides Registered on Onion for Onion Maggot Control in NY

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Company</th>
<th>Active Ingredient</th>
<th>Class (IRAC(^2) group)</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lorsban Advanced and OLF(^1)</td>
<td>Dow Agro-Sciences and others</td>
<td>chlorpyrifos</td>
<td>OP (1)</td>
<td>At planting in-furrow, or Post-plant band</td>
</tr>
<tr>
<td>Diazinon AG500 and OLF(^1)</td>
<td>Makhteshim</td>
<td>diazinon</td>
<td>OP (1)</td>
<td>Pre-plant broadcast &amp; incorporate</td>
</tr>
<tr>
<td>Trigard OMC</td>
<td>Syngenta</td>
<td>cyromazine</td>
<td>Triazine (17)</td>
<td>Seed treatment</td>
</tr>
<tr>
<td>Sepresto</td>
<td>Bayer CropScience</td>
<td>clothianidin + imidacloprid</td>
<td>Neonicotinoid (4) + Neonicotinoid (4)</td>
<td>Seed treatment</td>
</tr>
<tr>
<td>FarMore F1500</td>
<td>Syngenta</td>
<td>thiamethoxam + spinosad</td>
<td>Neonicotinoid (4) + Spinosyn (5)</td>
<td>Seed treatment</td>
</tr>
<tr>
<td>FarMore OI100</td>
<td>Syngenta</td>
<td>spinosad</td>
<td>Spinosyn (5)</td>
<td>Seed treatment</td>
</tr>
</tbody>
</table>

\(^1\)OLF: other labeled formulation. \(^2\)IRAC: Insecticide resistance action committee
Insecticides for onion maggot

Type of Application

<table>
<thead>
<tr>
<th>In-furrow</th>
<th>Seed treatment</th>
</tr>
</thead>
</table>

chlorpyrifos (Lorsban) = industry standard
Insecticides for onion maggot

<table>
<thead>
<tr>
<th>Type of Application</th>
<th>Chlorpyrifos</th>
<th>Cyromazine</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-furrow</td>
<td>(Lorsban)</td>
<td>(Trigard)</td>
</tr>
<tr>
<td>Seed treatment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

85% reduction in a.i. per acre compared with Lorsban drench!
Insecticides for onion maggot

- **Type of Application**
  - **In-furrow**
  - **Seed treatment**

- **In-furrow**: Seed treatment

- **chlorpyrifos** (Lorsban)
- **cyromazine** (Trigard)
- **chlorpyrifos + cyromazine** (Lorsban + Trigard) = industry standard

Insecticides for onion maggots

**Type of Application**

- In-furrow
- Seed treatment

---

- chlorpyrifos (Lorsban)
- cyromazine (Trigard)
- chlorpyrifos + cyromazine (Lorsban + Trigard)
- spinosad + thiamethoxam (FarMore F1500)

---

**Year**

- 1980
- 1985
- 1990
- 1995
- 2000
- 2005
- 2010
- 2015
Onion maggot control in onion using insecticides

Sodus, NY       2012       (n = 4)

Mean % plants killed by maggots

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean % plants killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>*</td>
</tr>
<tr>
<td>Lorsban</td>
<td>a</td>
</tr>
<tr>
<td>FarMore</td>
<td>ab</td>
</tr>
<tr>
<td>FarMore + Lorsban</td>
<td>b</td>
</tr>
</tbody>
</table>

F = 7.67; df = 2, 8; P = 0.0138

Cornell University
College of Agriculture and Life Sciences
Onion maggot control in onion using insecticides

Sodus, NY 2012 (n = 4)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Mean % plants killed by maggots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>*</td>
</tr>
<tr>
<td>Lorsban</td>
<td>a</td>
</tr>
<tr>
<td>FarMore</td>
<td>ab</td>
</tr>
<tr>
<td>FarMore + Lorsban</td>
<td>b</td>
</tr>
</tbody>
</table>

53% reduction

$F = 7.67; \text{df} = 2, 8; P = 0.0138$
Onion maggot control in onion using insecticides

Sodus, NY       2013      (n = 4)

Mean % plants killed by maggots

- Untreated: *
- Lorsban: a
- FarMore: b
- FarMore + Lorsban: b

F = 10.45; df = 2, 8; P = 0.0059
Onion maggot control in onion using insecticides

Sodus, NY      2013      (n = 4)

Mean % plants killed by maggots

Untreated

Lorsban

FarMore

FarMore + Lorsban

23% reduction

\( F = 10.45; \text{ df} = 2, 8; P = 0.0059 \)
Insecticides for Onion Maggot Control

➢ FarMore F1500 is effective; inclusion of chlorpyrifos not necessary unless high pressure expected

➢ Trigard OMC is effective, but not consistent; inclusion of chlorpyrifos not necessary unless high pressure expected

➢ Sepresto has not been very effective; inclusion of chlorpyrifos does not seem to improve control

➢ Lorsban Advanced or OLF alone is not very effective

➢ Diazinon AG500 or OLF efficacy is not known
Anually rotate insecticides to mitigate resistance in onion maggot.

* Only 1 of 6 generations will be exposed to the same insecticide in 2 yrs.
Onion maggot insecticide resistance management

- Adding Lorsban to the FarMore Fl500 package did not significantly improve control; however, may be worthwhile including if maggot pressure is high.

- Consider annually rotating seed treatment packages.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>FarMore Fl500</td>
<td>Trigard + Lorsban</td>
<td>FarMore Fl500</td>
<td>Trigard + Lorsban</td>
</tr>
</tbody>
</table>
Future management
Onion maggot in onion

▪ Challenges
  ➢ Lack of crop rotation
  ➢ Chlorpyrifos is inexpensive (EPA to revoke tolerances)

▪ Potential Solutions
  ▪ Use sterile male release (Fournier unpublished)
  ▪ Delay planting (Nault et al. 2011)
  ▪ Avoid chlorpyrifos use in low risk fields