Managing onion thrips and status of IYSV in New York

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Collaborators on Thrips and IYSV Projects

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• **Plant Pathology & Plant Microbe Biology**
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• **Crop and Soil Sciences**
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• **Cooperative Extension**
  Christy Hoepting, Katie Panek, Carol MacNeil,
  Maire Ullrich and J. J. Schell
Outline of Presentation

1) Challenges of managing onion thrips

2) New insecticide products

3) Optimizing insecticide performance
   a) Concerns about tank mixing with fungicides
   b) Application sequence and thresholds

4) Update on *Iris yellow spot virus* (IYSV)
Onion Thrips, *Thrips tabaci* Lindeman

**Adult**

**Larva**

*J. Ogrodnick*
Onion Thrips Damage in Onion

Unprotected
341 cwt/acre

Protected with insecticides
529 cwt/acre

30 to 50% yield loss
Sources of Onion Thrips in New York

- Thrips overwinter in soil, emerge in May and then colonize onion fields in June via weeds, other crops, volunteer onions and imported onion plants.
Example of Onion Thrips Occurrence in a Single Onion Field

Thrips produce 3 to 4 generations in a field, requiring 6 to 8 weeks of protection.
General IPM Tactics

Onion Thrips in Onion

- Chemical Control
- Cultural Control
- Biological Control
- Plant Resistance
Insecticide Use for Thrips Control

• Most labeled insecticides perform poorly
  - Resistance to insecticide active ingredient
  - Active ingredient only somewhat effective

• New products are limited in number of applications allowed (e.g., Radiant, Movento and Agri-Mek)
  - Slow down resistance development
  - Limits ability to control thrips for entire season

• Need more management options (e.g., resistant plants, cultural control, reduced-risk and/or selective insecticides, biological control)
Outline of Presentation

1) Challenges of managing onion thrips

2) New insecticide products

3) Optimizing insecticide performance
   a) Concerns about tank mixing with fungicides
   b) Application sequence and thresholds

4) Update on *Iris yellow spot virus* (IYSV)
**Novel Products Evaluated for Managing Onion Thrips on Onion in NY in 2009**

<table>
<thead>
<tr>
<th>Product</th>
<th>Active Ingredient</th>
<th>Class</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBI-205</td>
<td>Eucalyptus extract</td>
<td>Botanical</td>
<td>3% v:v</td>
</tr>
<tr>
<td>Requiem</td>
<td><em>Chenopodium</em> sp.</td>
<td>Botanical</td>
<td>96 fl oz/A</td>
</tr>
<tr>
<td>Neemazad 1%EC</td>
<td>azadirachtin</td>
<td>Botanical</td>
<td>16 fl oz/A</td>
</tr>
<tr>
<td>Neemix 4.5 +Trilogy</td>
<td>azadirachtin + neem oil</td>
<td>Botanical</td>
<td>4 fl oz/A</td>
</tr>
<tr>
<td>Clutch WDG</td>
<td>clothianidin</td>
<td>Neonicotinoid</td>
<td>6 oz/A</td>
</tr>
<tr>
<td>Agri-Mek 0.15EC</td>
<td>abamectin</td>
<td>Avermectin</td>
<td>12 fl oz/A</td>
</tr>
<tr>
<td>HGW86 10 OD</td>
<td>cyantraniliprole</td>
<td>Diamide</td>
<td>20.5 fl oz/A</td>
</tr>
<tr>
<td>Movento 240SC</td>
<td>spirotetramat</td>
<td>Tetramic Acid</td>
<td>5 fl oz/A</td>
</tr>
</tbody>
</table>

*Lannate (methomyl) and Radiant SC (spinetoram) were included as well*
Evaluating Insecticides for Thrips Management in Onion

- First application @ average of 1 larva/leaf
- Weekly sprays - total of 8 sprays in 2009
- Record number of thrips larvae per plant from 15 plants per plot one week after spray
Season Total Number of Thrips Larvae
(8 applications and weekly counts) Potter, NY 2009

Mean total number of larvae/ plant

<table>
<thead>
<tr>
<th>Treatment</th>
<th>N=4</th>
<th>F= 43.96; df= 10, 30; P&lt;0.0001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBI-205 @ 3%</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>Neemazad @ 16 fl oz</td>
<td>a</td>
<td></td>
</tr>
<tr>
<td>Clutch @ 6 oz</td>
<td>ab</td>
<td></td>
</tr>
<tr>
<td>Requiem @ 96 fl oz</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>Neemix @ 4 fl oz</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>Lannate @ 48 fl oz</td>
<td>bc</td>
<td></td>
</tr>
<tr>
<td>Agri-Mek @ 12 fl oz</td>
<td>c</td>
<td></td>
</tr>
<tr>
<td>Movento @ 5 fl oz</td>
<td>d</td>
<td></td>
</tr>
<tr>
<td>Radiant @ 6 fl oz</td>
<td>de</td>
<td></td>
</tr>
<tr>
<td>HGW86 @ 20.5 fl oz</td>
<td>ef</td>
<td></td>
</tr>
</tbody>
</table>

Treatments (amount of product/ acre)
Season Total Number of Thrips Larvae
(8 applications and weekly counts) Potter, NY 2009

![Graph showing mean total number of larvae per plant for different treatments.](image)

- Untreated
- MBI-205 @ 3%
- Neemazad @ 16 fl oz
- Clutch @ 6 oz
- Requiem @ 96 fl oz
- Neemix @ 4 fl oz
- Lannate @ 48 fl oz
- Agri-Mek @ 12 fl oz
- Movento @ 5 fl oz
- Radiant @ 6 fl oz
- HGW86 @ 20.5 fl oz

Mean total number of larvae/ plant

- Treatments (amount of product/ acre)

F = 43.96; df = 10, 30; P < 0.0001  N=4
Season Total Number of Thrips Larvae
(8 applications and weekly counts) Potter, NY 2009

Mean total number of larvae/ plant

<table>
<thead>
<tr>
<th>Treatments (amount of product/ acre)</th>
<th>a</th>
<th>a</th>
<th>ab</th>
<th>ab</th>
<th>b</th>
<th>bc</th>
<th>c</th>
<th>d</th>
<th>de</th>
<th>ef</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
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<tr>
<td>MBI-205 @ 3%</td>
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<td>Neemazad @ 16 fl oz</td>
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<tr>
<td>Clutch @ 6 oz</td>
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<td>Requiem @ 96 fl oz</td>
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<td>Neemix @ 4 fl oz</td>
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<tr>
<td>Lannate @ 48 fl oz</td>
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<tr>
<td>Agri-Mek @ 12 fl oz</td>
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<tr>
<td>Movento @ 5 fl oz</td>
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<tr>
<td>Radiant @ 6 fl oz</td>
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<tr>
<td>HGW86 @ 20.5 fl oz</td>
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</tbody>
</table>

F = 43.96; df = 10, 30; P < 0.0001  N=4

Treatments (amount of product/ acre)
Season Total Number of Thrips Larvae
(8 applications and weekly counts) Potter, NY 2009

Mean total number of larvae/ plant

Treatments (amount of product/ acre)

N=4

F= 43.96; df= 10, 30; P<0.0001
Season Total Number of Thrips Larvae  
(8 applications and weekly counts) Potter, NY 2009

![Bar chart showing the mean total number of larvae per plant for various treatments. The treatments include Untreated, MBI-205 @ 3%, Neemazad @ 16 fl oz, Clutch @ 6 oz, Requiem @ 96 fl oz, Neemix @ 4 fl oz, Lannate @ 48 fl oz, Agri-Mek @ 12 fl oz, Movento @ 5 fl oz, Radiant @ 6 fl oz, and HGW86 @ 20.5 fl oz. The treatments are ordered from highest to lowest effect, with letters indicating groups of similar means. The F-statistic is 43.96 with df=10, 30 and P<0.0001. N=4.](attachment:chart.png)
Season Total Number of Thrips Larvae and Performance Grade

Mean total number of larvae/ plant

F= 43.96; df= 10, 30; P<0.0001  N=4

Treatments (amount of product/ acre)

- Untreated
- MBI-205 @ 3%
- Neemazad @ 16 fl oz
- Clutch @ 6 oz
- Requiem @ 96 fl oz
- Neemix @ 4 fl oz
- Lannate @ 48 fl oz
- Agri-Mek @ 12 fl oz
- Movento @ 5 fl oz
- Radiant @ 6 fl oz
- HGW86 @ 20.5 fl oz

a, b, c, d, e, f
A, A, A, A, A, A
Summary: New Products

- Movento and Agri-Mek received Section 18s in 2009; already submitted for 2010 season
- HGW86 is not labeled; IR-4 has residue data and DuPont will include onions on initial Section 3 label
- Botanicals and neonicotinoid performed poorly in 2009
- Carzol could receive Section 3 label in late February or March 2010
- SpinTor no longer produced; Entrust still available (OMRI approved)
Outline of Presentation

1) Challenges of managing onion thrips

2) New insecticide products

3) Optimizing insecticide performance
   a) Concerns about tank mixing with fungicides
   b) Application sequence and thresholds

4) Update on *Iris yellow spot virus* (IYSV)
Optimizing Insecticide Use
Concerns about Tank Mixing with Fungicides

Background:

• Movento has systemic activity

• Agri-Mek has translaminar activity

• Both require a penetrating surfactant to be effective

• Fungicides like Bravo WeatherStik and Dithane Rainsheild are formulated with spreader stickers that distribute and spread these materials across the leaf surface
Optimizing Insecticide Use
Concerns about Tank Mixing with Fungicides

Concern:

• Onions are normally treated with a tank mix of insecticides and fungicides

• Spreader sticker and penetrating surfactant may interfere with each other
  – Movento and Agri-Mek could be less effective against thrips
  – Fungicide may be less effective against foliar diseases and could cause phytotoxicity
Optimizing Insecticide Use
Concerns about Tank Mixing with Fungicides

Treatments:

• Movento (5 fl oz/A) + Induce
• Movento (5 fl oz/A) + Induce
  + Bravo (1.5 pts/A) + Scala (9 fl oz/A)
• Agri-Mek (12.8 fl oz per acre) + Induce
• Agri-Mek (12.8 fl oz per acre) + Induce
  + Bravo (3 pts/A)
Impact of Movento with or without fungicides on Onion Thrips - 2009

Hoepting 2009

Significant different between insecticide and insecticide + Bravo

- untreated
- Movento 5 floz + Induce
- Movento 5 fl oz + Induce + Bravo 1.5pt + Scala 9 floz

Date
- July 6 (9 leaf)
- July 13 (10 leaf)
- July 20 (10 leaf)
- July 27 (10 leaf)

Number of adults + larvae per leaf

a, ab, b, c
Impact of Agri-Mek with or without fungicides on Onion Thrips - 2009

Significant different between insecticide and insecticide + Bravo

- untreated
- Agri-Mek 12.8 floz + Induce
- Agri-Mek 12.8 floz + Induce + 3pts Bravo

Date

July 6 (9 leaf)  
July 13 (10 leaf)  
July 20 (10 leaf)  
July 27 (10 leaf)  

Number of adults + larvae per leaf
Summary: Tank mixing insecticides and fungicides

- Agri-Mek and Movento were less effective when tank mixed with fungicide
- No data taken on foliar disease control or phytotoxicity
- Solutions
  - apply insecticides and fungicides separately
  - determine how to make tank mixes work
Outline of Presentation

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Application Sequence and Thresholds

- Product should not be applied more than twice
  - *Movento, *Agri-Mek and Radiant

- Product should be applied consecutively
  - Limits number of thrips generations exposed to product (thrips generation time ~ 2 to 3 wks)

- Do not use the same chemistry class more than one time per season

- Minimize use (time sprays using thresholds)

* Specifications on Section 18s
Example of Insecticide Application Sequence

Need to protect crop from thrips for 8 weeks
Example of Insecticide Application Sequence

Need to protect crop from thrips for 8 weeks

*Movento

Thrips

Onions

Harvest

Planting


* Not federally registered on onion in USA
Example of Insecticide Application Sequence

Need to protect crop from thrips for 8 weeks

* Not federally registered on onion in USA
Example of Insecticide Application Sequence

Need to protect crop from thrips for 8 weeks

*Not federally registered on onion in USA
Example of Insecticide Application Sequence

Need to protect crop from thrips for 8 weeks

- **Planting**
- **Onions**
- **Thrips**
- **Radiant**
- **Lannate**
- **Agri-Mek**
- **Movento**

* Not federally registered on onion in USA
Action Thresholds for Onion Thrips in Onion

- Radiant SC: 3 larvae per leaf
- Lannate LV: \( \leq 1 \) larva per leaf
- *Movento*: 1 larva per leaf
- *Agri-Mek*: 1 larva per leaf

* Not federally registered on onion
Combining Insecticide Sequences and Thresholds

Need to protect crop from thrips for 8 weeks

Onions

Planting

Harvest

Thrips

* Movento

* Agri-Mek

* Radiant

* Not federally registered on onion
Combining Insecticide Sequences and Thresholds

Need to protect crop from thrips for 8 weeks

* Not federally registered on onion
Combining Insecticide Sequences and Thresholds

Need to protect crop from thrips for 8 weeks

* Need 8 weeks of thrips control in this crop

* Not federally registered on onion
Summary: Sequences and Action Thresholds

- Movento should be used early in the season when adults thrips populations are low.
- Agri-Mek must be used early as well because of a 30 d pre-harvest interval.
- Radiant should be used later in the season when populations are high.
- Consider timing sprays based on action thresholds rather than the calendar.
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4) Update on *Iris yellow spot virus* (IYSV)
Iris yellow spot virus (IYSV)

- Family: Bunyaviridae
  Genus: Tospovirus

- Transmitted by onion thrips (i.e., not seed-transmitted)

- Disease can reduce photosynthesis, reducing bulb yield
**Iris yellow spot virus (IYSV)**

- **Plant host range**
  - *Allium* spp. like onion and garlic
  - Many weeds like dandelion and burdock
Thrips and IYSV transmission

- Transmitted by onion thrips, *Thrips tabaci*
  - Acquired by first-instars, transmitted by second-instars and adults
  - Adults can NOT acquire the virus
IYSV Detected in All Major Onion Regions in NY

13,500 acres of onions in NY
### IYSV in Onion Fields in Elba Muck (NY)

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of fields sampled</th>
<th>Number of fields with IYSV</th>
<th>% Sites within fields positive for IYSV (n = 60 sites)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2007</td>
<td>12</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>2008</td>
<td>12</td>
<td>10</td>
<td>38</td>
</tr>
<tr>
<td>2009</td>
<td>12</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>
Impact of IYSV on Bulb Onion Production

IYSV can cause significant bulb yield losses in western US.
Does IYSV reduce yield in NY?
Impact of IYSV on Bulb Yield in New York Onion Fields in 2009

Elba, NY

<table>
<thead>
<tr>
<th>Variety</th>
<th>Milestone (seeded + transplanted)</th>
<th>Red Bull (seeded)</th>
<th>Red Bull (transplanted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Bulb Weight (lbs)</td>
<td>279 20</td>
<td>115 65</td>
<td>206 24</td>
</tr>
</tbody>
</table>

- Milestone: a
- Red Bull (seeded): b
- Red Bull (transplanted): b
Sources of IYSV in New York

Reintroduced annually
- Imported transplants from AZ

Established
- Volunteer onions
- Non-annual weeds
Sources of IYSV in New York

Reintroduced annually

- Imported transplants from AZ @ 0.034% infected; ~ 36 plants/acre

Established

- Volunteer onions
- Non-annual weeds
Sources of IYSV in New York

Reintroduced annually

- Imported transplants from AZ
  @ 0.034% infected; ~ 36 plants/acre

Established

- Volunteer onions
  @ 9% infected; ~ 0.4 plant/acre

- Non-annual weeds
Non-Annual Weeds Known as Hosts for IYSV & Commonly Found Near New York Onion Fields

<table>
<thead>
<tr>
<th>Species</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Burdock, <em>Arctium minus</em></td>
<td></td>
</tr>
<tr>
<td>Chicory, <em>Cichorium intybus</em></td>
<td></td>
</tr>
<tr>
<td>Curly dock, <em>Rumex crispus</em></td>
<td></td>
</tr>
<tr>
<td>Dandelion, <em>Taraxacum officinale</em></td>
<td></td>
</tr>
<tr>
<td>Prickly lettuce, <em>Lactuca serriola</em></td>
<td></td>
</tr>
<tr>
<td>Spiny sowthistle, <em>Sonchus asper</em></td>
<td></td>
</tr>
</tbody>
</table>

Nischwitz et al. (2007); Sampangi et al. (2007); Nault et al. (2007)
Non-Annual Weeds Known as Hosts for IYSV & Onion Thrips Larvae

Species

- Common Burdock, *Arctium minus*
- Chicory, *Cichorium intybus*
- Curly dock, *Rumex crispus*
- Dandelion, *Taraxacum officinale*
- Prickly lettuce, *Lactuca serriola*
- Spiny sowthistle, *Sonchus asper*

Smith (unpublished)
Non-Annual Weeds Known as Hosts for IYSV & Onion Thrips Larvae

Species

- Common Burdock, *Arctium minus*
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Smith (unpublished)
Non-Annual Weeds Known as Hosts for IYSV & Onion Thrips Larvae

Plants per hectare (x 1000)

Weed species

- Common Burdock
- Chicory
- Dandelion
- Curly Dock

2008
2009
Sources of IYSV in New York

Reintroduced annually

- Imported transplants from AZ
  @ 0.034% infected; ~ 36 plants/acre

Established

- Volunteer onions
  @ 9% infected; ~ 0.4 plant/acre

- Non-annual weeds
  % infected ?; if infection is 1%,
  ~ 219 to 275 dandelions/acre
When does IYSV occur in New York onion fields?

- **Planting:** 15-Mar to 14-Apr
- **Onion:** 14-May to 13-Jul
- **Thrips**
- **IYSV?**
- **Harvest:** 11-Aug to 11-Oct
Percent Sites in Onion Fields Testing Positive for IYSV in NY in 2007

Hsu et al., Environ. Entomol. (in press)
Hsu et al., Environ. Entomol. (in press)
Percent Sites in Onion Fields Testing Positive for IYSV in NY in 2008

Hsu et al., Environ. Entomol. (in press)
Percent Sites in Onion Fields Testing Positive for IYSV in NY in 2008

Hsu et al., Environ. Entomol. (in press)
Comparing Final Incidence of IYSV Between Varieties and Between Plant Types

Mean % Sites Positive for IYSV per Field (60 sites / field)

- **Milestone**
  - 2008: N = 2
  - 2009: N = 3

- **Red Bull**
  - 2008: N = 2
  - 2009: N = 4

- **Mean % Sites Positive**
  - 60 sites / field
Although high IYSV levels do not occur until the end of the season, yield loss may result.
Summary: Update on IYSV

• IYSV significantly reduces bulb yield

• Selected weed species are likely important reservoirs for IYSV and help it survive across seasons

• IYSV infection levels are low until August, but then can increase substantially

• IYSV infection levels differ among varieties and crop type; higher in ‘Red Bull’ than ‘Milestone’ and greater in seeded crops than transplanted ones
Conclusions

1) Selective insecticides, action thresholds and application sequences should advance onion thrips management in onion (*must address tank mixing with fungicides*)

2) Future research should consider combining insecticide use with other tactics

3) Research on IYSV and its management in New York onion fields deserves more attention
Acknowledgements

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- NY Onion Research & Development Program
- NY Farm Viability Institute
- Various industries

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- Collin McGregor
- Jane Petzoldt
- Katie Reiners
- Hannah Schoonover
- Katie Straight
- Ryan Taylor
- Brandon Viertel

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- Mark Torrey
- Matt Mortellaro
- Leon Hallet (Sr. & Jr.)
- Jim Panek
- Troy Shuknecht
Questions?