Can we improve management of onions thrips in organic onions?

Lindsay Iglesias and Brian Nault
Cornell University
NOFA-NY Winter Conference
January 17, 2020
What we will cover today

1. Intro to onion thrips
2. Study I: OMRI insecticides + enhancements
3. Study II: Resistant cultivars and plastic mulches
4. Bringing it all together: on-farm trials (year 1)
5. What’s next for 2020
Onion Thrips (*Thrips tabaci*)

Photos: I. Yannuzzi

Photo: D. Egel, L. Ingwell
Onion thrips feeding
Facilitate the spread of pathogens

- Iris Yellow Spot Virus (IYSV)
- Purple Blotch
  *Alternaria porri*
- Bacterial bulb rot
  *Pantoea agglomerans, P. ananatis*
- Stemphylium Leaf Blight
  *Stemphylium vesicarium*
Onion thrips life cycle

1 female lays 63 eggs

Photo: Copyright Mark S. Hoddle All rights reserved.
Onion thrips life cycle

1 female lays 63 eggs

One generation ~ 2 wks
3-6 generations in a field

Photo: Copyright Mark S. Hoddle All rights reserved.
Management of onion thrips
Management of onion thrips

Cultural

- Site selection
- Crop rotation
- Sanitation
- Mulches

Management

Cultural
• Site selection
• Crop rotation
• Sanitation
• Mulches

Plant Resistance
• Thrips-resistant varieties (open necks, glossy)

Diaz-Montana et al. 2012a, 2012b)
Management

Cultural

- Site selection
- Crop rotation
- Sanitation
- Mulches

Plant Resistance

- Thrips-resistant varieties (open necks, glossy)

Biological

Fok et al. 2014
Management

Cultural
- Site selection
- Crop rotation
- Sanitation
- Mulches

Plant Resistance
- Thrips-resistant varieties (open necks, glossy)

Chemical
- Spinosad, azadirachtin

Biological

Nault and Hessney 2009, Khaliq et al. 2014
Management

Cultural
• Site selection
• Crop rotation
• Sanitation
• Mulches

Plant Resistance
• Thrips-resistant varieties (open necks, glossy)

Chemical
• Spinosad, azadirachtin

Biological
What is currently being done?

Growers said:

- 100% who manage, use insecticides
- 83% spray at least weekly
- 86% concerned about resistance

*Few effective products are available!*
Study I

Can the efficacy of OMRI Listed insecticides be improved with co-applied enhancements?
Field experiment in Geneva, NY, 2018-19

Seeded April
cv. ‘Bradley’
Field experiment in Geneva, NY, 2018-19

1. Seeded April cv. ‘Bradley’
2. Transplanted June
Seeded April cv. ‘Bradley’

Transplanted June

Start weekly (7) sprays @ 0.5-1 thrips/leaf
Field experiment in Geneva, NY, 2018-19

1. Seeded April cv. ‘Bradley’

2. Transplanted June

3. Start weekly (7) sprays @ 0.5-1 thrips/leaf

4. Thrips counted weekly
Field experiment in Geneva, NY, 2018-19

1. Seeded April cv. 'Bradley'
2. Transplanted June
3. Start weekly (7) sprays @ 0.5-1 thrips/leaf
4. Thrips counted weekly
5. Onions weighed/graded
# Insecticides + enhancement treatments

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Active Ingredient</th>
<th>Manufacturer</th>
<th>IRAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Azera</td>
<td>azadirachtin + pyrethrin</td>
<td>Valent</td>
<td>UN, 3A</td>
</tr>
<tr>
<td>Entrust SC</td>
<td>spinosad</td>
<td>Corteva Agriscience</td>
<td>5</td>
</tr>
<tr>
<td>Neemix 4.5</td>
<td>Azadirachtin</td>
<td>Certis</td>
<td>UN</td>
</tr>
<tr>
<td>PFR 97 20% WDG</td>
<td><em>Isaria fumosorosea</em> Apopka strain 97</td>
<td>Certis</td>
<td>UN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Enhancements</th>
<th></th>
<th></th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-Pede</td>
<td>K salts of fatty acids</td>
<td>Gowan</td>
<td>UN</td>
</tr>
<tr>
<td>Nu Film P</td>
<td>Pinolene (polyterpene)</td>
<td>Miller Chemical &amp; Fertilizer</td>
<td>UN</td>
</tr>
<tr>
<td>Trilogy</td>
<td>Neem oil</td>
<td>Certis</td>
<td>UN</td>
</tr>
</tbody>
</table>

*Fungicide, insecticide, miticide
## Insecticide + enhancement treatments

<table>
<thead>
<tr>
<th>Trt</th>
<th>Insecticide (a.i)</th>
<th>Enhancement (a.i)</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Untreated Control</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Azera (pyrethrin + azadirachtin)</td>
<td></td>
<td>3.5 pts/ac</td>
</tr>
<tr>
<td>3</td>
<td>Azera (pyrethrin + azadirachtin)</td>
<td></td>
<td>3.5 pt/ac</td>
</tr>
<tr>
<td>4</td>
<td>Azera (pyrethrin + azadirachtin)</td>
<td></td>
<td>3.5 pt/ac</td>
</tr>
<tr>
<td>5</td>
<td>Entrust (spinosad)</td>
<td></td>
<td>8 fl oz/ac</td>
</tr>
<tr>
<td>6</td>
<td>Entrust (spinosad)</td>
<td></td>
<td>8 fl oz/ac</td>
</tr>
<tr>
<td>7</td>
<td>Entrust (spinosad)</td>
<td></td>
<td>8 fl oz/ac</td>
</tr>
<tr>
<td>8</td>
<td>Neemix (azadirachtin)</td>
<td></td>
<td>16 fl oz/ac</td>
</tr>
<tr>
<td>9</td>
<td>Neemix (azadirachtin)</td>
<td></td>
<td>16 fl oz/ac</td>
</tr>
<tr>
<td>10</td>
<td>Neemix (azadirachtin)</td>
<td></td>
<td>16 fl oz/ac</td>
</tr>
<tr>
<td>11</td>
<td>PFR 97 (<em>Isaria fumosorosea</em> Apopka Strain 97)</td>
<td></td>
<td>2 lb/ac</td>
</tr>
<tr>
<td>12</td>
<td>PFR 97 (<em>Isaria fumosorosea</em> Apopka Strain 97)</td>
<td></td>
<td>2 lb/ac</td>
</tr>
<tr>
<td>13</td>
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</tr>
<tr>
<td>2</td>
<td>Azera (pyrethrin + azadirachtin)</td>
<td>Nu-Film P (pinolene)</td>
<td>3.5 pts/ac + 8 fl oz/ac</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>M-Pede (K salts of fatty acids)</td>
<td>3.5 pt/ac + 2% v:v</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Trilogy (neem oil)</td>
<td>3.5 pt/ac + 1% v:v</td>
</tr>
<tr>
<td>5</td>
<td>Entrust (spinosad)</td>
<td>Nu-Film P</td>
<td>8 fl oz/ac + 8 fl oz/ac</td>
</tr>
<tr>
<td>6</td>
<td></td>
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</tr>
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<td>13</td>
<td></td>
<td>Trilogy</td>
<td>2 lb/ac + 1% v:v</td>
</tr>
</tbody>
</table>
Onion thrips 2018

Mean Onion Thrips / Leaf

Insecticide + Enhancement

Azera + NuFilm
Azera + M-Pede
Azera + Trilogy
PFR 97 + Trilogy
PFR 97 + M-Pede
Neemix + Trilogy
Neemix + M-Pede
Untreated
Entrust + NuFilm
PFR 97 + NuFilm
Neemix + NuFilm
Entrust + Trilogy
Entrust + M-Pede

\[ F_{12,324} = 6.92; P < 0.0001 \]
Onion thrips 2018

Insecticide + Enhancement

- Azera + NuFilm
- Azera + M-Pede
- Azera + Trilogy
- PFR 97 + Trilogy
- PFR 97 + M-Pede
- Neemix + Trilogy
- Neemix + M-Pede
- Untreated
- Entrust + NuFilm
- PFR 97 + NuFilm
- Neemix + NuFilm
- Entrust + Trilogy
- Entrust + M-Pede

Mean Onion Thrips / Leaf

- Entrust + M-Pede < untreated

$F_{12,324} = 6.92; \ P < 0.0001$
Onion thrips 2018

- **Entrust + M-Pede** or Trilogy, Neemix + NuFilm < worst

**Worst treatment**

- **Entrust + M-Pede** < untreated
Mean Marketable Yield (kg)

Insecticide

Azera  Entrust  Neemix  PFR-97  Untreated

- Azera
- Entrust
- Neemix
- PFR-97
- Untreated

$F_{4,44} = 3.96; P = 0.0078$

Marketable yield 2018

- Entrust > Azera, PFR-97
- Neemix = Entrust

\[ F_{4,44} = 3.96; P = 0.0078 \]
Onion thrips 2019

Insecticide + Enhancement

- Untreated
- PFR 97 + Trilogy
- PFR 97 + NuFilm
- Neemix + NuFilm
- Neemix + M-Pede
- PFR 97 + M-Pede
- Azera + M-Pede
- Azera + NuFilm
- Neemix + Trilogy
- Azera + Trilogy
- Entrust + NuFilm
- Entrust + Trilogy
- Entrust + M-Pede

Mean Onion Thrips / Leaf

- $F_{12,324} = 69.14; \ P < 0.0001$
Onion thrips 2019

Entrust + M-Pede
Entrust + Trilogy
Entrust + NuFilm
Azera + Trilogy
Azera + NuFilm
Neemix + Trilogy
Neemix + NuFilm
PFR 97 + NuFilm
PFR 97 + M-Pede
Azera + M-Pede
Untreated

Not different than the untreated control

Entrust < all other treatments

F_{12.324} = 69.14; P < 0.0001
Onion thrips 2019

- Untreated
- PFR 97 + Trilogy
- PFR 97 + NuFilm
- Neemix + NuFilm
- Neemix + M-Pede
- PFR 97 + M-Pede
- Azera + M-Pede
- Azera + NuFilm
- Neemix + Trilogy
- Neemix + Trilogy
- Azera + Trilogy
- Entrust + NuFilm
- Entrust + Trilogy
- Entrust + M-Pede

Not different than the untreated control

Entrust < all other treatments

\[ F_{12,324} = 69.14; \ P < 0.0001 \]
Marketable yield 2019

Mean Marketable Onion Yield (kg)

- Azera
- Entrust
- Neemix
- PFR 97
- Untreated

Insecticide Treatment

- $F_{4,43} = 5.13; P = 0.0018$
Mean Marketable Onion Yield (kg)

- **Entrust > PFR-97, untreated**
- **Neemix, Azera = Entrust**

$F_{4,43} = 5.13; P = 0.0018$
Bulb rot 2019

• Range: 5-15% of bulbs at harvest

• No significant differences among treatments

Center rot
*Pantoea agglomerans*, *P. ananatis*

Sour skin
*Burkholderia cepacia*
Onion thrips screening trial summary

√ √ √ Entrust (spinosad)
Onion thrips screening trial summary

√ √ √ Entrust (spinosad)

• Enhancements differed when co-applied with Entrust
  1. M-Pede and Trilogy were better than NuFilm
  2. M-Pede at 2% v/v caused phytotoxicity on the leaves*
  3. None were better than the other in terms of yield
Onion thrips screening trial summary

✓ ✓ ✓ Entrust (spinosad)

- Enhancements differed when co-applied with Entrust
  1. M-Pede and Trilogy were better than NuFilm
  2. M-Pede at 2% v/v caused phytotoxicity on the leaves*
  3. None were better than the other in terms of yield

✓ Neemix (azadirachtin)

- Neemix + NuFilm had similar numbers of thrips as Entrust (2018)
- Neemix treatments had similar yield to Entrust treatments (both years)
What is currently being done?

Growers said:

- 100% who manage, use insecticides
- 83% spray at least weekly
- 86% concerned about resistance

Identified compounds

- *Entrust* + *Trilogy*
- *Neemix* + *NuFilm*
What is currently being done?

Growers said:
- 100% who manage, use insecticides
- 83% spray at least weekly
- 86% concerned about resistance

Other strategies?
- 60% already use mulches
- 100% said thrips-resistant cultivar is very important
Mulches in vegetable production

Weed suppression
Moisture retention
Fertilizer conservation
Soil temperatures modulation
Mulches in vegetable production

Silver mulches can:

• Reduce thrips in peppers (Stavinsky et al. 2002, Reitz et al. 2003)
• Reduce bacterial bulb rots in onions (Hoepting et al. 2010)
• Increase yield compared (Hoepting et al. 2010)
Mulches in vegetable production

Silver mulches can:

- Reduce thrips in peppers (Stavinsky et al. 2002, Reitz et al. 2003)
- Reduce bacterial bulb rots in onions (Hoepting et al. 2010)
- Increase yield compared (Hoepting et al. 2010)

Can reflective mulches improve onion thrips control??
Thrips-resistant onion cultivars

Glossy  Semi-glossy  Waxy

Diaz-Montano et al 2010, 2012

Photo: M. Havey
Thrips-resistant onion cultivars

Glossy  Semi-glossy  Waxy

Diaz-Montano et al 2010, 2012

Photo: M. Havey
Thrips-resistant onion cultivars

Glossy  Semi-glossy  Waxy

Diaz-Montano et al 2010, 2012

Photo: M. Havey
Thrips-resistant onion cultivars

Glossy

Semi-glossy

Waxy

Diaz-Montano et al 2010, 2012

Photo: M. Havey
Can mulches and resistant cultivars improve the efficacy of OMRI-Listed insecticides?
Field experiment in Geneva, NY, 2018-19

1. Seeded April
2. Transplanted June
3. Start weekly (7) sprays @ 0.5-1 thrips/leaf
4. Thrips counted weekly
5. Onions weighed/graded
Treatments

• Plastic mulch (2)
  • White on black
  • Silver reflective
Treatments

- Plastic mulch (2)
  - White on black
  - Silver reflective

- Onion cultivar (3)
  - ‘Bradley’ – waxy, susceptible check
  - ‘Rossa di Milano’ – semi-glossy, some resistance
  - B5336 x B5351 – semi-glossy, some resistance
Treatments

• Plastic mulch (2)
  • White on black
  • Silver reflective

• Onion cultivar (3)
  • ‘Bradley’ – waxy, susceptible check
  • ‘Rossa di Milano’ – semi-glossy, some resistance
  • B5336 x B5351 – semi-glossy, some resistance

• OMRI Listed insecticide (2)
  • Untreated
  • Entrust (spinosad) + Trilogy (neem oil)
## Treatments

<table>
<thead>
<tr>
<th>MULCH TYPE</th>
<th>CULTIVAR</th>
<th>INSECTICIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reflective</td>
<td>Bradley</td>
</tr>
<tr>
<td>2</td>
<td>Reflective</td>
<td>Bradley</td>
</tr>
<tr>
<td>3</td>
<td>Reflective</td>
<td>Rossa di Milano</td>
</tr>
<tr>
<td>4</td>
<td>Reflective</td>
<td>Rossa di Milano</td>
</tr>
<tr>
<td>5</td>
<td>Reflective</td>
<td>B5336xB5351</td>
</tr>
<tr>
<td>6</td>
<td>Reflective</td>
<td>B5336xB5351</td>
</tr>
<tr>
<td>7</td>
<td>White</td>
<td>Bradley</td>
</tr>
<tr>
<td>8</td>
<td>White</td>
<td>Bradley</td>
</tr>
<tr>
<td>9</td>
<td>White</td>
<td>Rossa di Milano</td>
</tr>
<tr>
<td>10</td>
<td>White</td>
<td>Rossa di Milano</td>
</tr>
<tr>
<td>11</td>
<td>White</td>
<td>B5336xB5351</td>
</tr>
<tr>
<td>12</td>
<td>White</td>
<td>B5336xB5351</td>
</tr>
</tbody>
</table>
How did mulch affect onion thrips densities?

2018

Reflective: ns

White: ns

$F_{1,41} = 3.84, P = 0.0570$

2019

Reflective: b

White: a

$F_{1,41} = 30.8, P < 0.0001$
How did **mulch** affect onion thrips densities?

### 2018

- **Reflective** vs **White**
  - Mean OT larvae/leaf: ns
  - $F_{1,41} = 3.84, P = 0.0570$

### 2019

- **Reflective</White)**
  - Mean OT larvae/leaf: Reflective < White
  - $F_{1,41} = 30.8, P < 0.0001$
How did **cultivar** affect onion thrips?

![Graph showing the effect of cultivar on onion thrips]

**2018**

- **Bradley**: Mean OT larvae/leaf: a
- **Rossa di Milano**: Mean OT larvae/leaf: b
- **B5336 x B5351C**: Mean OT larvae/leaf: b

\[ F_{2,164} = 18.33, \ P < 0.0001 \]

**2019**

- **Bradley**: Mean OT larvae/leaf: a
- **Rossa di Milano**: Mean OT larvae/leaf: b
- **B5336 x B5351C**: Mean OT larvae/leaf: a

\[ F_{2,164} = 14.92, \ P < 0.0001 \]
How did **cultivar** affect onion thrips?

**2018**

- Bradley
- Rossa di Milano
- B5336 x B5351C

Resistant cultivars < susceptible check

\[ F_{2,164} = 18.33, P < 0.0001 \]

**2019**

- Bradley
- Rossa di Milano
- B5336 x B5351C

\[ F_{2,164} = 14.92, P < 0.0001 \]
How did *cultivar* affect onion thrips?

### 2018

- **Resistant cultivars < susceptible check**

<table>
<thead>
<tr>
<th></th>
<th>Mean OT larvae / leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradley</td>
<td>a</td>
</tr>
<tr>
<td>Rossa di Milano</td>
<td>b</td>
</tr>
<tr>
<td>B5336 x B5351C</td>
<td>b</td>
</tr>
</tbody>
</table>

$F_{2,164} = 18.33, P < 0.0001$

### 2019

- **Only resistant Rossa < susceptible check**

<table>
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<tr>
<td>Bradley</td>
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<tr>
<td>Rossa di Milano</td>
<td>b</td>
</tr>
<tr>
<td>B5336 x B5351C</td>
<td>a</td>
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</tbody>
</table>

$F_{2,164} = 14.92, P < 0.0001$
How did insecticide affect onion thrips?

**2018**

<table>
<thead>
<tr>
<th></th>
<th>Mean OT larvae/leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>5</td>
</tr>
<tr>
<td>Entrust + Trilogy</td>
<td>1</td>
</tr>
</tbody>
</table>

\[ F_{1,248} = 307.65, \quad P < 0.0001 \]

**2019**

<table>
<thead>
<tr>
<th></th>
<th>Mean OT larvae/leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>20</td>
</tr>
<tr>
<td>Entrust + Trilogy</td>
<td>619.41</td>
</tr>
</tbody>
</table>

\[ F_{1,248} = 619.41, \quad P < 0.0001 \]
How did insecticide affect onion thrips?

**2018**

- Untreated: a
- Entrust + Trilogy: b

**2019**

- Untreated: a
- Entrust + Trilogy: b

Entrust + Trilogy < Untreated

F_{1,248}=307.65, P<0.0001

F_{1,248}=619.41, P<0.0001
How did mulch and insecticide affect onion thrips?

\[ F_{1,248} = 5.26, \quad P = 0.0226 \]
How did **mulch and insecticide** affect onion thrips?

![Graph showing the effect of mulch and insecticide on onion thrips]

2018

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Reflective</th>
<th>White</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>a</td>
<td>c</td>
</tr>
<tr>
<td>Entrust + Trilogy</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

For the Reflective treatment, the ANOVA result is:

\[ F_{1,248} = 5.26, \quad P = 0.0226 \]
How did mulch and insecticide affect onion thrips?

### 2018

<table>
<thead>
<tr>
<th></th>
<th>Untreated (Reflective)</th>
<th>Untreated (White)</th>
<th>Entrust + Trilogy (Reflective)</th>
<th>Entrust + Trilogy (White)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a</td>
<td>b</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

$F_{1,248} = 5.26$, $P = 0.0226$
Only mulch\textsuperscript{*}insecticide interaction affected onion thrips

Mulch type was not significant in insecticide-treated plots

$F_{1,248} = 5.26, \ P = 0.0226$
How did **mulch** affect yield?

### Mean onion yield (tonnes/ha)

#### 2018

- **Reflective**: ns
- **White**: ns

#### 2019

- **Reflective**: ns
- **White**: ns

**2018**

\[ F_{1,5} = 0.77, \ P = 0.4197 \]

**2019**

\[ F_{1,5} = 3.2, \ P = 0.1336 \]
How did **mulch** affect yield?

Differences in OT by mulch type did not translate to yield differences.

2018

- Reflective: [Data]
- White: [Data]

- $F_{1,5} = 0.77, P = 0.4197$

2019

- Reflective: [Data]
- White: [Data]

- $F_{1,5} = 3.2, P = 0.1336$
How did insecticide affect yield?

**2018**

- Untreated
- Entrust + Trilogy

**2019**

- Untreated
- Entrust + Trilogy

**Statistical Analysis**

- \( F_{1,32} = 12.06, \ P = 0.0015 \)

- \( F_{1,32} = 132.94, \ P < 0.0001 \)
How did **insecticide** affect yield?

![Bar chart showing mean onion yield comparison between untreated and treated conditions in 2018 and 2019.](image)

**2018**

- Untreated: 10.06 (b)
- Entrust + Trilogy: 15.06 (a)

**2019**

- Untreated: 25.94 (b)
- Entrust + Trilogy: 40.94 (a)

**Statistical Analysis**

- 2018: $F_{1,32} = 12.06, P = 0.0015$
- 2019: $F_{1,32} = 132.94, P < 0.0001$

**Result:** Entrust + Trilogy > Untreated
How did insecticide affect onion thrips in each cultivar?

2019

<table>
<thead>
<tr>
<th></th>
<th>Untreated</th>
<th>Entrust + Trilogy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bradley</td>
<td>b</td>
<td>a</td>
</tr>
<tr>
<td>Rossa di Milano</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>B5336 x B5351</td>
<td>b</td>
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Mean onion yield (tonnes/ha)

\( F_{2,32} = 10.47, \ P = 0.0003 \)
Only **cultivar**\textsuperscript{−}**insecticide** interaction affected yield.

### 2019

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Mean onion yield (tonnes/ha)

\[ F_{2,32} = 10.47, \quad P = 0.0003 \]
Bulb rot 2019

- Center rot
  *Pantoea agglomerans, P. ananatis*
- Sour skin
  *Burkholderia cepacia*

- Range: 5-20% of bulbs at harvest
- No significant differences among treatments
Summary and Discussion

• Reflective mulches DID NOT provide further benefit in terms of lower OT or higher yield when employed with insecticides.

• HOWEVER...
  • Rossa DID reduce OT numbers in both years, B5336 x B5351 in 2018.

WHAT’S NEXT?
• Season long programs on commercial farms (2019-2020)
Snapshot of 2019 on-farm trials of season-long programs
Treatments: Split-Split Plot Design

- Silver reflective mulch
- Cultivar (2)
  - ‘Bradley’ – waxy, susceptible check
  - B5336 x B5351 – semi-glossy, some resistance
- OMRI Listed insecticide program (3)
  - Untreated
  - Action Threshold (AT): 0.5 thrips larvae/leaf
  - Weekly
Field experiment in Geneva, NY, 2018-19

1. Seeded April
2. Transplanted June
3. Start weekly (7) sprays @ 0.5-1 thrips/leaf
4. Thrips counted weekly
5. Onions weighed/graded
## Insecticide program

<table>
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<tr>
<th>Weeks</th>
<th>Insecticide (a.i)</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 &amp; 2</td>
<td>Entrust (spinosad) + Trilogy (neem oil)</td>
<td>8 fl oz/ac + 1% v:v</td>
</tr>
<tr>
<td>3 &amp; 4</td>
<td>Neemix (azadirachtin) + NuFilm (pinolene)</td>
<td>16 fl oz/ac + 8 fl oz/ac</td>
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<td>5 &amp; 6</td>
<td>Venerate (<em>Burkholderia</em> spp.) + Neemix (azadirachtin) + NuFilm (pinolene)</td>
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- Program started at 0.5 thrips larvae/leaf
- AT only sprayed when AT reached, per cultivar
- Fungicide (Cueva, Certis @ 1% v:v) began when symptoms observed
Insecticide program

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- Program started at 0.5 thrips larvae/leaf
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- Fungicide (Cueva, Certis @ 1% v:v) began when symptoms observed

**AT and Weekly programs were both sprayed every week at both sites**
Onion thrips – on-farm trials 2019

Site 1

Site 2

Resistant > susceptible

Bradley B5336 x B5351C

Cultivar

Bradley B5336 x B5351C

Cultivar
Onion thrips – on-farm trials 2019

Site 1

Resistant > susceptible

Bradley  B5336 x B5351C
Cultivar

Site 2

Resistant = check

Bradley  B5336 x B5351C
Cultivar
Onion thrips – on-farm trials 2019

Site 1

Resistant > susceptible

Bradley B5336 x B5351C Cultivar

Resistant = check

Bradley B5336 x B5351C Cultivar

Mean OT larvae / leaf

Site 2

Unsprayed Insecticide Program

Weekly Insecticide Program

Site 1

Unsprayed Insecticide Program

Weekly Insecticide Program

Site 2

Unsprayed Insecticide Program

Weekly Insecticide Program

Bradley B5336 x B5351C Cultivar

Weekly Insecticide Program

Bradley B5336 x B5351C Cultivar

Resistant > susceptible

Resistant = check
Onion thrips – on-farm trials 2019

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Resistant > susceptible

Resistant = check

AT, weekly < unsprayed

Insecticide Program

Site 1

Unsprayed:

Weekly:

Site 2

Unsprayed:

Weekly:
Marketable yield – on-farm trials 2019

Site 1

<table>
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<tr>
<th>Treatment</th>
<th>Mean Marketable Yield (tonnes/ha)</th>
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Cultivar and Insecticide Program
Onion thrips – on-farm trials 2019

No differences among spray programs
On-Farm Trial Summary

• Resistant hybrid had more or similar OT than susceptible check
• Weekly and AT programs were sprayed every week → had similar OT, yield

Maybe AT of 0.5 thrips/leaf is too low?

WHAT’S NEXT?
• Repeat on-farm trials in 2020 with additional higher AT treatment
Overall Discussion

- Reflective mulch DID NOT reduce OT or affect yield
- Resistant B5336 x B5351C had similar or more (on-farm) OT than susceptible Bradley
- Weekly and AT were the same at AT=0.5 OT/leaf

WHAT’S NEXT?
- Repeat on-farm trials in 2020 with additional higher AT treatment
- Temperature and soil conditions for mulch treatments (2019-2020)
Acknowledgements

Nault Lab
AgriTech greenhouse
FRU
Corteva Agriscience
Certis USA

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