Biopesticides and control of spotted-wing Drosophila

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Talk Outline

• SWD population in 2018
• Coverage is key - pruning to improve coverage
• Biopesticides to control SWD - trial results
• PAA products for SWD control
• Rotating biopesticides to conserve natural enemies
• Conclusions
New Research into Organic SWD Control

• New grant funded by Organic Research and Extension Initiative of USDA
• 3 year project
• MSU work lead by Matt Grieshop and Rufus Isaacs
• More research into:
  • Cultural (Pruning and spray coverage)
  • Chemical (PAA products)
  • Biological (Classical and Augmentative)
Statewide SWD captures - 2018

What will 2019 bring? Mild winter or harsh winter...we need to be flexible in management between years

Later first catches are due to long winter and delayed build up is due to hot dry weather
Challenges with chemical management

<table>
<thead>
<tr>
<th>Crop</th>
<th>Blueberry</th>
<th>Raspberry, Blackberry</th>
<th>Strawberry</th>
<th>Stone Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Rate</td>
<td>4-6 fl oz/acre</td>
<td>4-6 fl oz/acre</td>
<td>4-6 fl oz/acre</td>
<td>4-8 fl oz/acre</td>
</tr>
<tr>
<td>PHI</td>
<td>3 days</td>
<td>1 days</td>
<td>1 days</td>
<td>7 days</td>
</tr>
<tr>
<td>Retreatment Interval</td>
<td>6 days</td>
<td>5 days</td>
<td>5 days</td>
<td>7 days</td>
</tr>
<tr>
<td>Max Amount</td>
<td>29 fl oz per year</td>
<td>29 fl oz per year</td>
<td>29 fl oz per year</td>
<td>29 fl oz per year</td>
</tr>
<tr>
<td>Max No. Applications</td>
<td>6 per year</td>
<td>6 per year</td>
<td>5 per year</td>
<td>3 per year</td>
</tr>
</tbody>
</table>


Fanning et al. (2018), J Appl Entomol, 142, 26-32
Gress et al. in press
OMRI products for SWD control

- Biopesticides evaluated in lab experiments and field trials:
  - Spinosad (Entrust SC)
  - *Chromobacterium subtsugae* (Grandeo W)
  - Sabadilla alkaloids (Veratran D)
  - Pyrethrins (PyGanic)
  - *Burkholderia* spp. (Venerate XC)
  - Azadirachtin (AzaGuard)
  - Azadirachtin + Pyrethrins (Azera)
  - Peroxyactic acid
Biopesticides need good coverage

- Increased relevance, especially for organic producers
- Coverage is reduced as the canopy develops

**Canopy Development and Spray Deposition in Highbush Blueberry**

Gary VanEe,¹
Richard Ledebuhr,²
Eric Hanson,³ Jim Hancock,⁴ and Donald C. Ramsdell⁵

Fig. 5. Spray coverage (percent of surface area of card targets) in different positions in ‘Jersey’ blueberry canopies following treatment with an airblast sprayer (SP) on four dates between 13 May (pink bud) and 11 July (green fruit). Data are means across three pruning treatments. LSD value refers to comparisons between dates and positions.
# Pruning and Spray Coverage

## Increasing Spray Coverage

![Diagram showing spraying coverage for Light, Medium, and Heavy pruning treatments](image)

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### Table 1. Effect of pruning on the number of canes in different diameter size categories in 'Jersey' bushes in May, 1996.

<table>
<thead>
<tr>
<th>Pruning treatment</th>
<th>Total canes/bush</th>
<th>Canes in diameter (cm²) categories (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>&lt;0.6</td>
</tr>
<tr>
<td>Light</td>
<td>41.9 a&lt;sup&gt;z&lt;/sup&gt;</td>
<td>36 a</td>
</tr>
<tr>
<td>Moderate</td>
<td>37.4 ab</td>
<td>46 b</td>
</tr>
<tr>
<td>Heavy</td>
<td>34.9 b</td>
<td>42 ab</td>
</tr>
</tbody>
</table>

<sup>2.5 cm = 1 inch.<sup>

<sup>z</sup>Means in columns within each year separated by LSD (P = 0.05). F test was not significant if means are not followed by letters.
Benefit of pruning alone - no insecticide

**Larvae per gram of fruit**

**interior canopy**
- 25% more
- standard
- 25% less

**exterior canopy**
- 25% more
- standard
- 25% less

**Pruning level**

25% more | standard | 25% less
Biopesticides for control of SWD in Raspberries

• 5 week small plot field trial in fall red raspberries

• Aim: Identify effective rotation partners for spinosad

• Main treatments to highlight:
  • Entrust (7 day)
  • Grandevo WDG (3-5 day)
  • Veratran D (3-5 day)
  • Entrust/Grandevo WDG (rotation)
  • Entrust/Veratran D (rotation)
Biopesticides for control of SWD in Raspberries

Started regular harvest of ripe fruit

Average number of Drosophila larva/gram

- Untreated
- Entrust SC
- Grandevo WP
- Veratran D
- Entrust SC/ Grandevo
- Entrust SC/ Veratran D

Biopesticides for control of SWD in Raspberries

Fruit treated with Entrust alone (not legal), or in rotation with Grandevo and Veratran D (legal) had fewer 3rd instar Drosophila larvae.
Conclusions

• In the final week, treatments with rotations of either Entrust/Grandevo or Entrust/Veratran D had a 67% and 57% reduction in infestation compared with the untreated.

• Entrust alone every 7 days, and Grandevo alone every 3–5 days both had a 62% and 61% reduction in infestation than the untreated.

• Grandevo and Veratran D are good rotational partners.
Biopesticides for control of SWD in Blueberries

• Standard annual efficacy trial
• 5 week small plot (n=3) field trial in highbush blueberry ‘Jersey’
• Weekly applications and three assessment of larval infestation in fruit
• Main treatments to highlight:
  • Entrust
  • Grandevo WDG
  • Veratran D
  • Danitol (conventional-pyrethroids)
Biopesticides for control of SWD in Blueberries

Mean number of Drosophila larva per lbs.

- Untreated
- Veratran D x 5
- Entrust x 5
- Grandevo x 5
- Danitol x 5

Aug 2
Aug 16
Aug 23
Can crop sterilants play a role - a novel approach?

- Yeast play an important role in:
  - Larva development and survival
  - Adult attraction to fruit
  - Adult fecundity
- Products containing peroxyacetic acid can help with SWD control

![Graph showing average mortality of D. suzukii adults](chart)
Effect of Jet Ag on SWD infestation - 2017

2017- Small plot trials at TNRC in Blueberry

- Untreated
- Mustang Maxx, Lannate, Imidan
- Mustang Maxx, Jet-Ag, Jet-Ag
- Jet-Ag, Jet-Ag, Jet-Ag

Average (± S.E.) number of Drosophila larvae per ounce of fruit

July 24
July 31
August 7
August 14

Averages followed by different letters are significantly different.
Effect of Jet Ag on SWD infestation- 2018

2018- Small plot trials at TNRC in Blueberry

Average (± S.E.) number of Drosophila larvae per gram of fruit

- Untreated
- Mustang Maxx, Lannate, Imidan
- Mustang Maxx, Jet-Ag, Jet-Ag
- Jet-Ag, 1X/Week
- Jet-Ag, 2X/Week
Applying PAA products for SWD
Biopesticides to conserve natural enemies

• Increased spraying for SWD raises concerns of secondary pest induction

• Biopesticides are inherently less toxic than conventional pesticides

• Conserve natural enemies
Conservation of natural enemies

• Conservation of natural enemies is important
• Waiting for release of classical biocontrol agents to control SWD
• Work led by UC Berkeley and USDA-ARS
• Two species of wasps are promising:
  • *Ganaspis brasiliensis*
  • *Leptopilina japonica*
Augmentative releases of natural enemies

• Colonies of Drosophila parasitoids collected in MI in summer 2018, mass released in spring 2019

• Two species:
  • Larval (Leptopilina sp.)
  • Pupal (Pachycrepoideus vindemiae)

• Experiments in Italy indicate 36% reduction in unmanaged areas
Biopesticides to conserve natural enemies

Average (± S.E.) % mortality of the aphid parasitoid *Aphidius colemani* after 24 hours exposure
Conclusions

- Pruning will benefit spray coverage and reduce suitability for SWD
- Grandevo and Veratran D are good rotational partners for Entrust - important for resistance management
- Interesting results with PAA product (Jet Ag), good coverage essential, growers report disease reduction benefit
- Rotation of products with Entrust will also benefit conservation of natural enemies
Acknowledgements

• Liz Espeland and many others for technical assistance
• Trevor Nichols Research Center staff
• Clarksville Research Center

Research Funding Provided By:

USDA-NIFA: IR-4 Biopesticides Program grant (2015-34383-23710)

USDA-NIFA: Organic Research and Extension Initiative (award 2015-51300-24154)

USDA NIFA: Specialty Crop Research Initiative (award 2015-51181-24252)