Spotted wing drosophila management in the Southeastern USA- economic impacts and future management

Lauren M. Diepenbrock
and
Hannah J. Burrack
Department of Entomology
North Carolina State University
Topics

- SWD significance and impacts in the Southeastern US
- Seasonal biology in the Southeast
- Management options - current & future
Spotted wing drosophila significance

Damage is cryptic & seasonally difficult

Limited effective chemical management tools
Non chemical tools have unclear benefit & are potentially costly
## SWD impacts in the Southeastern US

<table>
<thead>
<tr>
<th>2013</th>
<th>Blueberry</th>
<th>Raspberry</th>
<th>Blackberry</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Maximum loss</strong>&lt;br&gt;(all states reporting)</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Average loss</strong>&lt;br&gt;(all states reporting)</td>
<td>4.7%</td>
<td>16.3%</td>
<td>12%</td>
</tr>
<tr>
<td><strong>Estimated losses</strong>&lt;br&gt;(all states reporting)</td>
<td>$13,003,298</td>
<td>$4,586,893</td>
<td>$5,328,768</td>
</tr>
<tr>
<td><strong>NC Average loss</strong></td>
<td>2%</td>
<td>19%</td>
<td>10%</td>
</tr>
<tr>
<td><strong>NC Estimated losses</strong></td>
<td>$1,420,000</td>
<td>$169,316</td>
<td>$561,439</td>
</tr>
</tbody>
</table>

More information on impacts: [http://swd.ces.ncsu.edu](http://swd.ces.ncsu.edu)
What is different about the Southeastern US?

Burrack et al. 2012, map updated 2013
Seasonal biology differences:
- SWD most active at 20°C
- Less active above 30°C
- Low survival under 10°C
- Precipitation differences

Dalton et al 2011; Walsh et al 2011; Wiman et al. 2014
SWD seasonal biology in Southeastern blueberries

2013 fruit infestation patterns in NC blueberries
SWD Management

• Current chemical management options
  – SE season-long management trials

• Future management options
Summary rankings of insecticide efficacy against SWD
8 states, 15 state x crop combinations

Van Steenwyk, Burrack, Liburd, Shearer, Beers, Tanigoshi, Spitler, Isaacs, Drummond, Collins, Loeb, Rodriguez-Saona, Nielsen, Polk, Sial

Excellent
Good
Fair
Weak
No activity

(Michigan State University)
Season-long management

- Treatment program needs:
  - Effective materials
  - Safe, reduced risk
    - Minimize residue levels
    - Reduce non-target impacts
  - Short time from application to harvest

- Applicable at commercial grower scale

- Designed Rotational treatment programs:
  - Export
  - Short PHI
  - Reduced Risk
Laboratory assessment

- Bioassays: 0DAT & 7DAT
  - treated plant material and berries
  - challenged with 5 male, 5 female SWD
  - diet and water supplemented
  - mortality check 1, 3 and 5 days
  - fruit checked at 7 days for infestation
Measuring treatment efficacy

**Field-level assessment**

- **Adult trapping**
  - Yeast, sugar and water bait
  - Checked weekly
  - Adult SWD counted

- **Larval infestation**
  - 50 ripe berries collected weekly
  - Incubated for 7 days
  - Dissected for larvae/pupae

- **Pesticide residue sampling**
  - Berry samples collected 7 days after treatment
  - Analysis performed by Georgia Department of Agriculture
2013 Results: Acute impacts (female)

These same assays conducted with samples collected 7 days after treatment had no significant mortality.
2013 Larval Infestation - Southern highbush

![Graph showing larval infestation over time with different treatment groups.](image-url)
2013 Export Friendly Rotation Residue data

- **Imidan**: Parts per million (ppm)
  - NC 1: 10 ppm
  - NC 2: 10 ppm
  - GA 1: 10 ppm
  - GA 2: 10 ppm

- **Malathion**: Parts per million (ppm)
  - NC 1: 8 ppm
  - NC 2: 8 ppm
  - GA 1: 8 ppm
  - GA 2: 8 ppm

- **Delegate**: Parts per million (ppm)
  - NC 1: 0.5 ppm
  - NC 2: 0.5 ppm
  - GA 1: 0.5 ppm
  - GA 2: 0.5 ppm

- **Danitol**: Parts per million (ppm)
  - NC 1: 5 ppm
  - NC 2: 5 ppm
  - GA 1: 5 ppm
  - GA 2: 5 ppm

Legend:
- JPN
- CAN
- USA
2013 Short PHI Rotation Residue data

- Mustang Max*
  - NC 1: 0.2 ppm
  - NC 2: 0.4 ppm
  - GA 1: 0.6 ppm
  - GA 2: 0.8 ppm

- Malathion
  - NC 1: 8.0 ppm
  - NC 2: 8.0 ppm
  - GA 1: 8.0 ppm
  - GA 2: 8.0 ppm

*No MRL for zeta-cypermethrin specific to Canada
2013 Reduced Risk Rotation Residue data

- Delegate
- Assail
- Cyantraniliprole

Parts per million (ppm)
Results from 2013 trials

Laboratory assessment
- All treatments killed SWD in bioassays at 0DAT
- No residual impact at 7 DAT

→ Spray schedule for 2014 set at 7 days

Field-level assessment
- Adult trapping
  - Very few adult SWD
- Larval infestation
  - No infestation during treatments
- Residue sampling
  - Below limits

→ Use a later-maturing variety of blueberry for 2014
2014 Results: Acute impacts (female)

Season-long acute impacts (female): $F_{4,5} = 7.47, p = 0.02a$

* treatment not applied
2014 Larval Infestation - Rabbiteye

Larvae per berry

- Export1
- Export 2
- Short PHI
- Reduced Risk
- UTC

Final treatment applied

Week 1  Week 2  Week 3  Week 4  Week 5  Week 6  Week 7  Week 8
Results of 2013 & 2014 chemical management trials

- All programs are effective during harvest
- Residues within MRL standards (2013)
- Weather may impact residual efficacy
  - Rainfastness of materials
Where to manage spotted wing drosophila – How should management tools be applied?

Where does SWD infestation most commonly occur in blackberries?

Fruit sampled weekly, August through October at two locations

Preliminary data, 2014
Where to manage spotted wing drosophila

Infestation by location- minimally managed site
Aug. 14 - Oct. 8 2014

- Canopy
- Inner
- Lower edge
- Mid edge

Preliminary data, 2014
Future management

• Improved monitoring/detection
• Rotational treatment programs for minimizing resistance
• Need sustainable IPM programs
  • Take advantage vegetation structure/refuges
  • Determine what biological control options exist
  • Optimize chemicals/reduced use of broad-spectrum
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• Blueberry image (background)- Bryan Wieczorek