Chemical Control of Spotted Wing Drosophila in Berry Crops

Greg Loeb, Cathy Heidenreich, Laura McDermott, Peter Jentsch, Debbie Breth, and Juliet Carroll, Cornell University

At the start of 2012 field season quite a few berry growers in the Northeast were unaware of the new invasive pest spotted wing drosophila. The situation is likely quite different for 2013 due to the widespread negative impact SWD had on vulnerable berry crops; particularly fall raspberries, late varieties of blueberries, and day-neutral strawberries. Unlike other vinegar flies that attack overripe and rotting fruit, SWD females are able to lay eggs in ripe, marketable fruit of softer skinned crops such as raspberries and blueberries. We estimate SWD caused upwards of 2 million dollars in damages to berry crops in New York State alone in 2012.

We have every reason to believe that SWD will be back among us in 2013 and indeed, there is a lot of research going on to better understand its biology and management. In the short term, though, insecticides will be the main method of control. Below we provide a list of registered insecticide options currently available for use against SWD in NY for blueberries, raspberries/caneberries, and strawberries.

There are a number of important factors to keep in mind in selecting insecticides including pre-harvest interval, total amount of active ingredient allowed per season, minimum days between spray applications, total number of applications allowed per season, reentry interval, insecticide class (and therefore mode of action), whether the insecticide is active through contact or whether it needs to be ingested, compatibility with other chemistry in the spray tank, rain fastness, length of residual, and impact on beneficial insects such as bees. And of course costs. It’s beyond the scope of this article to cover all these variables. However, the tables do provide a convenient summary of the most pertinent information. Please also refer to the full insecticide label.

Also note that for a significant number of materials we have obtained 2(ee) label recommendations to include spotted wing drosophila on the list of pests. You must have a copy of this 2(ee) recommendation in hand when using the insecticide (2(ee) recommendations can be obtained at Cornell PMEP web site: pims.psur.cornell.edu/).

We did want to discuss a couple of aspects of chemical control that might prove helpful in optimizing their use for SWD. Some of the newer insecticide chemistry works best when ingested. For example, although the spinosyns (IRAC group 5) have some contact activity, they work best when ingested.
That is also the case for neonicotinoids (IRAC group 4A). For these types of insecticides, recent research has indicated that the addition of a small amount of cane sugar (2 lb/100 gallons water) acts as a feeding stimulant and increases the amount of material ingested and overall efficacy. This is a relatively small amount of sugar and therefore we do not anticipate secondary problems to develop associated with adding sugar to the foliage (e.g. support of sooty mold or increased mortality to beneficial insects), but it’s something we continue to investigate.

A related question is what life-stage is being targeted by these insecticides? For the most part, it’s the adults and this raises questions about how to increase the probability of contacting them with the insecticide. We have a lot to learn about SWD behavior in this regard. Adults do appear negatively affected by dry, low relative humidity conditions and probably seek out shelter in the crop canopy or adjoining habitat during hot, dry weather. And they may be more active in the evenings and early mornings when relative humidity tends to increase. Therefore, it’s reasonable to assume an insecticide applied at dusk or dawn might be more effective than if applied during the middle of the day. Regardless, though, the females need to come to the fruit to lay eggs and both males and females will feed on damaged or overripe fruit. Therefore, getting good insecticide coverage in the fruiting zone is important.

Insecticides will remain the principal method of control for SWD for the near term. The combination of a long harvest period of multiple berry crops and the short generation time of SWD will likely increase the chances for SWD to develop resistance to some insecticide products. One way to reduce selective pressure for resistance development is to rotate among insecticides with different modes of action (MOA). IRAC codes reflect these different MOAs and we strongly encourage rotating to new MOAs with each successive SWD generation. For example, at the start of the harvest period for fall raspberries a grower might start with 2 applications of Delegate (IRAC code 5) over a 10-day period (5 d spray interval). The label requires the next spray to be from a different IRAC group, for example an OP like malathion (IRAC group 1B). After another 10 to 14 days you could rotate back to Delegate or maybe better, go to a third MOA like a pyrethroid (IRAC group 3A) or a neonicotinoid (IRAC group 4A).

As has been the case for years, but perhaps is particularly true for SWD, growers must incorporate many different factors in making chemical control decisions. The accompanying tables provide guidance in this decision process.

For additional information on SWD biology and management, please see the new SWD web site on Cornell Fruit (www.fruit.cornell.edu/spottedwing/).
<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>AI&lt;sup&gt;1&lt;/sup&gt;</th>
<th>IRAC group</th>
<th>EPA#</th>
<th>RATE/A</th>
<th>REI&lt;sup&gt;2&lt;/sup&gt;</th>
<th>DTH&lt;sup&gt;4&lt;/sup&gt;</th>
<th>Product (ai)/acre</th>
<th>Total applic’s</th>
<th>Spray Interval</th>
<th>Probable efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrust Naturalyte (2ee)</td>
<td>spinosad</td>
<td>5</td>
<td>62719-282</td>
<td>1.25-2 oz</td>
<td>4 hr</td>
<td>3 d</td>
<td>9 oz (0.45 lb)</td>
<td>3 per crop</td>
<td>6 d</td>
<td>Good to Excellent&lt;sup&gt;#&lt;/sup&gt;</td>
</tr>
<tr>
<td>Entrust SC (2ee)</td>
<td>spinosad</td>
<td>5</td>
<td>62719-621</td>
<td>4-6 fl oz</td>
<td>4 hr</td>
<td>3 d</td>
<td>29 fl oz (0.45 lb)</td>
<td>3 per crop</td>
<td>6 d</td>
<td>Good to Excellent&lt;sup&gt;#&lt;/sup&gt;</td>
</tr>
<tr>
<td>Delegate WG (2ee)</td>
<td>spinetoram</td>
<td>5</td>
<td>62719-541</td>
<td>3-6 oz</td>
<td>4 hr</td>
<td>3 d</td>
<td>19.5 oz (0.305 lb)</td>
<td>6</td>
<td>6 d</td>
<td>Excellent&lt;sup&gt;#&lt;/sup&gt;</td>
</tr>
<tr>
<td>Brigade WSG (2ee)</td>
<td>bifenthrin</td>
<td>3A</td>
<td>279-3108</td>
<td>5.3-16 oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>5 lb (0.5 lb)</td>
<td>-</td>
<td>7 d</td>
<td>Excellent</td>
</tr>
<tr>
<td>Danitol 2.4EC</td>
<td>fenpropathrin</td>
<td>3A</td>
<td>59639-35</td>
<td>16 fl oz</td>
<td>24 hr</td>
<td>3 d</td>
<td>32 fl oz (0.6 lb)</td>
<td>2</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Mustang Max Insecticide (2ee)</td>
<td>zeta-cypermethrin</td>
<td>3A</td>
<td>279-3249</td>
<td>4 fl oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>24 fl oz (0.15 lb)</td>
<td>6</td>
<td>7 d</td>
<td>Excellent</td>
</tr>
<tr>
<td>Triple Crown</td>
<td>bifenthrin, imidacloprid, zeta-cypermethrin</td>
<td>3A,4A</td>
<td>279-3440</td>
<td>6.4-10.3 fl oz</td>
<td>12 hr</td>
<td>3 d</td>
<td>31.0 fl oz (0.54 lb)</td>
<td>5</td>
<td>7 d</td>
<td>Good to excellent</td>
</tr>
<tr>
<td>Imidan 70W</td>
<td>phosmet</td>
<td>1B</td>
<td>10163-169</td>
<td>1.33 lb</td>
<td>24 hr</td>
<td>3 d</td>
<td>7.125 lb (5.0 lb)</td>
<td>5</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>19713-217</td>
<td>2.0 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>6 pts (3.75 lb)</td>
<td>3</td>
<td>5 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>66330-220</td>
<td>2.0 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>6 pts (3.75 lb)</td>
<td>3</td>
<td>5 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 8 Aquamul (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>34704-474</td>
<td>1.875 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>3.75 pts (3.75 lb)</td>
<td>1</td>
<td>5 d</td>
<td>Good</td>
</tr>
<tr>
<td>Assail 30SG</td>
<td>acetamiprid</td>
<td>4A</td>
<td>8033-36-7050</td>
<td>4.5-5.3 oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>26.7 oz (0.5 lb)</td>
<td>5</td>
<td>7 d</td>
<td>Good&lt;sup&gt;#&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pyganic EC 1.4</td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1771</td>
<td>1 pt – 2 qts</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td>Pyganic EC 5.0</td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1772</td>
<td>4.5 – 18 fl oz</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td>AzaSol</td>
<td>azadirachtin</td>
<td>UN</td>
<td>81899-4</td>
<td>6 oz in 50 gal</td>
<td>4 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
</tbody>
</table>

<sup>1</sup> Active Ingredient.  
<sup>2</sup> Mode of Action, based on IRAC group code.  
<sup>3</sup> Re-entry Interval.  
<sup>4</sup> Days to Harvest.

<sup>*</sup>Labeled Insecticides for Control of Spotted Wing Drosophila in New York Berry Crops  
Compiled by Greg Loeb, Cathy Heidenreich, Laura McDermott, Peter Jentsch, Debbie Breth, & Juliet Carroll, Cornell University, May 22, 2013
*Labeled Insecticides for Control of Spotted Wing Drosophila in New York Berry Crops

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<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>AI</th>
<th>IRAC group</th>
<th>EPA#</th>
<th>RATE/A</th>
<th>REI</th>
<th>DTH</th>
<th>Product (ai)/acre</th>
<th>Total applic’s</th>
<th>Spray Interval</th>
<th>Probable efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrust Naturalyte (2ee)</td>
<td>spinosad</td>
<td>5</td>
<td>62719-282</td>
<td>1.25-2 oz</td>
<td>4 hr</td>
<td>1 d</td>
<td>9 oz (0.45 lb)</td>
<td>3 per crop</td>
<td>6 d</td>
<td>Good to Excellent#</td>
</tr>
<tr>
<td>Entrust SC (2ee)</td>
<td>spinosad</td>
<td>5</td>
<td>62719-621</td>
<td>4-6 fl oz</td>
<td>4 hr</td>
<td>1 d</td>
<td>29 fl oz (0.45 lb)</td>
<td>3 per crop</td>
<td>6 d</td>
<td>Good to Excellent#</td>
</tr>
<tr>
<td>Delegate WG (2ee)</td>
<td>spinetoram</td>
<td>5</td>
<td>62719-541</td>
<td>3-6 oz</td>
<td>4 hr</td>
<td>3 d</td>
<td>19.5 oz (0.305 lb)</td>
<td>6</td>
<td>4 d</td>
<td>Excellent#</td>
</tr>
<tr>
<td>Brigade WSG (2ee)</td>
<td>bifenthrin</td>
<td>3A</td>
<td>279-3108</td>
<td>8.0-16 oz</td>
<td>12 hr</td>
<td>3 d</td>
<td>2 lb (0.2 lb)</td>
<td>1 post bloom</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Brigade EC (2ee)</td>
<td>bifenthrin</td>
<td>3A</td>
<td>279-3313</td>
<td>3.2-6.4 fl oz</td>
<td>12 hr</td>
<td>3 d</td>
<td>12.8 fl oz (0.2 lb)</td>
<td>1 post bloom</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Danitol 2.4EC</td>
<td>fenpropathrin</td>
<td>3A</td>
<td>59639-35</td>
<td>16 fl oz</td>
<td>24 hr</td>
<td>3 d</td>
<td>32 fl oz (0.6 lb)</td>
<td>2</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Mustang Max Insecticide (2ee)</td>
<td>zeta-cypermethrin</td>
<td>3A</td>
<td>279-3249</td>
<td>4 fl oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>24 fl oz (0.15 lb)</td>
<td>6</td>
<td>7 d</td>
<td>Excellent</td>
</tr>
<tr>
<td>Triple Crown</td>
<td>bifenthrin, imidacloprid, zeta-cypermethrin</td>
<td>3A,4A</td>
<td>279-3440</td>
<td>6.4-10.3 fl oz</td>
<td>12 hr</td>
<td>3 d</td>
<td>10.3 fl oz (0.181 lb)</td>
<td>1 post bloom</td>
<td>7 d</td>
<td>Good to excellent</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>19713-217</td>
<td>3.0 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>9 pts (6.0 lb)</td>
<td>3</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>66330-220</td>
<td>3.0 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>9 pts (6.0 lb)</td>
<td>3</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 8 Aquamul (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>34704-474</td>
<td>2.0 pts</td>
<td>12 hr</td>
<td>1 d</td>
<td>6 pts (6.0 lb)</td>
<td>3</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Assail 30SG</td>
<td>acetamiprid</td>
<td>4A</td>
<td>8033-36-70506</td>
<td>4.5-5.3 oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>26.7 oz (0.5 lb)</td>
<td>5</td>
<td>7 d</td>
<td>Good#</td>
</tr>
<tr>
<td>Pyganic EC 1.4</td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1771</td>
<td>1 pt – 2 qts</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td>Pyganic EC 5.0</td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1772</td>
<td>4.5 – 18 fl oz</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td>AzaSol</td>
<td>azadirachtin</td>
<td>UN</td>
<td>81899-4</td>
<td>6 oz in 50 gal</td>
<td>4 hr</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
</tbody>
</table>

*Refer to label for details and additional restrictions.

#Adding sugar (sucrose) at 2 lb/100 gal water as a feeding stimulant will increase efficacy.

^ Approved for organic use in NY.

@ After two consecutive applications must rotate to different mode of action.

1 Active Ingredient.
2 Mode of Action, based on IRAC group code.
3 Re-entry Interval.
4 Days to Harvest.

1 AI – Active Ingredient; 2 MOA – mode of action based on IRAC group code; 3 REI – Re-entry Interval; 4 DTH – Days to Harvest.
# Labeled Insecticides for Control of Spotted Wing Drosophila in New York Berry Crops

*Compiled by Greg Loeb, Cathy Heidenreich, Laura McDermott, Peter Jentsch, Debbie Breth, & Juliet Carroll, Cornell University, May 22, 2013*

## Strawberries

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>AI</th>
<th>IRAC group</th>
<th>EPA#</th>
<th>RATE/A</th>
<th>REI</th>
<th>DTH</th>
<th>Product (ai)/acre</th>
<th>Total applic’s</th>
<th>Spray Interval</th>
<th>Probable efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Entrust Naturalyte (2ee)</strong></td>
<td>spinosad</td>
<td>5</td>
<td>62719-282</td>
<td>1.25-2 oz</td>
<td>4 hr</td>
<td>1 d</td>
<td>9 oz (0.45 lb)</td>
<td>5</td>
<td>5 d</td>
<td>Good to Excellent #</td>
</tr>
<tr>
<td><strong>Entrust SC (2ee)</strong></td>
<td>spinosad</td>
<td>5</td>
<td>62719-621</td>
<td>4-6 fl oz</td>
<td>4 hr</td>
<td>1 d</td>
<td>29 fl oz (0.45 lb)</td>
<td>5</td>
<td>5 d</td>
<td>Good to Excellent #</td>
</tr>
<tr>
<td><strong>Radiant (2ee)</strong></td>
<td>spinetoram</td>
<td>5</td>
<td>62719-545</td>
<td>6-10 fl oz</td>
<td>4 hr</td>
<td>1 d</td>
<td>39 fl oz (0.305 lb)</td>
<td>5</td>
<td>3 d</td>
<td>Excellent #</td>
</tr>
<tr>
<td>Brigade WSG (2ee)</td>
<td>bifenthrin</td>
<td>3A</td>
<td>279-3108</td>
<td>5.3-16 oz</td>
<td>12 hr</td>
<td>0 d</td>
<td>5 lb (0.5 lb)</td>
<td>-</td>
<td>7 d</td>
<td>Excellent</td>
</tr>
<tr>
<td>Danitol 2.4EC</td>
<td>fenpropathrin</td>
<td>3A</td>
<td>59639-35</td>
<td>16-21.3 fl oz</td>
<td>24 hr</td>
<td>2 d</td>
<td>42.7 fl oz (0.8 lb)</td>
<td>2</td>
<td>-</td>
<td>Excellent</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>19713-217</td>
<td>3.2 pts</td>
<td>12 hr</td>
<td>3 d</td>
<td>12.8 pts (8.0 lb)</td>
<td>4</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 5EC (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>66330-220</td>
<td>2.0 pts</td>
<td>12 hr</td>
<td>3 d</td>
<td>12.8 pts (8.0 lb)</td>
<td>4</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Malathion 8 Aquamul (2ee)</td>
<td>malathion</td>
<td>1B</td>
<td>34704-474</td>
<td>2.0 pts</td>
<td>12 hr</td>
<td>3 d</td>
<td>8 pts (8.0 lb)</td>
<td>4</td>
<td>7 d</td>
<td>Good</td>
</tr>
<tr>
<td>Assail 30SG</td>
<td>acetamiprid</td>
<td>4A</td>
<td>8033-36-70506</td>
<td>4.5-5.3 oz</td>
<td>12 hr</td>
<td>1 d</td>
<td>13.8 oz (0.26 lb)</td>
<td>2</td>
<td>7 d</td>
<td>Good #</td>
</tr>
<tr>
<td><strong>Pyganic EC 1.4</strong></td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1771</td>
<td>1 pt – 2 qts</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td><strong>Pyganic EC 5.0</strong></td>
<td>pyrethrin</td>
<td>3A</td>
<td>1021-1772</td>
<td>4.5 – 18 fl oz</td>
<td>12 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
<tr>
<td><strong>AzaSol</strong></td>
<td>azadirachtin</td>
<td>UN</td>
<td>81899-4</td>
<td>6 oz in 50 gal</td>
<td>4 hr</td>
<td>0 d</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Fair to Poor</td>
</tr>
</tbody>
</table>

*Refer to label for details and additional restrictions.

1 Active Ingredient.
2 Mode of Action, based on IRAC group code.
3 Re-entry Interval.
4 Days to Harvest.

*After two consecutive applications must rotate to different mode of action.

---

1 Adding sugar (sucrose) at 2 lb/100 gal water as a feeding stimulant will increase efficacy.

2 Approved for organic use in NY.

5 Approved for organic use in NY.