Cornell University
College of Agriculture and Life Sciences

# New York Berry News



***Volume 13, Number 5*** ***SWD SPECIAL EDITION*** ***June 25, 2014***

## FROM THE SWD BLOG…

*Juliet Carroll, NYS IPM Program*

If you want to be up to the minute with SWD happenings in NY State you need to be subscribed to the SWD blog! Visit the blog page to sign up now. *http://blogs.cornell.edu/swd1/*

### No Finds in NY

**June 20, 2014.** A quick note to let everyone know that no SWD has been caught this week (June 14-20) in traps reporting to the SWD monitoring network in NY.

There is still time to prepare and plan for the actions that will be needed to protect your crops; use this time wisely. Review management tactics, calibrate sprayers, get a cooler for marketing harvested berries, install an accurate thermometer to track daily max/min temperatures, review your insecticide inventory, develop an insecticide rotation program, keep row middles mowed, control weeds, prune to open the plant canopy and reduce shady areas in the planting. Hummingbird feeders anyone?

### Videos to Monitor By

**June 12, 2014.** Videos of 2014 SWD trap contents! This year's monitoring has begun and Anna Wallingford, Postdoctoral Associate in Greg Loeb's lab at the Experiment Station in Genev created a Youtube channel, *Finger Lakes SWD monitoring*, for weekly vid updates (every Monday) on what the Loeb lab is finding in traps in and around Geneva. The videos will aim to inform the novice, pointing out various insects that can be found in the traps but also concentrating on those SWD look-a-like drosophilid species that pose challenges when trying to ID the rare, first SWD female(s).

Please post a comment on the *Finger Lakes SWD monitoring* Youtube site or send Anna an email if you have any suggestions on how to make the videos more useful. Also include any ideas for "how to" videos/content that we might produce as Extension materials.


Screen shot of the first SWD Youtube video showing trap catch samples.

### Alerts & Protecting Fruit

**June 11, 2014.** No SWD has been reported, as of June 11, 2014, from any of the monitoring locations in New York. Any confirmed first trap catch SWD findings will once again be posted on the blog.

Current guidelines for managing SWD are to begin insecticide applications on vulnerable crops when fruit are ripening. Late-season blueberries, blackberries and fall raspberries are especially vulnerable to attack. Less vulnerable, but also at risk, are late season plums, peaches, cherries and grapes, and late harvest summer raspberries, early to mid-season blueberries, and early harvest day-neutral strawberries.

Insecticide table quick guides are linked

# FROM THE SWD BLOG... *(continued)*

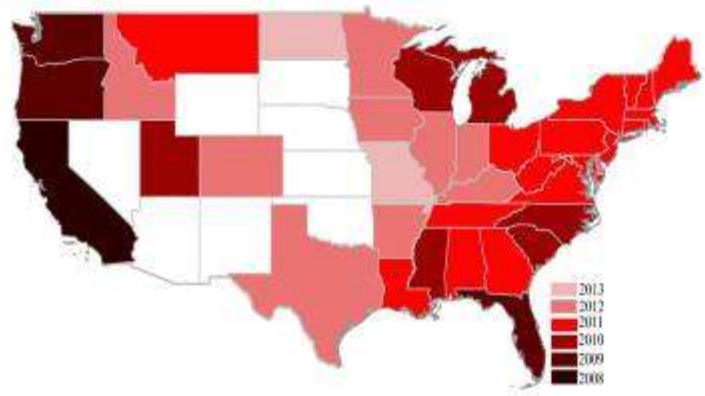
below and available on the Spotted Wing Drosophila website on Cornell Fruit Resources, www.fruit.cornell.edu. If you are reading this from outside of New York, keep in mind that NY State may be more restrictive on labeling insecticides and there may be additional insecticide options available in your state; contact your local Extension Service for more information.

**2014 Labeled insecticides for berry crops**

**2014 Labeled insecticides for stone fruit & grapes**

## Where is SWD found?

**May 21, 2014.** As we gear up for our 2014 monitoring efforts in New York, reports are circulating of new places this invasive and destructive fruit fly is being found. From February through May, 2013, *Drosophila suzukii* was found for the first time in southern Brazil. Closer to home, spotted wing Drosophila is found in the Canadian provinces to our north and east. To get a baseline for SWD occurrence in the USA, look at the map compiled by Hannah Burrack, entomologist at NC State University.




**Map of SWD detections in the US, as of 2013.**
Source: Hannah Burrack, NC State Univ.

In New York, entomologist Faruque Zaman, Suffolk County Cornell Cooperative Extension, Long Island, has traps out, but has not caught SWD yet. Peter Jentsch, entomologist at the Hudson Valley Laboratory, has traps out, as does Greg Loeb, entomologist at the NY State Ag Experiment Station in Geneva. So far no SWD detected.

The NY statewide monitoring traps will be set in early June in the following counties – Albany, Cayuga, Chautauqua, Chemung, Clinton, Columbia, Dutchess, Erie, Herkimer, Livingston, Monroe, Niagara, Onondaga, Ontario, Orange, Orleans, Rensselaer, St. Lawrence, Saratoga, Schuyler, Seneca, Steuben, Suffolk, Tioga, Ulster, Washington, Wayne, and Yates. Reports of SWD trap catch will be posted as they come in.

## Frozen or Baked SWD?

**April 8, 2014.** As we emerge from the clutches of a long and very cold winter, we're pondering if SWD was killed off…as were many fruit buds in New York. A study in Japan (Kimura 2004) investigating cold and heat tolerance of fruit flies included SWD. Interestingly, SWD is distributed in all three of the climatic regions in Japan from which drosophilid flies were collected for the research, the cool-temperate region (January mean temperature 23 F, August mean temperature 71 F), the warm-temperate region (January mean temperature 39 F, August mean temperature 80 F), and the subtropical region (January mean temperature 64 F, August mean temperature 82 F). Progeny from SWD females collected from each of these regions showed little variation in the range of heat and cold tolerance; the conclusion being that populations don't gain much improved heat tolerance in the subtropical region or much improved cold tolerance in the cold-temperate region.

To test SWD's temperature tolerance, flies were held at constant temperature in dark for a 24-hr period to determine the lethal temperature (LT) at which 25%, 50%, and 75% of the flies died. 75% of females die at 28.7 F and 75% of males die at 30.7 F (Table below).

**Lethal temperature (F) at which SWD is killed**

| SWD | Cold | | | Heat | | |
|---|---|---|---|---|---|---|
| Gender | LT 25% | LT 50% | LT 75% | LT 25% | LT 50% | LT 75% |
| Female | 30.0 | 29.1 | 28.7 | 90.1 | 90.7 | 91.2 |
| Male | 32.9 | 31.8 | 30.7 | 88.9 | 89.9 | 90.7 |

Can we start celebrating? With low temperatures dipping into the negative teens this winter, was LT 100% reached? -17 F is certainly well below the LT 75% of 28.7 F. I would argue that a distinct possibility exists that a majority of SWD attempting to overwinter in the New York died this winter. However, remember how small SWD is and that microclimates do exist near buildings, compost

## FROM THE SWD BLOG... *(continued)*

piles, etc. where temperature may not drop as low as the recorded air temperature. Also, research has yet to determine if SWD overwinters in New York, so maybe the argument is irrelevant?

Another take home message from the lethal temperature table for SWD is that they die at and above 90 F. Last summer was hot and SWD damage seemed not as severe to many of us as in 2012. Perhaps adult flies died off during periods of 90 F and above this summer. As June nears its end this year, invest in an accurate thermometer and keep track of how hot it gets.

**References:**

Masahito T. Kimura. 2004. Cold and Heat Tolerance of Drosophilid Flies with Reference to Their Latitudinal Distributions. Oecologia, Vol. 140, No. 3 pp. 442-449.

## SPOTTED WING DROSOPHILA TRAP NETWORK 2013

*Juliet Carroll, NYS IPM Program*

Spotted wing Drosophila (SWD) was first detected in New York in 2011 and, in 2012, was reported from across the state causing significant damage to berry crops. For 2013, a coordinated approach was taken in the collection and delivery of SWD information to fruit growers, as well as home gardeners. An SWD website was launched at www.fruit.cornell.edu/spottedwing/ containing webpages on SWD hosts, monitoring, identification, management, distribution, impact, and biology; a blog at blogs.cornell.edu/swd1/ was started that currently has 51 subscribers; quick reference tables of labeled insecticides for at-risk fruit crops were developed; and a home gardener SWD fact sheet was written.

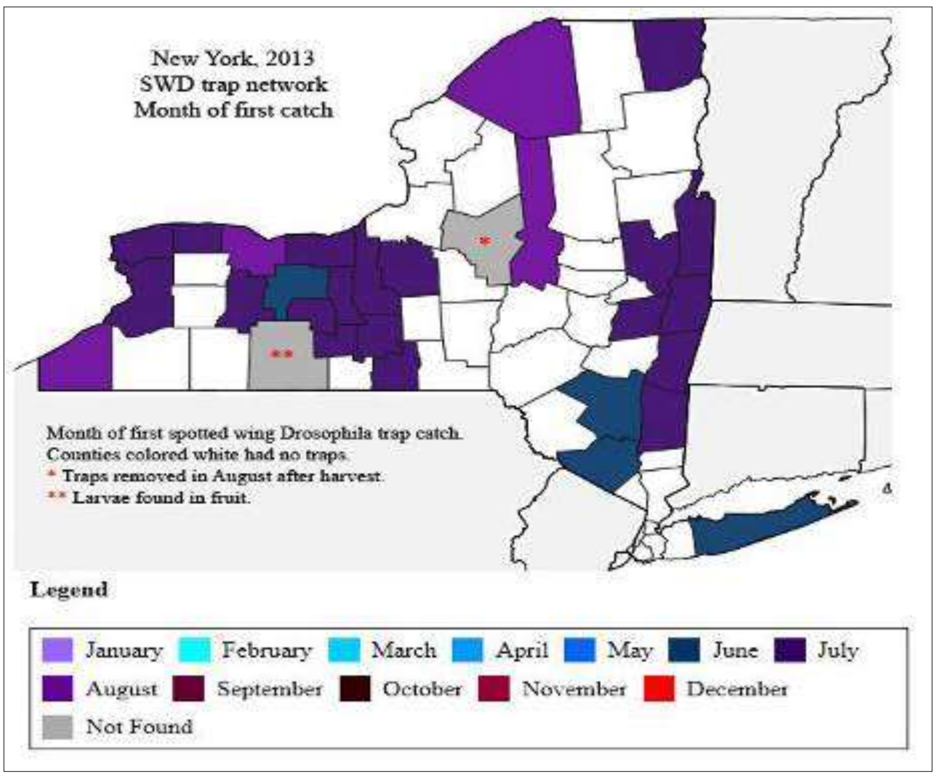



**Figure 1.** Four counties reported first trap catch in June (dark blue), 19 counties reported first trap catch in July (dark purple), and four counties reported first trap catch in August (light purple). Two counties did not find SWD in traps (gray).

Because SWD was considered to be established throughout NY, efforts were undertaken to monitor and report first trap catch. Scientists at Cornell University, in Cornell Cooperative Extension County Associations and Regional Programs set out vinegar and yeast baited traps in 29 Counties and reported trap catch data to the Eastern SWD Volunteer Monitoring Network mapping system, www.eddmaps.org/project/project.cfm?proj=9. The SWD trap network data was used to generate a NY distribution map (Fig. 1). Cornell Cooperative Extension personnel that participated in the trap network alerted growers to protect their crops when SWD was found in their area. On average, SWD

# SPOTTED WING DROSOPHILA TRAP NETWORK 2013 *(continued)*

was first trapped in NY at about the same time as in 2012, though peak activity seemed to occur later in 2013 than in 2012. This may have spared early maturing berries and lessened fruit damage to late maturing varieties of fruit.

Traps were made from red or clear cups containing an apple cider vinegar drowning solution. Inside the trap, a smaller cup containing a bait mixture of bread yeast, whole wheat flour and sucrose in water either floated in the vinegar or was fastened above it. Traps are described at www.fruit.cornell.edu/spottedwing/pdfs/SWDTraps_CornellFruit.pdf . Traps were placed within the crop, on the edge of the crop, or in the adjacent wild hedgerow or woods (Table 1). Traps were checked weekly until sustained trap capture or until the crop was harvested, after which point they were removed. First reports were posted on the SWD blog and accumulated GDD (base 50) and day length calculated for the location. Weather data for GDD was obtained from the nearest station in the Network for Environment and Weather Applications (NEWA) newa.cornell.edu.

Preliminary results from the trap network data are summarized in Table 2 and Fig 2. Data was collected and input to the distribution map for 140 trap locations. The most common landscape location for the earliest trap catches in NY was in the crop edge or the wild edge. First, unsustained catch in NY was in Ontario County in the Finger Lakes region on June 11, although SWD was not caught the following week at this location. First sustained trap catch in New York State was found on Long Island (Suffolk County) and in the lower Hudson Valley (Orange County).

**Table 1.** Collaborators in the SWD trap network, the New York Counties where monitoring took place and the crops in which traps were located. 'Wild edge' indicates a hedgerow or a forested edge of the crop.

| Name | Counties | Crops |
|---|---|---|
| Agnello | Ontario, Wayne | Cherry |
| Armata | Herkimer | Caneberry |
| Bachman | Erie | Caneberry, blueberry |
| Breth | Monroe, Niagara, Orleans | Caneberry, blueberry |
| Carlberg | Chautauqua | Caneberry |
| Carroll | Cayuga, Niagara, Onondaga, Orleans, Schuyler, Wayne | Cherry, strawberry, caneberry, blueberry |
| Cook | Dutchess, Ulster | Caneberry, blueberry, DN strawberry, wild edge |
| Fargione | Columbia, Ulster | Cherry, wild edge |
| Hetzler | St. Lawrence | Caneberry, blueberry, currant |
| Ivy | Clinton | Blueberry, wild edge |
| Jentsch | Orange | Cherry, caneberry, blueberry |
| Loeb | Monroe, Ontario, Schuyler, Seneca, Tompkins, Yates | Strawberry, caneberry, blueberry, wild edge |
| Loeck | Tioga | Caneberry |
| McDermott | Albany, Columbia, Rensselaer, Saratoga, Washington | Caneberry, blueberry, DN strawberry, wild edge |
| Mehlenbacher | Steuben | Blueberry |
| Miller | Oneida | June strawberry |
| O'Connell | Ulster | Blackberry |
| Thorp | Livingston | Caneberry |
| Zaman | Suffolk | Caneberry, peach, apple, blueberry, grape, wild edge |

# SPOTTED WING DROSOPHILA TRAP NETWORK 2013 *(continued)*

**Table 2.** Preliminary data for first SWD trap catch dates in NY by County. 'Wild edge' indicates a hedgerow or a forested edge of the crop and the crop is indicated in parentheses if no SWD was found in the trap placed in the crop. Preliminary data for GDD and day length are given and derived from NEWA and the Solar Topo Day length calculator, respectively.

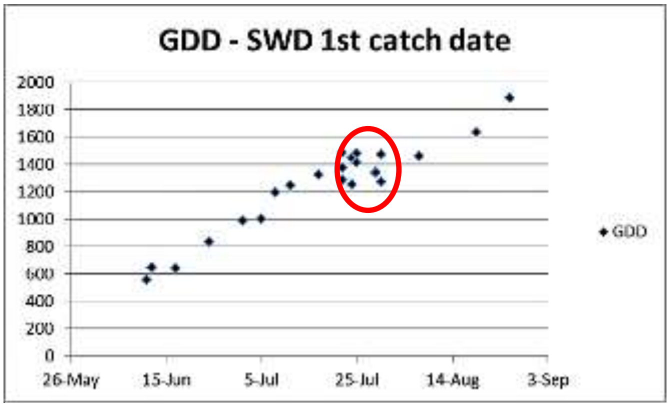
| County | Plant or Crop | 1st Trap Catch | GDD | Day Length |
|---|---|---|---|---|
| Ontario | Blueberry edge | 11-Jun* | 554 | 15:14 |
| Suffolk | Wild edge & raspberry | 12-Jun | 650 | 15:07 |
| Orange | Wild edge & raspberry | 17-Jun | 640 | 15:05 |
| Ulster | Wild edge & blackberry | 24-Jun | 834 | 15:09 |
| Dutchess | Sweet cherry | 1-Jul | 990 | 15:05 |
| Yates | Blueberry | 5-Jul | 1001 | 15:09 |
| Columbia | Stone fruit orchard | 8-Jul | 1193 | 14:52 |
| Schuyler | Wild edge (blueberry) | 11-Jul | 1247 | 15:01 |
| Seneca | Blueberry | 17-Jul | 1325 | 14:54 |
| Wayne | Cherry & DN strawberry | 22-Jul | 1374 | 14:48 |
| Rensselaer | Wild edge (blueberry & HT raspberry) | 22-Jul | 1287 | 14:44 |
| Washington | Wild edge (blueberry) | 22-Jul | 1483 | 14:47 |
| Livingston | Raspberry | 24-Jul | 1252 | 14:40 |
| Tompkins | Blackberry | 24-Jul | 1447 | 14:40 |
| Cayuga | Sweet cherry & raspberry | 25-Jul | 1416 | 14:40 |
| Onondaga | Sweet cherry & raspberry | 25-Jul | 1481 | 14:41 |
| Clinton | Wild edge (blueberry) | 29-Jul | 1344 | 14:52 |
| Tioga | HT raspberry | 29-Jul | 1336 | 14:29 |
| Niagara | Raspberry | 30-Jul | 1273 | 14:31 |
| Orleans | Sweet Cherry | 30-Jul | 1475 | 14:31 |
| Chautauqua | Raspberry | 7-Aug | 1458 | 14:07 |
| St. Lawrence | Black currant | 19-Aug | 1632 | 13:48 |
| Herkimer | Wild edge & raspberry | 26-Aug | 1888 | 13:23 |

* Not sustained trap catch, i.e. SWD not caught the following week.

Traps that were placed in June strawberries and monitored until after harvest, typically did not catch SWD, e.g. in Oneida and Niagara Counties. In contrast, at some locations, traps that were set in blueberries failed to catch SWD, but larvae were found in fruit, e.g. in Steuben County. Grapes suffered low to no damage, though SWD oviposition was observed in intact berries. A sweet cherry orchard in the lower Hudson Valley suffered significant fruit infestation, though sweet cherry in the upper Hudson Valley and Western NY escaped damage. Damage in blueberries, as expected, was influenced by the timing of maturity of the cultivar. Infestations were noted in day-neutral strawberries. Crops most heavily damaged were fall raspberries and blackberries. The earliest fruit-bearing, wild host identified to date is honeysuckle, *Lonicera tartarica*, a common invasive shrub in NY.

Most berry crops grown in NY are for U-pick or direct markets. Insecticide applications appear to have provided acceptable levels of control in 2013, even in cases where only two early applications were made as fruit were beginning to ripen. Concentrating U-pick customers in berry plantings to aid in clean-picking was cited by some growers as an effective tactic in SWD management. The occurrence of only one susceptible fruit crop on a farm may also have an effect in reducing crop injury. Late-season first trap catch may be related to isolation of the crop in areas outside of commercial fruit production regions, e.g. Herkimer and St. Lawrence Counties. More research on SWD management is needed to address optimal insecticide timings, crop diversification, landscape ecology, and effective cultural management tactics.

# SPOTTED WING DROSOPHILA TRAP NETWORK 2013 *(continued)*



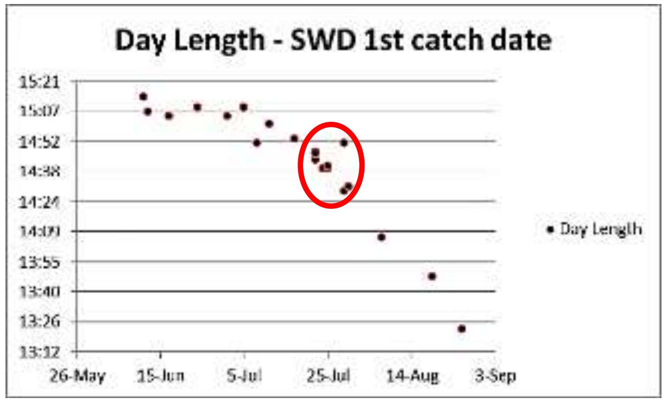




**Figure 2.** Preliminary data for growing degree days (GDD), on left, and day length (hr:min), on right, plotted against the first trap catch dates in the 2013 trap network in New York. The median and mode date was July 22. With July 24 and 25, these dates accounted for 30% of the first trap catch dates, while the eight day period from July 22 to July 30 accounted for 48%. The GDD and day length for these dates ranged from 1252 to 1483 and 14:29 to 14:52, respectively (circle).

The quick reference tables of insecticides were distributed relatively frequently to growers and may prove to be a useful approach to disseminating this type of information from the Cornell Guidelines. Information and photos (Figure 3) posted on the SWD blog were used, with permission, for newspaper articles on SWD.

The NY trap network appears to have proven successful in accomplishing its primary goal of monitoring for first trap catch of SWD and disseminating information to growers.
*(Reprinted from: Proceedings of the 2014 Empire Producers EXPO, Syracuse, NY.)*


**Figure 3**. SWD male on blueberry, photo posted on the blog, blogs.cornell.edu/swd1/2013/09/05/swd-easily-found-now/.

***SWD Online Resources***

**Spotted Wing Drosophila blog** blogs.cornell.edu/swd1/

***Subscribe to the SWD blog*** to get the latest information on SWD. First trap catch locations and dates are posted on the blog. Subscribe directly on the blog website or contact Juliet Carroll at jec3@cornell.edu.

*Who's monitoring SWD in NY?* SWD blog for May 2013.
blogs.cornell.edu/swd1/2013/05/31/swd-monitoring-in-ny/

**Spotted Wing Drosophila website**
www.fruit.cornell.edu/spottedwing/

**Spotted Wing Drosophila Biology and Life Cycle**
www.fruit.cornell.edu/spottedwing/bio.html

**Spotted Wing Drosophila Crops of Concern and Wild Hosts**
www.fruit.cornell.edu/spottedwing/cropshosts.html

**Recognize Fruit Damage from Spotted Wing Drosophila**
ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/19525/em9021.pdf

**Spotted Wing Drosophila Identification Guide**
www.ipm.msu.edu/uploads/files/MSU-SWD-ID.pdf

**Spotted Wing Drosophila Monitoring Traps**
www.fruit.cornell.edu/spottedwing/pdfs/SWDTraps_CornellFruit.pdf

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# 2014 - Spotted Wing Drosophila (SWD) Monitoring Traps

Juliet Carroll, Fruit IPM Coordinator, NYS IPM Program
*Based on methods tested by Steven Alm, Dept. of Plant Sciences and Entomology, University of Rhode Island, Richard Cowles, Connecticut Agricultural Experiment Station and Greg Loeb, Dept. of Entomology, Cornell University.*

Research continues, to improve SWD traps and baits. As improvements are made, this fact sheet will be updated and posted on www.fruit.cornell.edu/spottedwing/. Revision date June 16, 2014.

## Materials for One Trap

- 16 oz Red Plastic Party Cup
- Plastic Drink Cup lid (*fragile, may need extras*)
- 4.5 oz Specimen Container graduated wide mouth with screw lid
- No-see-um fabric netting (*mesh size < 1 mm to prevent SWD from entering yeast solution*)
- 2-3 ft of plastic coasted wire (*twist tie wire on a spool with cutter is convenient*)

**Fermenting Dough Bait recipe**
*– enough for one specimen container*
1/2 tsp Sugar (2 g)
1/8 tsp dry active bread yeast (0.325 g)
2 TBsp whole wheat flour (17.25 g)
1/5 tsp apple cider vinegar* (1 mL)
1 fl oz water* (25 mL)

*The proportion of apple cider vinegar to water is 1:25. A stock solution can be made with 950 mL water plus 38 mL apple cider vinegar.

**Vinegar Drowning Solution recipe**
Apple cider vinegar
drop Unscented** dish detergent

**Unscented detergent may be difficult to obtain, read ingredients.

## Other Materials

Black electrical tape; hole punch tool (McGill Punchline Hole Punch, 1/8 inch round, 2 inch reach); No-see-um fabric mesh pieces (6x6” and 4x4”); paper towels; squirt bottle; small artist brush; funnel, 6 inch diam (15.24 cm); dump containers for filtering trap contents into; bamboo poles or stakes; flagging tape; sandwich bags; sharpies; cooler; freeze packs.

## Methods for Making a Trap

1. Make a circular ring hanger for the cup out of the wire. This makes it easy to remove the cup and collect the samples. Leave sufficient length of wire to hang the cup on a branch or pole.

2. Make 40 holes around the cup, preferably within the strip of black tape. Leave a wide area without holes to pour out the drowning solution. The holes should be 1/8$^{th}$ inch diam (2 to 3 mm). A glue gun tip or a hole punch will melt/cut holes without cracking the cup.

3. Make the ampule to hold the dough bait. Cut out the inside of the lid leaving a ring. Cut a 4x4 inch (10x10 cm) piece of the mesh fabric. The fabric will be held in place over the specimen cup with the cut-out lid.

4. Assemble trap components. Assembly and addition of baits can easily be done in the field.

Viewed from above, the ampule fits inside cup and floats on the drowning solution.

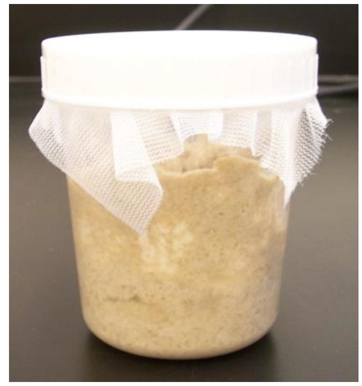
Hanger made from twist tie spool wire.

Holes cut near top lip of cup (black electric tape for enhanced color stripe).

Red cup trap and specimen container assembly for the dough bait ampule.

## Methods for Setting up a Trap

1. The afternoon before servicing traps, prepare the bait. Put dry ingredients (yeast, sugar, flour) in the specimen cup and combine. Add liquid ingredients (water, vinegar) and stir to mix. Put on mesh and cut lid. Store in the refrigerator overnight. Place in cooler to take out to field the next day.



Ampule with dough bait, after 5 days at room temperature. Mixed dough will initially fill about one third of the volume, allowing enough head space for dough to rise.

2. In the field, pour the vinegar drowning solution into the red plastic cup until it is about 2 inches deep.

3. Place the dough bait ampule into the trap. It will float in the vinegar drowning solution.

4. Put on the cup lid and hang the trap on a branch, bamboo pole or stake using the wire hanger. Place traps in the plant canopy so they are shaded.

5. Label the trap with a code number for your records. (Record the trap GPS coordinates, if needed.)

6. Collect trapped insects and change the drowning solution and bait once per week.



Hang traps with plastic-coated wire in or near the canopy.

## Methods for Collecting the Insects

1. Remove the trap from the wire hanger and bring to the collection point (field vehicle). Remove the dough bait ampule and set aside. Label a plastic bag with trap number, farm name, and date.

2. Pour the drowning solution through a 6x6 inch piece of fabric mesh in a funnel so the drowning solution pours into a waste container and the flies are collected on the mesh.

3. To collect insects that stick to the sides of the cup or the ampule, use a squirt bottle, artist brush or flick the sides of the cup.

4. Place the mesh containing the collected insects into the labeled plastic bag. Place in a cooler, if out in the field.

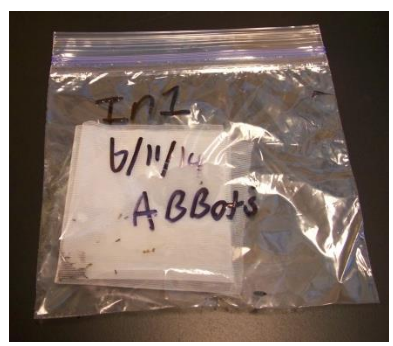
5. Wipe out the trap cup, if needed. Replace cracked or broken lids.

6. Refill the trap as described on page 3 and re-hang it.

7. Refrigerate collected specimens until you can count the SWD.

Collect insects by pouring the vinegar drowning solution through a piece of mesh fabric.

Insects can be collected from the ampule surface with a squirt bottle.




Place mesh fabric filter in a labeled plastic bag and into the cooler.

# ASSESSMENT OF LURES FOR MONITORING ADULT SWD

*Greg Loeb, Stephen Hesler, Johanna Elsensohn, and Ash Sial, Cornell University Dept. of Entomology*

Spotted Wing Drosophila (SWD) *Drosophila suzukii*, originally from Asia, is a new invasive fruit pest that became established in NY and surrounding states in 2011. Unlike other fruit flies that typically only infest overripe and rotten fruit, female SWD can oviposit in ripe fruit thereby making them unmarketable. Soft-skinned fruit, particularly berry crops, are at greatest risk. Berry growers are facing numerous challenges with regards to SWD. An effective monitoring program that provides an early warning of imminent infestation is of paramount importance. The standard adult monitoring tool, using a deli cup with apple cider vinegar as the attractant, eventually captures many SWD and other fruit flies. However, our results for 2012, as well as the results of other investigators, indicate that adult flies are often first caught after infestation has already occurred. In the absence of a better early warning system, growers are probably better off to initiate insecticide treatments as soon as vulnerable fruit begins to ripen, even though this could result in unnecessary costs (economic and environmental). Therefore, in 2013 we initiated a project in New York, along with colleagues in other states across the country, to assess the effectiveness and practicality of new lures and/or lure placement as an early warning of impending infestation.

Our experiment was conducted at two sites in the Finger Lakes Region of NY with a history of SWD infestation and high populations in the fall of 2012. Site 1 was a mixed planting that included June-bearing strawberries, floricane-fruiting raspberries and various stone fruits. Site 2 was an isolated blueberry planting bordered by woods and soybeans. Adult SWD were monitored using standardized deli cup traps baited with one of five lure treatments: apple cider vinegar, fermenting yeast-sugar-water mixture, separate fermenting whole wheat mixture with apple cider vinegar-ethanol drowning solution, DroskiDrink (apple cider vinegar-red wine-raw sugar mixture), and a water control. At site 2 a sixth synthetic lure treatment was included. This was a prototype lure that is currently not commercially available. Traps were deployed the week of 27-May 2013 with the exception of the synthetic lure baited traps that were deployed the week of 1-Jul. Replicate traps were monitored and serviced weekly for 12 weeks, thru the week of 19-Aug. In addition, four replicates of each lure treatment were placed along the wooded perimeter of both sites in close proximity to the fruit plantings. Potential wild hosts, including wild black raspberry, wild blackberry, bush honeysuckle, dogwood, pokeweed, and buckthorn, were noted in the wood perimeter of both sites. When the respective crops began to ripen, fruit samples were collected from each site and held in rearing containers under ambient laboratory conditions until adult emergence at which time total adult fruit flies were quantified. Similar methods were used by our cooperators in New Jersey, North Carolina, Michigan, Maine, Arkansas, Minnesota, Oregon, Washington, and Wisconsin.

The seasonal occurrence of SWD followed a similar pattern as had been observed during the season of 2012. First detection was from the week of 10-Jun in a trap baited with the separate fermenting dough mixture in a woods perimeter (Table 1). This date was 3 weeks earlier than recorded in 2012. In 2012 the trap lure used was apple cider vinegar. The date of first capture in 2013 using apple cider vinegar was within 7d of the calendar date of first capture in 2012. Results comparing different lures (Table 1) indicates that the separate fermenting bait + apple cider vinegar drowning solution lure provided the first capture at both sites, and generally captured the most flies during each sampling interval. In weeks that the synthetic lure was deployed at site 2, captures were comparable, and sometimes surpassed, total captures in fermenting dough +apple cider vinegar baited traps. Other baits including apple cider vinegar, yeast-sugar-water mixture, and DroskiDrink consistently captured fewer flies than either the fermenting bait + apple cider vinegar or synthetic baited traps. Overall total captures of adult SWD in traps was greater in the raspberry crop compared to blueberry.

Date for first trap catch and first reared SWD from raspberry fruit for site 1 occurred in the same week. It should be noted that the grower did elect to treat with insecticide after detection of SWD. Higher rates of infestation were found in fruit at the end of the fruiting season as fruit was becoming scarcer, and the grower was no longer harvesting. Date for first trap catch at site 2 was on 11-Jun, from a woods trap. First trap catch from traps in the crop occurred the week of 15-Jul. First reared SWD from blueberry fruit for site 2 occurred the week of 22-Jul.

Early season monitoring with various lure treatments provided some important information concerning our objective of using monitoring as an early warning for SWD infestation. Fermenting bait + ACV drowning

# ASSESSMENT OF LURES FOR MONITORING ADULT SWD *(continued)*

solution and the synthetic lure provided higher rates of SWD capture than other baits assessed in this trial. At site 1 trap catch in the crop and woods preceded measured fruit infestation by three days. At Site 2 trap catch in the crop preceded measured fruit infestation by 7 days and trap catch in the woods preceded infestation by over a month. Trap captures in crops and infestations occurred within one week of each other at our two study sites. At this time the level of infestation was relatively low (4 to 17 berries per 1000). Hence, traps baited with an attractive lure such as fermenting dough may be adequate as an early warning in susceptible crops such as summer raspberry and blueberry to initiate control measures under some circumstances, although this needs to be tested at more sites over more years.

We want to thank the many researchers, extension educators, and growers who worked with us during 2013 to address this new threat to berry production in NY. We would like to thank Gabrielle Brind-Amour, McKenzie Schessl, and Allison Wentworth for their assistance both in the field and the lab in completing this research. Funding for this project was provided from several sources, including the North American Raspberry and Blackberry Association, North American Strawberry Growers Association, NY Dep.t of Ag and Markets Specialty Crops Program, USDA NIFA, and New York Berry Growers Association.

*(Reprinted from: Proceedings of the 2014 Empire Producers EXPO, Syracuse, NY.)*

**Table 1.** Total number of spotted winged drosophila captured in four 32-oz. deli-cup traps with different bait treatments), from different habitats at two sites in Geneva, NY. Shade color shows density (higher numbers in orange to red)

| Week---> | 27-May | 3-Jun | 10-Jun | 17-Jun | 24-Jun | 1-Jul | 8-Jul | 15-Jul | 22-Jul | 29-Jul | 5-Aug | 12-Aug | 19-Aug | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Site 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 14 | 60 | 89 | 224 | 529 | 1130 | 2048 |
| Raspberry | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 | 4 | 19 | 110 | 403 | 530 | 1071 |
| Apple Cider Vinegar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 62 | 62 | 126 |
| DroskiDrink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 10 | 14 | 102 | 99 | 226 |
| Fermenting Bait + ACV/ETOH | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 2 | 62 | 153 | 281 | 502 |
| Water/Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 |
| Yeast + Sugar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 | 5 | 32 | 86 | 88 | 215 |
| Strawberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | | | 0 |
| Apple Cider Vinegar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | 0 |
| DroskiDrink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | 0 |
| Fermenting Bait + ACV/ETOH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | 0 |
| Water/Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | 0 |
| Yeast + Sugar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | x | x | x | x | x | 0 |
| Woods | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 | 56 | 70 | 114 | 126 | 600 | 977 |
| Apple Cider Vinegar | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 14 | 6 | 15 | 26 | 63 |
| DroskiDrink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 17 | 33 | 15 | 80 | 159 |
| Fermenting Bait + ACV/ETOH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 25 | 11 | 46 | 50 | 433 | 570 |
| Water/Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Yeast + Sugar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 17 | 28 | 29 | 46 | 61 | 185 |
| Site 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 | 58 | 204 | 465 | 660 | 1645 | 3036 |
| Blueberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 21 | 137 | 301 | 449 | 542 | 1453 |
| Apple Cider Vinegar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 7 | 41 | 59 | 112 |
| DroskiDrink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 32 | 44 | 51 | 82 | 210 |
| Fermenting Bait + ACV/ETOH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 12 | 26 | 116 | 88 | 119 | 362 |
| Scentry Lure | x | x | x | x | x | 0 | 0 | 1 | 5 | 52 | 55 | 103 | 107 | 323 |
| Water/Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 |
| Yeast + Sugar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 23 | 79 | 165 | 174 | 444 |
| Woods | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 37 | 67 | 164 | 211 | 1103 | 1583 |
| Apple Cider Vinegar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 3 | 57 | 48 | 110 |
| DroskiDrink | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 13 | 50 | 13 | 171 | 269 |
| Fermenting Bait + ACV/ETOH | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 4 | 13 | 50 | 59 | 388 | 515 |
| Scentry Lure | x | x | x | x | x | 0 | 0 | 0 | 5 | 29 | 17 | 30 | 425 | 506 |
| Water/Control | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Yeast + Sugar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 10 | 44 | 52 | 71 | 183 |
| **Grand Total** | **0** | **0** | **1** | **0** | **0** | **1** | **1** | **17** | **118** | **293** | **689** | **1189** | **2775** | **5084** |

# YEAR-ROUND SPOTTED WING DROSOPHILA MONITORING AND FRUIT DAMAGE ASSESSMENT

*Faruque Zaman and Dan Gilrein, Cornell Cooperative Extension of Suffolk County*

Spotted wing drosophila (SWD) has emerged as a serious pest to many specialty crops in the United States. Since its detection in 2011 in New York, SWD is considered one of the major insects affecting small-fruit production on Long Island. Year-round monitoring of SWD populations and damage in cultivated and wild areas was done in 2012 and 2013. 20 monitoring traps were placed in raspberries, blackberries, peaches, apples, blueberries, grapes, and adjacent forests in eastern Long Island locations. Similar to 2012, first sustained SWD capture on Long Island occurred between 12 – 19 June in raspberries in 2013 (approx. 650 GDD from Jan 1). Combining trap data from all sites, adult numbers increased as the season progressed, dropping off with onset of cold weather (Figure 1). Very high trap counts in late fall may be related to both the very high population present particularly in protected forest areas, as well as the absence of hosts.

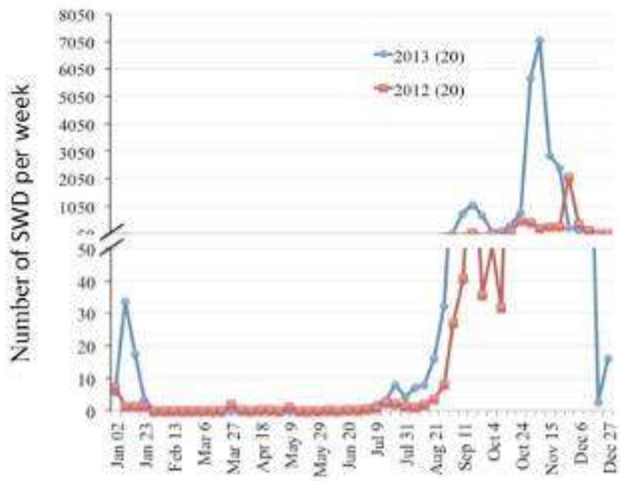
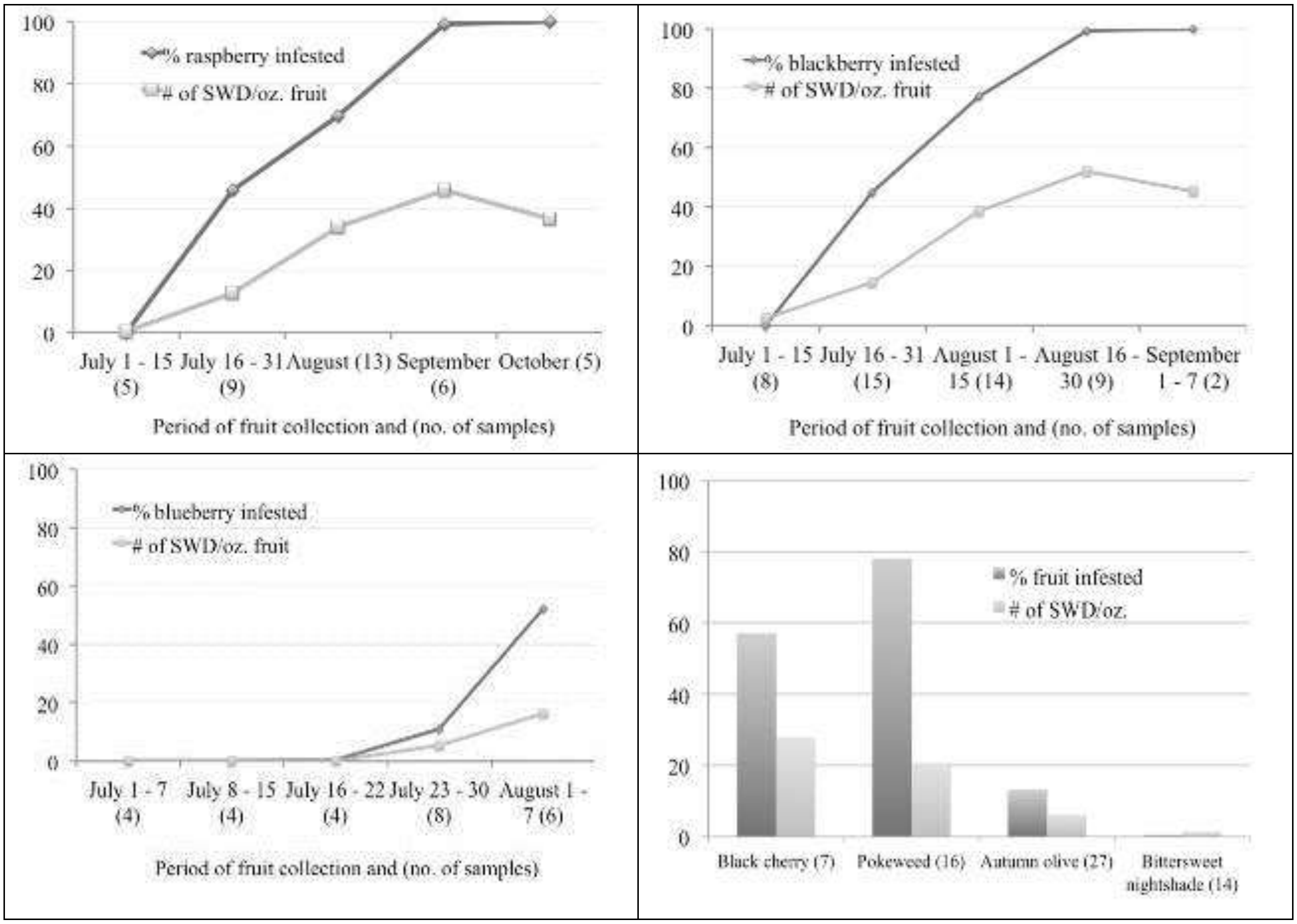



***Figure 1:*** *Average number of spotted wing drosophila adults captured per week in traps around eastern Long Island in 2012 and 2013. Numbers in parentheses are the number of monitoring traps placed in various locations.*

Raspberries and blackberries were heavily damaged by SWD in 2013 starting late July. Intensive fruit damage assessments were done weekly by holding samples from 3 commercial farms in the laboratory for rearing. Raspberry fruit infestation levels rose from about 10% in late July to 70% in August and 99% by September. Blackberries followed a similar pattern, increasing from 45% in July to 77% in mid-August and 100% thereafter. Blueberries were little affected by spotted wing drosophila until late July. Less than 1% blueberries were found infested in samples taken around July 17. The following week less than 2% were infested, but samples collected from July 31 – August 7 (harvest ends) found about 48% infestation. On Long Island blueberry acreage is small with 90% of fruit harvested by late July, when SWD pressure increased sharply. Raspberries, blackberries and blueberries ripening around late July or early August onwards appear to be at significant risk of SWD damage.

Grape damage was assessed intensively from just prior to ‘Chardonnay’ harvest to the end of the wine grape season. A total of 102 four-ounce samples were collected from several vineyards at the beginning of August through harvest end. Grape clusters collected were apparently intact without evidence of damage or infestation and immediately placed in rearing containers. Berries were separated from clusters with stems and checked under the microscope for evidence of SWD oviposition. No SWD oviposition was observed on fruit in early September. However, after mid-September low level of SWD infestation was found in some red cultivars (‘Pinot Noir,’ ‘Merlot,’ and ‘Cabernet Franc’). Some ‘Merlot’ samples collected from near forest borders have shown unusually high levels of SWD infestation. In early October, infestation levels as high as 50% were observed in both “Merlot” and “Cabernet” grapes in some samples from two vineyards. It should be noted that overall grape damage was less than 2% and infestation appears to be almost entirely limited to border rows and occurs very close to harvest, so we believe this level of damage has very minimal impact, if any, on fruit quality. Also, fruit infestation in red grapes in 2012 was low, mostly found in border rows and much lower than in 2013. Similar to last year, we did not find any infestation in ‘Chardonnay’ in 2013. It is clear that grape is significantly less preferred over other kinds of small fruit and lack of more preferred hosts in fall together with the very high SWD populations present might explain the limited infestation in grapes. However, we did note high levels of common fruit fly, *Drosophila melanogaster*, eggs on some varieties. We plan to continue monitoring grape infestation levels in 2014, to assess the consistency of our observations given normal variations in weather, crop condition and SWD population levels from year to year.

# YEAR-ROUND SWD MONITORING AND FRUIT DAMAGE ASSESSMENT *(continued)*




Wild fruit, which can serve as an alternate host for SWD, was sampled (66 four-ounce samples) in areas growing adjacent to fruit orchards to determine what kinds and when they may be infested. Black cherry, *Prunus serotina*, a native plant commonly found in forest and landscapes around Long Island, appears to be among the earliest and most preferred wild hosts (12-90% fruit infested) of SWD, ripening around late July, followed by pokeweed berries (native, ripening around mid-August, 40-90% fruit infested), bittersweet nightshade (invasive, ripening around late August, <15% fruit infested), and autumn olive (invasive, ripening around mid-September, 10-80% fruit infested).

We are currently conducting an experiment on the effect of post-harvest cold treatment for SWD damage control in raspberries. Fresh SWD oviposited (0 - 48 hours old) raspberries (12 berries/condition) were held at 2C (36F) in growth chamber for various durations and compared SWD larval development with infested fruits held in room temperature (69 – 72 F). Preliminary findings from this trial have shown in figure 3. Further details will be presented in future meetings and publications.

Both trap and fruit infestation data collected since 2011 on Long Island, and information from studies done elsewhere, have shown more clearly what Long Island crops are at greatest risk of damage from this new invasive pest. Brambles and possibly blueberries harvested after late July have been most consistently and severely affected, wine grape fortunately do not appear to be at risk though a small amount of very late-season damage has been seen in some red varieties.

# YEAR-ROUND SWD MONITORING AND FRUIT DAMAGE ASSESSMENT *(continued)*

**Acknowledgements**: Many thanks to Kevin Dichtl for his assistance with the study and The Friends of Long Island Horticulture for funding the work.

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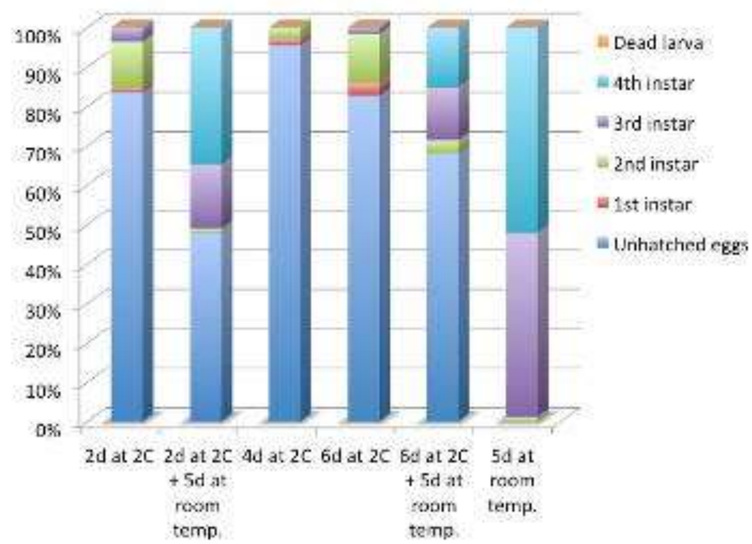


***Figure 3.*** *(right) Development of spotted wing drosophila eggs after incubating infested raspberries at 2C (36F) in growth chamber for various durations.*

# STRATEGIES FOR LATE SEASON SWD MANAGEMENT

*Peter J. Jentsch, Cornell University Dept. of Entomology*

Native to southeast Asia, the spotted-wing drosophila (SWD), ***Drosophila suzukii*** (Matsumura 1931), was widely observed throughout parts of Korea, and China prior to its identification in Japan in 1913. Its 1980 arrival into the United States as an invasive pest threat began in Hawaii, appearing in central California by August of 2008, spreading into Washington, Oregon and Florida the following year. By 2011 the SWD has become widespread, captured in Utah, Louisiana, Arkansas, Kentucky, Tennessee, North and South Carolina, Wisconsin, Michigan, West Virginia and Virginia, Maryland, Pennsylvania, New Jersey, New York and all of the New England States (Image 1). The pest has also been found in Europe, including the countries of Italy, France, and Spain. In NY the first SWD flies were captured in apple cider vinegar traps in the experimental vineyard at the Hudson Valley Laboratory in Highland late in August of 2011. Damage to small fruit was first reported in late raspberry grown organically in Ancram, NY, by Laura McDermott, a Regional CCE Specialist in the Capital District.

The SWD female differs from other vinegar flies in possessing a unique ovipositor, capable of inserting eggs into un-ripened fruit, which gives them a biological advantage over other *Drosophila*. Thus the SWD can reproduce on fruit earlier in the season to outcompete other fly species, producing as many as 13 generations per year in Asia, with 6-9 generations predicted for NY depending on the season. Another advantage this fly has is its use of multiple hosts including *Cornus kousa*, dogwood, *Eugenia uniflora*, Surinam cherry, *Fragaria ananassa*, strawberries, *Morus spp*., mulberry, *Murraya paniculata*, orange jasmine , *Myrica rubra*, Chinese bayberry , *Prunus spp.* - *P. avium*, sweet cherries; *P. domestica*, plums; *P. persica*, peaches, *Pyrus pyrifolia*, Asian pears, *Ribes spp*., currants, *Rubus spp. - R. armeniacus*, Himalayan blackberries; *R. loganobaccus*, loganberries; *R. idaeus,* raspberries; *R. laciniatus,* evergreen blackberries; *R. ursinus,* marionberries, *Vaccinium spp.*, blueberry, cranberry, *Vitis vinifera*, wine grape. In NY it has been reared from. The tartarian honeysuckle, *Lonicera tatarica*, is an invasive plant that also hails from Asia and Siberia. It grows along the wooded edges of agricultural crops, carrying red berries in pairs that become heavily infested with SWD by early July. In the Hudson Valley, SWD developed in very high numbers on this host in the spring of 2013, providing an ideal reproductive site for the fly to disperse to small fruit later in the month as fruit became available (Image 2). The black cherry*, Prunus serotina*, A woodland tree species, is also a preferred wild host for SWD. This tree grows in forests and landscapes throughout the Northeast and is native to North America. On

# STRATEGIES FOR LATE SEASON SWD MANAGEMENT *(continued)*

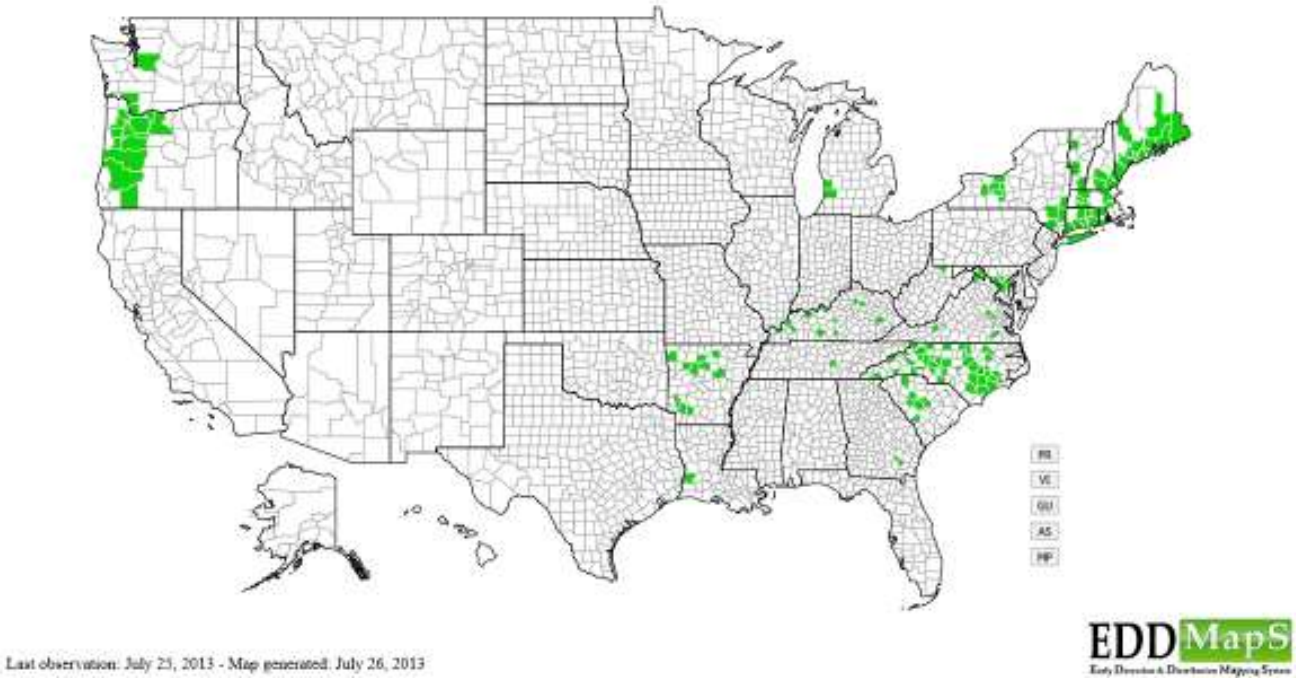


***Image 1.***

Long Island, recent observations by Faruque Zaman, Suffolk County Cornell Cooperative Extension, showed 90% infested fruit with SWD. On average, 112 adult SWD emerged after incubating 4 oz. samples of black cherry fruit in the lab. In Long Island, it appears that black cherry is the earliest wild host utilized by SWD. Pokeweed, *Phytolacca acinosa*, another known wild host of SWD, is found to have 80% infested fruit in late August. Fruit of these two wild hosts appear to be the most preferred in late summer and early fall, providing an additional point source of SWD along agricultural edge late into the growing season.

Over the past two years we have seen SWD spread throughout the fruit growing regions of the Hudson Valley and Lake Champlain in western NY in 26 NY counties (http://www.fruit.cornell.edu/spottedwing/dist.html). Across the Hudson Valley of NY, Suffolk County of Long Island and Hampshire County, Massachusetts, the first SWD captures occurred during the week of June 10th. Through the use of yeast and vinegar baited traps we have observed the fly nearly one month earlier then in 2012. Traps hung on 1 May in small fruit plantings of raspberry and blackberry throughout the lower Hudson Valley captured SWD 2 weeks prior to fruit infestations. The sustained capture of SWD flies prior to egg laying provided growers with a pest management start date to initiate preventative treatment. However, under the best of pest management programs in raspberry and blackberry, following a 3 to 4 day application schedule, rain events combined with pick-your-own weekend schedules forced application delays of up to 7-days, allowing SWD to infest fruit beyond rescue. All growers in the programs monitored by the ENY Fruit Team had infestation levels exceeding 17% using the best materials under tight treatment protocols.

Given the need for very tight insecticide schedules, insecticide labeled constraints and the need for resistance management strategies; it is likely that complete control of the SWD is unlikely, even under the most diligent of management programs. The perpetual regenerations and presence of all stages of the SWD life cycle provides insulation, in the form of egg, larva and pupa within the host fruit, to escape most insecticide applications. Under the best scenario, infestations can be significantly reduced by tight management intervals, with commitment to using a 3-4 day pest management program being the essential component to success. To improve on this strategy, cultural management considerations should also be undertaken. Creating a less favorable environment for SWD reproduction should begin by maintaining an open canopy through pruning to

# STRATEGIES FOR LATE SEASON SWD MANAGEMENT *(continued)*

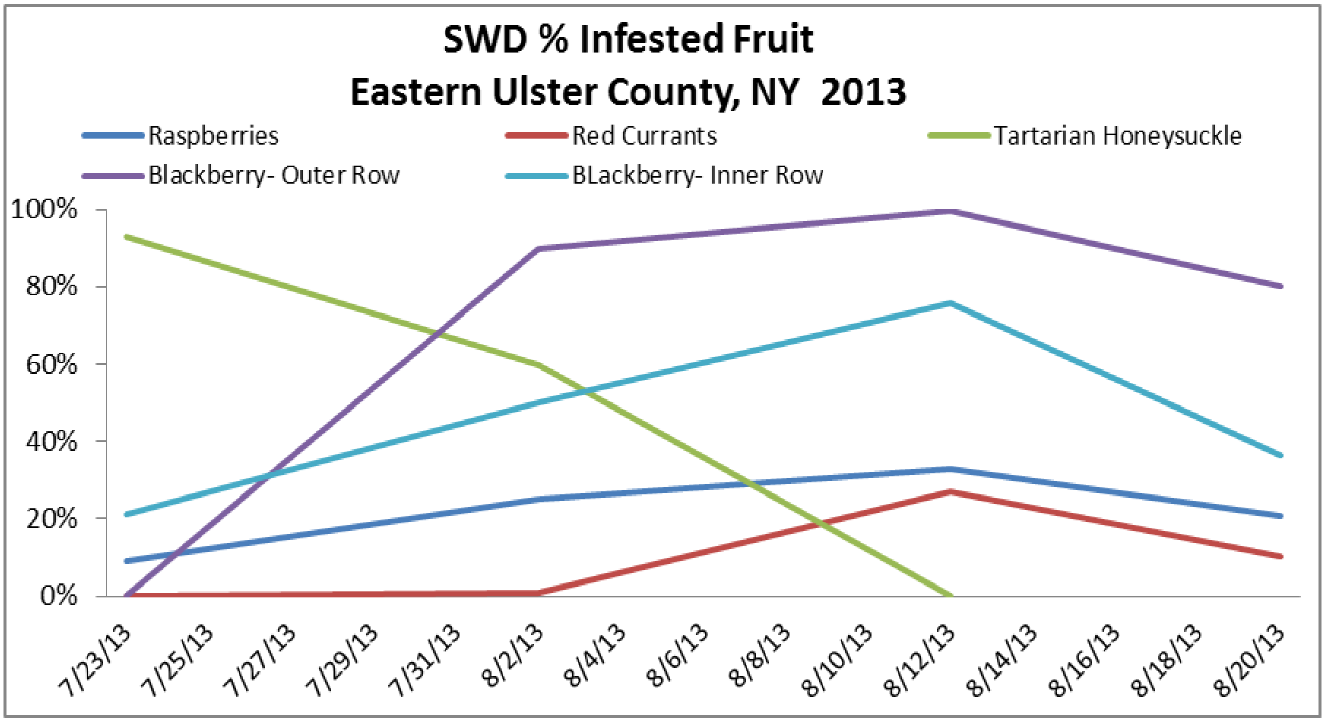


***Image 2.*** *Chart representing field collected small fruit from a commercial berry patch and the boarder host Tartarian Honeysuckle, Lonicera tatarica, Marlboro, NY, 2013.*

increase sunlight and reduce humidity while improving spray coverage. Drip lines should be installed 'in-ground' instead of using overhead irrigation when possible. Removal of infested fruit through cane and ground sanitation will reduce SWD emergence, reducing fly populations. Harvesting frequently and completely will prevent the buildup of ripe and over-ripe fruit. Unmarketable fruit should be removed from the field and either frozen, "baked" in clear plastic bags placed in the sun, or disposed of in bags off-site, killing the larvae and preventing adult emergence. Insecticide sprays directed at the SWD adults will reduce egg-laying. Begin insecticide treatments at the first SWD trap catch prior to fruit ripening. Treatments should be applied on a 3 to 4 day schedule, repeated after 1 inch of rain. During July and August the insect can reproduce quite quickly, every 10 to 14 days. Select only the most effective insecticides, rotating insecticide modes of action on a 10-14 day interval during peak flight periods.

**A 2013 farm success story**: SWD was first found in Orange County, NY on 10 June, 2013. A successful pick-your-own operation in that county was able to keep infestation levels down to levels below 2% through to the end of July, then below 17% to the end of the season using a 3 to 7 day spray interval (as weather and pick-your-own scheduling would allow). Management was combined with near daily picking, often clean picking on weekends reducing the SWD population potential. Products were employed in 14-day rotational scheduling beginning with Malathion, and followed using alternations of Delegate, Danitol 2.4 EC, Triple Crown and Brigade WSB. His recommendation to the consumers, upon harvesting berries, was to keep fruit cold during storage, which successfully retained fruit quality. Success in this case was not defined by achieving complete control of the pest but by achieving customer satisfaction in fruit quality and an enjoyable farm / tourism experience.

*(Reprinted from: Proceedings of the 2014 Empire Producers EXPO, Syracuse, NY.)*

# May 2014 - *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, July29, 2013. No changes for 2014.*

## BLUEBERRIES

| PRODUCT | AI[1] | IRAC group | EPA# | Rate/A | REI[3] | DTH[4] | Max. Prod/A/yr (ai) | Total applic's | Spray Interval | Probable efficacy |
|---|---|---|---|---|---|---|---|---|---|---|
| ^@Entrust Naturalyte (2ee) | spinosad | 5 | 62719-282 | 1.25-2 oz | 4 hr | 3 d | 9 oz (0.45 lb) | 3 per crop | 6 d | Good to Excellent# |
| ^@Entrust SC (2ee) | spinosad | 5 | 62719-621 | 4-6 fl oz | 4 hr | 3 d | 29 fl oz (0.45 lb) | 3 per crop | 6 d | Good to Excellent# |
| @Delegate WG (2ee) | spinetoram | 5 | 62719-541 | 3-6 oz | 4 hr | 3 d | 19.5 oz (0.305 lb) | 6 | 6 d | Excellent# |
| Brigade WSG (2ee) | bifenthrin | 3A | 279-3108 | 5.3-16 oz | 12 hr | 1 d | 5 lb (0.5 lb) | - | 7 d | Excellent |
| Danitol 2.4EC | fenpropathrin | 3A | 59639-35 | 16 fl oz | 24 hr | 3 d | 32 fl oz (0.6 lb) | 2 | - | Excellent |
| Mustang Max Insecticide (2ee) | zeta-cypermethrin | 3A | 279-3249 | 4 fl oz | 12 hr | 1 d | 24 fl oz (0.15 lb) | 6 | 7 d | Excellent |
| Triple Crown | bifenthrin, imidacloprid, zeta-cypermethrin | 3A,4A | 279-3440 | 6.4-10.3 fl oz | 12 hr | 3 d | 31.0 fl oz (0.54 lb) | 5 | 7 d | Good to excellent |
| Imidan 70W | phosmet | 1B | 10163-169 | 1.33 lb | 24 hr | 3 d | 7.125 lb (5.0 lb) | 5 | - | Excellent |
| Lannate SP (2ee) | methomyl | 1A | 352-342 | 0.5 – 1.0 lb | 48 hr | 3 d | 4 lb (3.6 lb) | 4 | 5-7 d | Excellent |
| Lannate VP (2ee) | methomyl | 1A | 352-384 | 1.5-3.0 pts | 48 hr | 3 d | 12 pts (3.6 lb) | 4 | 5-7 d | Excellent |
| Malathion 5EC (2ee) | malathion | 1B | 19713-217 | 2.0 pts | 12 hr | 1 d | 6 pts (3.75 lb) | 3 | 5 d | Good |
| Malathion 5EC (2ee) | malathion | 1B | 66330-220 | 2.0 pts | 12 hr | 1 d | 6 pts (3.75 lb) | 3 | 5 d | Good |
| Malathion 8 Aquamul (2ee) | malathion | 1B | 34704-474 | 1.875 pts | 12 hr | 1 d | 3.75 pts (3.75 lb) | 1 | 5 d | Good |
| Malathion 57 (2ee) | malathion | 1B | 67760-40-53883 | 2.0 pts | 12 hr | 1 d | 6 pts (3.75 lb) | 3 | 5 d | Good |
| Assail 30SG | acetamiprid | 4A | 8033-36-70506 | 4.5-5.3 oz | 12 hr | 1 d | 26.7 oz (0.5 lb) | 5 | 7 d | Good# |
| ^Pyganic EC 1.4 | pyrethrin | 3A | 1021-1771 | 1 pt – 2 qts | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^Pyganic EC 5.0 | pyrethrin | 3A | 1021-1772 | 4.5 – 18 fl oz | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^AzaSol | azadirachtin | UN | 81899-4 | 6 oz in 50 gal | 4 hr | 0 d | - | - | - | Fair to Poor |

*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.

# May 2014 - *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, July29, 2013. No changes for 2014.*

## RASPBERRIES & BLACKBERRIES

| PRODUCT | AI[1] | IRAC group | EPA# | RATE/A | REI[3] | DTH[4] | Max. Prod/A/yr (ai) | Total applic's | Spray Interval | Probable efficacy |
|---|---|---|---|---|---|---|---|---|---|---|
| ^@Entrust Naturalyte (2ee) | spinosad | 5 | 62719-282 | 1.25-2 oz | 4 hr | 1 d | 9 oz (0.45 lb) | 3 per crop | 6 d | Good to Excellent# |
| ^@Entrust SC (2ee) | spinosad | 5 | 62719-621 | 4-6 fl oz | 4 hr | 1 d | 29 fl oz (0.45 lb) | 3 per crop | 6 d | Good to Excellent# |
| @Delegate WG (2ee) | spinetoram | 5 | 62719-541 | 3-6 oz | 4 hr | 1 d | 19.5 oz (0.305 lb) | 6 | 4 d | Excellent# |
| Brigade WSG (2ee) | bifenthrin | 3A | 279-3108 | 8.0-16 oz | 12 hr | 3 d | 2 lb (0.2 lb) | 1 post bloom | - | Excellent |
| Brigade EC (2ee) | bifenthrin | 3A | 279-3313 | 3.2-6.4 fl oz | 12 hr | 3 d | 12.8 fl oz (0.2 lb) | 1 post bloom | - | Excellent |
| Danitol 2.4EC | fenpropathrin | 3A | 59639-35 | 16 fl oz | 24 hr | 3 d | 32 fl oz (0.6 lb) | 2 | - | Excellent |
| Mustang Max Insecticide (2ee) | zeta-cypermethrin | 3A | 279-3249 | 4 fl oz | 12 hr | 1 d | 24 fl oz (0.15 lb) | 6 | 7 d | Excellent |
| Triple Crown | bifenthrin, imidacloprid, zeta-cypermethrin | 3A,4A | 279-3440 | 6.4-10.3 fl oz | 12 hr | 3 d | 10.3 fl oz (0.181 lb) | 1 post bloom | 7 d | Good to excellent |
| Malathion 5EC (2ee) | malathion | 1B | 19713-217 | 3.0 pts | 12 hr | 1 d | 9 pts (6.0 lb) | 3 | 7 d | Good |
| Malathion 5EC (2ee) | malathion | 1B | 66330-220 | 3.0 pts | 12 hr | 1 d | 9 pts (6.0 lb) | 3 | 7 d | Good |
| Malathion 8 Aquamul (2ee) | malathion | 1B | 34704-474 | 2.0 pts | 12 hr | 1 d | 6 pts (6.0 lb) | 3 | 7 d | Good |
| Malathion 57 (2ee) | malathion | 1B | 67760-40-53883 | 3.0 pts | 12 hr | 1 d | 9 pts (6.0 lb) | 3 | 7 d | Good |
| Assail 30SG | acetamiprid | 4A | 8033-36-70506 | 4.5-5.3 oz | 12 hr | 1 d | 26.7 oz (0.5 lb) | 5 | 7 d | Good# |
| ^Pyganic EC 1.4 | pyrethrin | 3A | 1021-1771 | 1 pt – 2 qts | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^Pyganic EC 5.0 | pyrethrin | 3A | 1021-1772 | 4.5 – 18 fl oz | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^AzaSol | azadirachtin | UN | 81899-4 | 6 oz in 50 gal | 4 hr | 0 | - | - | - | Fair to Poor |

*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.

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*Compiled by Greg Loeb, Cathy Heidenreich, Laura McDermott, Peter Jentsch, Debbie Breth, & Juliet Carroll, Cornell University, July29, 2013. No changes for 2014.*

## STRAWBERRIES

| PRODUCT | AI[1] | IRAC group | EPA# | RATE/A | REI[3] | DTH[4] | Max. Prod/A/yr (ai) | Total applic's | Spray Interval | Probable efficacy |
|---|---|---|---|---|---|---|---|---|---|---|
| ^@Entrust Naturalyte (2ee) | spinosad | 5 | 62719-282 | 1.25-2 oz | 4 hr | 1 d | 9 oz (0.45 lb) | 5 | 5 d | Good to Excellent# |
| ^@Entrust SC (2ee) | spinosad | 5 | 62719-621 | 4-6 fl oz | 4 hr | 1 d | 29 fl oz (0.45 lb) | 5 | 5 d | Good to Excellent# |
| @Radiant (2ee) | spinetoram | 5 | 62719-545 | 6-10 fl oz | 4 hr | 1 d | 39 fl oz (0.305 lb) | 5 | 3 d | Excellent# |
| Brigade WSG (2ee) | bifenthrin | 3A | 279-3108 | 5.3-16 oz | 12 hr | 0 d | 5 lb (0.5 lb) | - | 7 d | Excellent |
| Danitol 2.4EC | fenpropathrin | 3A | 59639-35 | 16-21.3 fl oz | 24 hr | 2 d | 42.7 fl oz (0.8 lb) | 2 | - | Excellent |
| Malathion 5EC (2ee) | malathion | 1B | 19713-217 | 3.2 pts | 12 hr | 3 d | 12.8 pts (8.0 lb) | 4 | 7 d | Good |
| Malathion 5EC (2ee) | malathion | 1B | 66330-220 | 3.2 pts | 12 hr | 3 d | 12.8 pts (8.0 lb) | 4 | 7 d | Good |
| Malathion 8 Aquamul (2ee) | malathion | 1B | 34704-474 | 2.0 pts | 12 hr | 3 d | 8 pts (8.0 lb) | 4 | 7 d | Good |
| Malathion 57 (2ee) | malathion | 1B | 67760-40-53883 | 3.2 pts | 12 hr | 3 d | 12.8 pts (8.0 lb) | 4 | 7 d | Good |
| Assail 30SG | acetamiprid | 4A | 8033-36-70506 | 4.5-5.3 oz | 12 hr | 1 d | 13.8 oz (0.26 lb) | 2 | 7 d | Good# |
| ^Pyganic EC 1.4 | pyrethrin | 3A | 1021-1771 | 1 pt – 2 qts | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^Pyganic EC 5.0 | pyrethrin | 3A | 1021-1772 | 4.5 – 18 fl oz | 12 hr | 0 d | - | - | - | Fair to Poor |
| ^AzaSol | azadirachtin | UN | 81899-4 | 6 oz in 50 gal | 4 hr | 0 d | - | - | - | Fair to Poor |

*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.

# ENHANCING INSECTICIDE EFFICACY WITH PHAGOSTIMULANTS

*Greg Loeb, Johanna Elsensohn, Stephen Hesler, Cornell University Dept. of Entomology and Richard Cowles, Connecticut Agricultural Experiment Station*

At the moment the most effective approach to managing Spotted Wing Drosophila (SWD) is based on the use of insecticides. Vulnerable crops that ripen during the late summer and fall, such as fall raspberries, require at least weekly insecticide applications. Although the number of products registered for controlling SWD in NY is increasing, there are still a limited number of effective options. Moreover, in choosing an insecticide, growers must consider a number of factors in addition to efficacy, including restrictions on the number of applications and total amount of active ingredient allowed during the season, days to harvest restrictions, mode of action and resistance, rain fastness and impact on beneficial organisms such as pollinators and natural enemies. To address some of these factors, the entomology small fruit program at Cornell has been evaluating insecticide efficacy of registered and unregistered insecticides over the past several years. One aspect that we have been particularly interested in exploring is a proposed method to enhance efficacy of insecticide by including a feeding stimulant (also known as a phagostimulant) with the product. Specifically, we have been testing, along with our colleague Dr. Rich Cowles at The Connecticut Experiment Station, how the addition of a small amount of sugar (sucrose) may synergize toxicity of some compounds. Sugar was chosen because when fruit flies taste sugar they are induced to eat. This should increase toxicity of insecticides, especially those with active ingredients that must be consumed to be effective.

In this presentation, we will report the results of experiments conducted in fall raspberries and day-neutral strawberries and involve a number of different active ingredients. Experiment 1 was a broad evaluation of labeled and unlabeled insecticides, with or without an added phagostimulant (sucrose at 2 lb/100 gallons). This trial was conducted using individual fruiting canes of fall raspberry in a commercial planting. After treatment in the field, whole tip cuttings with ripe fruit were brought back to the lab and SWD were exposed under laboratory conditions to the treated tissue 1d, 3d and 7d after application. Results show that Mustang Max resulted in the highest proportion of dead adult SWD at all days post-application (Figure 1). Products tested with

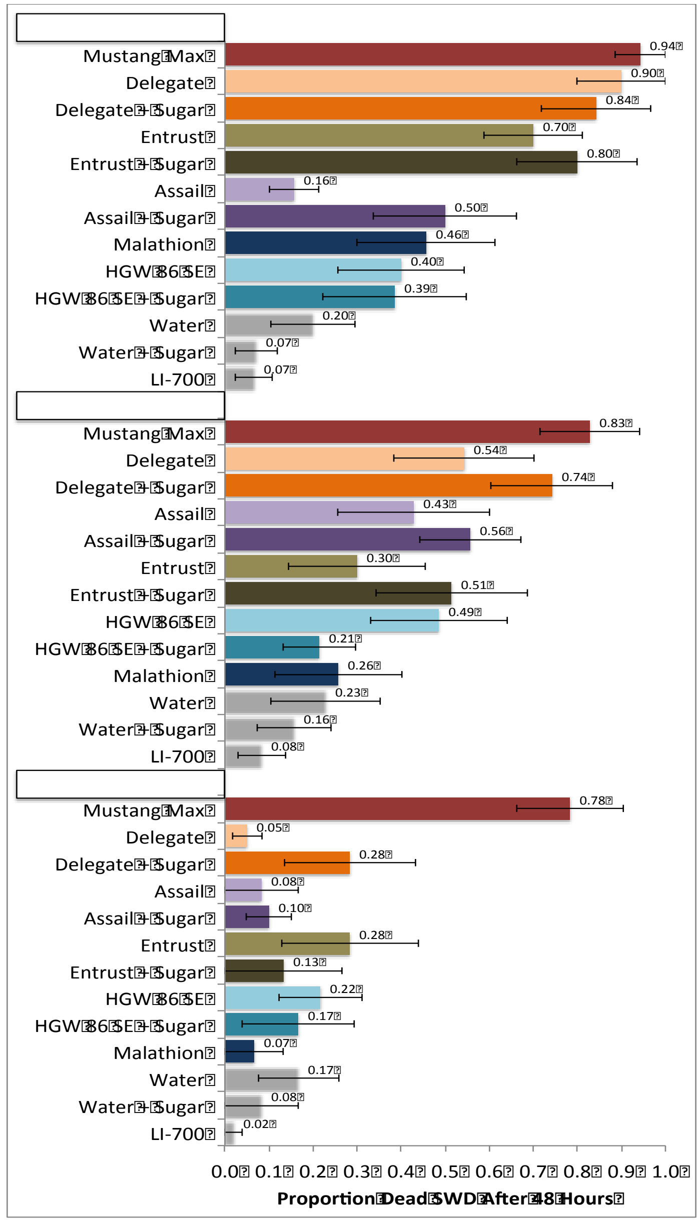



*Figure 1. Proportion SWD that died as function of time of application of insecticide under lab bioassay conditions.*

a phagostimulant generally exhibited increased mortality and a prolonged period of efficacy. The one exception was HGW 86 SE (also known as Cyzaypry). Proportion of SWD mortality for each product declined between 3d and 7d post-application.

In the second trial, we examined the efficacy of the organic version of spinosyn (Entrust) with and without sugar under field conditions in day-neutral strawberries, compared to the pyrethroid Brigade

# ENHANCING INSECTICIDE EFFICACY WITH PHAGOSTIMULANTS *(continued)*

(bifenthrin). For most of the sample dates, the addition of sugar to Entrust reduced SWD infestation of fruit, although strawberry plants treated with Brigade applied weekly or twice a week had the lowest level of infestation.

In a third field experiment, we tested the efficacy of an experimental product provided by DuPont. We used a two-year old planting of the primocane raspberry variety Caroline planted at Darrow Farm at NYSAES in Geneva, NY in the summer of 2012. Treatments included the Dupont product HGW 86 SE (Cyzaypyr) at different rates and with or without sugar, compared to a grower standard, Delegate (spinetoram). Insecticides were applied on 29-Aug, 6-Sept, 13-Sept, and 18-Sept 2013. Results indicate that Cyazypyr was effective in reducing infestation rates and comparable to grower standard (Figure 2). The addition of sugar to Cyazypyr did not increase efficacy. We measured fruit infestation for several weeks after we stopped applying insecticides and found that Cyazypyr continued to reduce fruit damage for at least a week longer than Delegate.

In a fourth field experiment, we tested the efficacy of Cyazypyr, with and without sugar, along with Delegate, in day-neutral strawberries. Results were similar to those found with raspberry. Cyazypyr and Delegate were comparable in efficacy, sugar did not increase efficacy of Cyazypyr, and Cyazypyr appeared to have a longer residual effect than Delegate.

We would like to thank Gabrielle Brind-Amour, McKenzie Schessl, and Allison Wentworth for their assistance both in the field and the lab in completing this research.

Funding for this project was provided from several sources, including the North American Raspberry and Blackberry Association, North American Strawberry Growers Association, NY Dept. of Ag and Markets Specialty Crops Program, USDA NIFA, and New York Berry Growers Association.

*Reprinted from: Proceedings of the 2014 Empire Producers EXPO, Syracuse, NY.)*

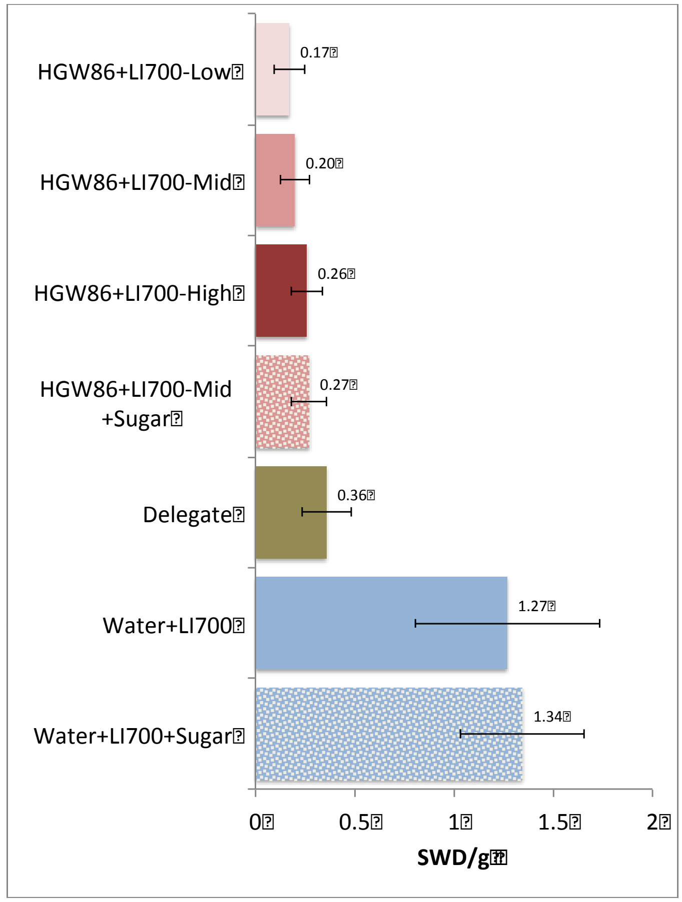



***Figure 2.*** *SWD per gram of fruit reared from raspberry treated with different insecticides over four-week period.*

# ORGANIC OPTIONS FOR SPOTTED WING DROSOPHILA MANAGEMENT

*Pam Fisher - Ontario Ministry of Agriculture & Food (OMAF) and Ontario Ministry of Rural Affairs (MRA)*

**February 14, 2014.** Spotted Wing Drosophila (SWD) is an invasive, direct pest of berry crops and other soft skinned fruit. In just a few years this pest has permeated all of the major fruit growing regions in the USA, British Columbia, and Eastern Canada.

Spotted wing drosophila is a serious problem because it lays eggs in fruit as the fruit is ripening. SWD eggs, larvae, and pupae are present in the fruit at harvest. Fruit loses its integrity and breaks down early. The pest has multiple generations a year and populations build up very quickly. Late-season fruit , such as fall-bearing raspberries, blueberries and day-neutral strawberries, are almost sure to be infested with SWD unless growers actively manage this pest.

Control of SWD is a challenge for organic as well as conventional growers.

**Organic insecticides:**

Insecticides are an important part of an SWD management program; weekly applications can provide SWD control while fruit is ripe and ripening.

We anticipate an emergency use registration for the insecticide ENTRUST SC on berry and stone fruit crops for SWD control in 2014. Entrust (spinosad) is very effective for SWD and is acceptable in most organic programs. However, there will be limitations on the number of applications per season, which means you might not have enough applications to protect crops with a long harvest period. Also, Entrust (insecticide group 5) should not be used repeatedly because resistance management is a concern. It is important to alternate insecticides from different groups. In California, SWD has already developed resistance to the organic insecticide Pyganic, when this insecticide was used repeatedly.

Watch for updates on emergency use registrations of organic products for SWD control at www.ontario.ca/spottedwing. Insecticides alone will not provide adequate SWD control, and researchers are actively searching for more sustainable options. Many other management practices must be incorporated into an SWD program.

**Harvest schedules:**

The most important management strategy for SWD is to harvest frequently and thoroughly. Ideally all ripe fruit should be harvested every day or two. On pick-your own farms, where harvest is seldom thorough, growers should send workers in after the customers, to clean up the field. By adjusting harvest schedules to accommodate thorough and frequent harvest, growers have found good SWD control in raspberries, and day neutral strawberries. However, this is not a very practical option for blueberries or blackberries which are picked once or twice a week.

**Removing over-ripe or damaged fruit:**

Removing unmarketable fruit from the field can reduce the build-up of SWD, but the cost-benefits of this expensive management practice are not really clear. However, in organic settings, where insecticide options are limited, removing unmarketable fruit can pay off (Figure 1). This waste fruit should be buried daily at least 30 cm deep, or held in sealed containers for a few days. Don't leave it in exposed piles to compost.

**Post- harvest cooling:**

Cooling to 1.6°C (35°F) degrees immediately after harvest will slow the development of SWD in

***Figure 1:*** *Removing over-ripe and unmarketable fruit from the field can help reduce SWD populations.*

# ORGANIC OPTIONS FOR SPOTTED WING DROSOPHILA MANAGEMENT *(continued)*

***Figure 2:*** *Crop management can affect SWD damage. Although total yields might be higher in the planting on the left, SWD will be easier to manage in the field on the right, where trellising is used to facilitate harvest. Landscape fabric as a ground cover can help desiccate fallen fruit.*

harvested fruit. If fruit is held for three days at this temperature, many eggs and small larvae will die. However, once SWD has laid eggs in fruit, shelf life is compromised because the surface of the fruit has been damaged. Post-harvest cooling should be used together with immediate marketing of fruit.

**Crop management:**

SWD populations are favored by moderate temperatures and high humidity. Growers can influence SWD populations by making sure crops are pruned to facilitate airflow, reduced humidity around the crop canopy, and ease of harvest. Prune brambles and install trellis systems (Figure 2). Blueberries should be pruned to open up the canopy. June-bearing strawberries should be renovated as soon as possible after harvest. Runners should be clipped on day-neutral strawberries to reduce crop debris on the beds.

**Ground cover management:**

Dropped fruit can be a source of SWD flies. Factors which favor desiccation of fruit, such as short grass, dry cultivated soil, or landscape fabric, could help to reduce SWD emergence from fallen fruit. Landscape fabric as a ground cover can also make it possible to rake dropped fruit up from the ground and dispose of it. Use of trickle irrigation, instead of overhead sprinklers, can help maintain a dry environment in the crop alleys and reduce humidity around the planting.

**Management of wild hosts:**

SWD has many wild hosts (i.e. mulberries, honeysuckle, brambles, pokeweed, dogwood, buckthorn, pin cherry) that are common in Ontario landscapes. These wild hosts are important habitat for pollinators and other beneficial insects. It is not practical or desirable to remove all wild hosts around your farm fields. However wild blackberries and wild raspberries should be removed where possible, or mowed below the fruiting zone each spring.

**Biological control:**

SWD has few natural enemies. Wasps parasitizing SWD have been identified in Ontario and elsewhere in North America, but biological controls are not providing economic control at this time. Most parasites of drosophila do not seem to be adapted to find this new invasive species, and parasitism rates are low, 1-2%. Research is underway in areas of Asia where the pest is well established to identify predators and/or parasites. Other researchers are

## ORGANIC OPTIONS FOR SPOTTED WING DROSOPHILA MANAGEMENT *(continued)*

studying the efficacy of biopesticides , with little success so far.

**Exclusion:**

Exclusion of SWD from the crop canopy has been tried on a small scale for blueberries, and could also be used in high tunnels . The netting used to exclude SWD is commercially available, has a very fine mesh, and is heavier than bird netting. It must be installed over a structure that is sturdy enough to hold the extra weight. The bottom edge of the netting must be trenched in at ground level , or installed to prevent any gaps between the ground and the net. In addition, doors must be kept closed, something difficult to do when pickers are moving in and out. Negative side effects from reduced light and ventilation can be caused by the netting. Research is continuing on this option for SWD control.

**For more information:**

For current and extensive information on Spotted Wing Drosophila, please see our website at www.Ontario.ca\spottedwing.

Growers can also listen to a recorded webinar by Dr. H. Burrack at North Carolina State University and Dr. V. Walton of Oregon State University, "Biologically Based Organic Management Strategies for Spotted Wing Drosophila". Some of the information in this presentation was used in the writing of this article.

*(Reprinted from: Ontario Berry Grower Vol. 2, March 1, 2014.)*

## Evaluation of Exclusion and Mass Trapping as Cultural Controls of SWD in Organic Blueberry Production

*Laura McDermott, CCE Eastern New York Commercial Horticulture Program and Lawrie Nickerson, Hay Berry Farm LLC.*

This project, supported by a NESARE Farmer grant, investigated the use of exclusion netting and mass trapping as cultural techniques to mitigate the damage caused by Spotted Wing Drosophila (SWD). SWD proved to be unusually damaging to 2012 berry crops in the Northeast. Despite the fact that the planting in question is quite young, farmer Lawrie Nickerson decided to be proactive and investigate netting as a control method. Research papers translated from Japanese by Cornell graduate student Masanori Seto provided the necessary incentive.[1]

Unlike native species, SWD uses its saw-like ovipositor to deposit eggs in ripening fruit resulting in larval development inside the berry. Activity of the fruit fly corresponds to the ripening of blueberries, raspberries, day neutral strawberries and a variety of other cultivated and wild hosts. In 2012, levels of infestation reported state and region-wide ranged from 80-100% of fruit examined with individual fruit infested with as many as 25 larvae.

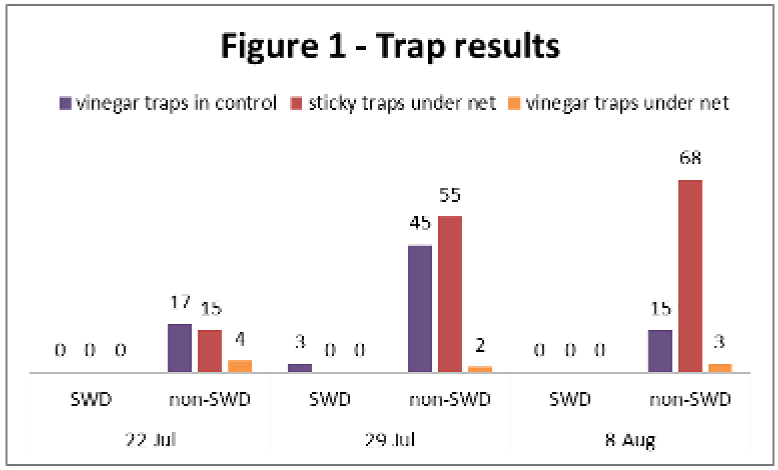
Traditional IPM, which relies on scouting to determine an economic threshold before pesticides are applied, has been temporarily abandoned. While monitoring for pest presence is still recommended, a 3-7 day insecticide spray schedule is currently the recommended management strategy. Organic berry growers are not inclined nor prepared to use insecticides at this frequency, and their customers are particularly concerned about pesticide use. There are very few organically approved pesticides available, making it difficult to properly rotate chemicals. This project evaluated the merits and costs of netting to exclude SWD from a blueberry planting, and attempted to evaluate mass trapping as

# Evaluation of Exclusion and Mass Trapping as Cultural Controls of SWD in Organic Blueberry Production *(continued)*

an additional means of reducing SWD effects.

Protek insect netting 1.00mm x .85mm was used in the trial. This netting is 80% porous and has 83% light transmission capabilities. The suggested life of the net is 7 years but if stored well it may last several additional seasons. The net was hung over 1 row of 50 plants that is intersected midway with an aisle for a total of 300 linear feet. To separate the treatment replications within this row we used extra netting material fastened with pig rings. The treatments were netted after bloom and before berries began to color. The exclusion netting was hung over wires placed at a height of 6' to accommodate pickers. The wires, anchored to 2 H-braces at rows' ends, were supported by posts set strategically along the row. The net was weighted down with construction grade water hose. This may have been more than was needed since the net itself is fairly heavy, but this method prevented inadvertent ripping.

Five year old 'Bluecrop' plants comprised the randomized treatments which were replicated three times. We evaluated exclusion alone and in combination with two different types of traps – unbaited red solo cups covered with tanglefoot and a yeast baited trap that uses vinegar as a drowning solution. The treatments were 1) netted 2) netted with sticky traps 3) netted with vinegar traps and 4) netted with weed mat. Lumite 994GC woven fabric ground cover made of UV stabilized polypropylene allows passage of water, nutrients and air while suppressing weeds. This treatment was added as an afterthought and not part of the original proposal. The netted treatment was replicated 3 times, the control portion was only replicated once. The final treatment was the # 5) non-netted control with vinegar traps. Each treatment was composed of 3 plants and fruit data was hand harvested twice weekly from the middle plant in the group for three weeks during peak production. The harvested berries were examined for % SWD infestation, individual fruit quality and yield. The insect traps were checked and changed weekly and numbers of SWD and other




insects were recorded. Light intensity and temperature under the nets was taken and compared to the untreated control on a weekly basis. Shoot regrowth in the netted, fabric mulch and control treatments will be evaluated during the spring of 2014.

The plants were treated consistently throughout the experiment. No sprays were used during the 2013 growing season except for a Neem application to control scale in the spring. All other cultural inputs were identical across all treatments and the control including pest control, fertilization, and irrigation. No frost control was necessary. Bird netting and deer fencing were in place for all treatments.

2014 prices for the 80 gr weight of 0.85mm x 1.00mm ProTek netting in the largest size possible of 13' x 328' is $665.00. Growers will need to sew the panels together in order to adequately net multiple rows.

SWD pressure was non-existent to very-low with only 3 females found in one control trap. As shown in Figure 1, the sticky traps and vinegar traps showed that the netting effectively excluded many other insects of similar and larger size. The sticky traps attracted a higher percentage of ants and crawling insects apparently not attracted to the yeast bait in the vinegar traps. Native drosophilas were found in the control traps in very low numbers. No drosophilids were found in the traps in the netted treatments. Due to the low SWD pressure, we were unable to make any determination on the efficacy of mass trapping for SWD.

# Evaluation of Exclusion and Mass Trapping as Cultural Controls of SWD in Organic Blueberry Production *(continued)*

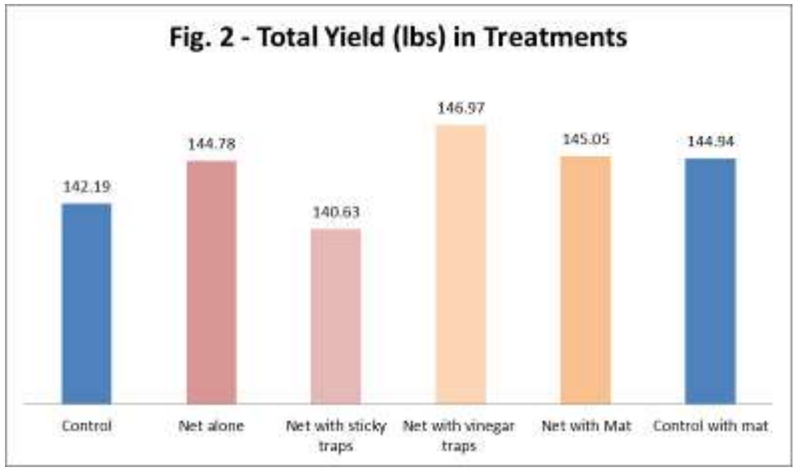
Fruit yield was not negatively impacted by netting or fabric mulch (Figure 2). Overall yield was slightly higher in some of the netted treatments.

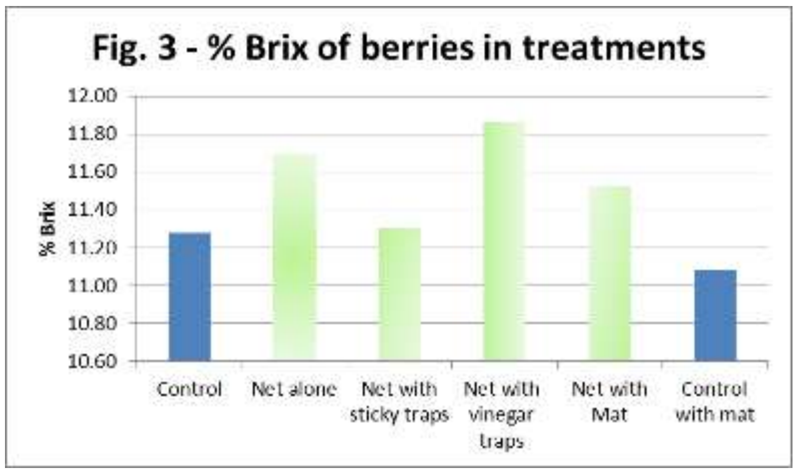
Fruit quality was not negatively impacted by the netting. Fruit size was measured by using a caliper on 10 randomly selected fruit from each replication at each picking date. Those same berries were individually examined under a microscope for evidence of SWD oviposition and then they were crushed together for a % Brix reading using a hand held refractometer. As shown in Figures 3 and 4, % Brix was slightly higher in the netted treatments, but individual berry size was larger in the controls. There was no evidence of SWD oviposition in any of the berries examined throughout the trial.

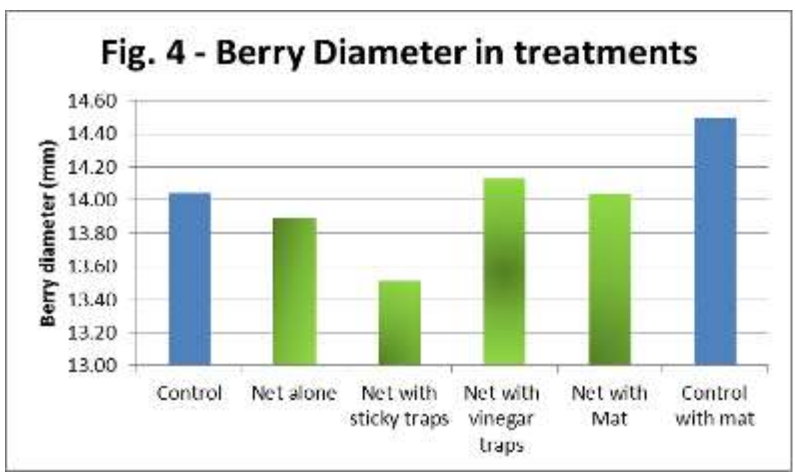
We were concerned about the effect of the net on light and temperature in the netted treatments. Temperatures were recorded weekly through the trial in each of the replications of the control and the netted treatment with no traps or weed mat. The temperature is slightly higher on two of the dates measured (Fig. 5) and the light is slightly lower in all three of the dates measured (Fig. 6). These differences do not correlate with fruit quality and appear from this one season of observation to be insignificant. Light under the net – despite the 85% transmission rating – was still good most likely because the white color allowed it to get reflected throughout the netted area.

This characteristic might be reduced as the netting ages. An observation made by pickers was that the netted treatments, especially the netted treatment with weed mat, ripened earlier by a few days than did the control.

No measurements have been made yet on shoot regrowth although visual observation does not indicate any difference in habit.



# Evaluation of Exclusion and Mass Trapping as Cultural Controls of SWD in Organic Blueberry Production *(continued)*

The weed mat did not have much impact on the data, although shoot regrowth over time will have to be monitored. One aspect that the grower really liked was that dropped berries could be very easily removed from planting simply with a broom and dustpan unlike the more problematic bark mulch. The grower is also hoping that fabric mulch will reduce the humidity caused by weeds thus discouraging SWD.

The cost of covering an acre of blueberries with insect netting would likely range from $7000 to $9000 depending on the support system used. The life of the net is 7 years, so the amortized cost of an $8000 investment would be $1143/year, not including labor. Given that estimates for annual increases in cost of production per acre to control SWD range from $36 to $290 [2], netting blueberries may be a viable strategy for organic or small acreage plantings. Those growers that do not have bird netting in place might want to track the reduction in bird damage as a result of having insect netting installed. The yield improvement realized from reducing bird damage might be enough to encourage netting as a sustainable option for SWD management.

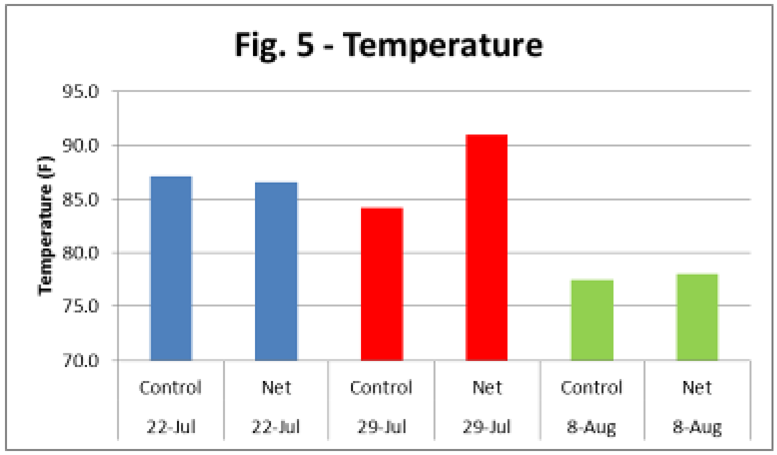


Fig. 5 - Temperature

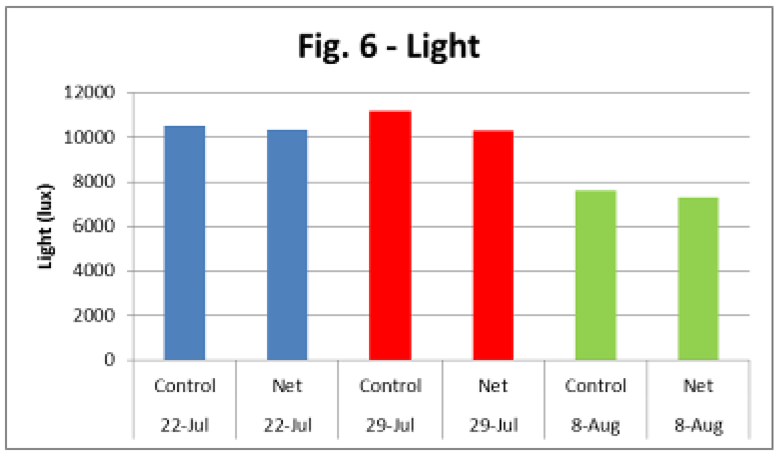


Fig. 6 - Light

**References**

[1] Netting control of *Drosophila suzukii* by Chiba Prefectural Agriculture Research Center & Chiba Industrial Technology Research Institute - Translated by Masanori Seto.

[2] Spotted wing drosophila impacts in the eastern United States. Developed by the eFly: Spotted Wing Drosophila Working Group. http://www.sripmc.org/WorkingGroups/eFly/Impacts%20of%20SWD%20in%20the%20Eastern%20US%202012.pdf

*(Reprinted from NY Fruit Quarterly Spring 2014.)*

# A FIXED-SPRAY SYSTEM FOR SWD MANAGEMENT IN HIGH TUNNEL RASPBERRIES

*Arthur Agnello, Andrew Landers, and Greg Loeb, Dept. of Entomology, Cornell University*

Spotted wing drosophila (SWD) represents a serious challenge for fruit growers in the Northeast and elsewhere. Unlike other fruit flies, SWD has the capacity to lay its eggs in ripe, marketable, soft-skinned fruit. Later maturing berries, such as blueberries, fall raspberries and day-neutral strawberries, appear to be especially vulnerable. SWD was first observed in the Northeastern region in 2010, became widespread during the 2011 field season, and in 2012 decimated fall berry crops throughout the region. Over 50% of the blueberry and bramble growers that responded to an end of season survey of small fruit growers in the Northeast conducted by Cornell University reported significant crop loss due to SWD.

High tunnels are increasingly being used for berry production in NY and elsewhere. Work by Pritts has been instrumental in the development and optimization of high tunnels for raspberry and blackberry production, showing that they perform particularly well under high tunnel conditions, with greater yields, extended harvest season, and greatly improved fruit quality. SWD represents a major economic constraint to the adoption of this profitable production innovation.

Raspberries grown in high-tunnels are particularly vulnerable to SWD. The invasion of SWD has forced raspberry growers to dramatically increase insecticide applications to produce marketable fruit, an especially significant logistical challenge for high tunnel production. Pesticides are the only practical management tools currently available to growers. To achieve a reasonable level of control, they need to be applied frequently (5–7-day spray intervals) over a long harvest period. These repeated insecticide applications are expensive (fuel and operator expenses plus the pesticides), time-consuming and sometimes not fully effective. Moreover, operating application equipment in the high tunnel environment can be very challenging. Previous work has been done in tree fruits using irrigation-type tubing fitted with greenhouse microsprinklers to deliver pesticide sprays directly to the crop canopy from a centralized pump. The supply lines are fixed on support wires within or above the canopy to optimize spray delivery and coverage.

A fixed system to apply insecticides may help mitigate a number of pest management problems in high tunnel production. Fixed sprayer systems may be particularly cost-effective in high tunnels, as the framework to support the fixed lines is already present. A fixed sprayer system would save time in the application of insecticides compared with using conventional application equipment (e.g., a backpack sprayer). Coverage, and therefore effectiveness, may also be improved with a fixed system.

In mid-July 2013, an arrangement of fixed tubing and nozzles for pesticide application was installed in each of three high tunnel (HT) systems currently under bramble production in NY: a high tunnel raspberry research planting at the NYS Agricultural Experiment Station in Geneva, a blackberry research planting at the Cornell Horticulture high tunnels in Ithaca, and a high tunnel raspberry operation at Stonewall Hill Farm (Dale Ila Riggs), in Stephentown, NY. For the raspberry systems (Geneva and Stephentown), the main supply lines consisted of 3/4" polyethylene irrigation tubing strung above the planted rows, and affixed to the cross-struts of the HT structure using cable ties, with 1/4" micro-tubing drop lines suspended down to the plant canopy every 5' along each side of the row. Each drop line was fitted with a Netafim DAN 7000 series microsprinkler with an 8-mm orifice and a flat circular pattern spreader; each unit contained a 20-psi check valve. The nozzles were oriented laterally facing toward the row center, producing a spray profile in the vertical plane and directed slightly into the canopy. In the blackberry HT system (Ithaca), the structure was similar, but because of the higher plant density of this crop, the drop lines were suspended every 2.5' along the sides of the rows, and an additional overhead supply line was used to contact the row center from drop lines spaced every 5'; nozzles on this line were oriented with the spray profile being horizontal over the canopy. All supply lines were connected to a PVC manifold (mounted on a board near the HT entrance) fitted with an individual pressure gauge and ball valve for each line; the manifold in turn was connected to a portable wheeled greenhouse sprayer (Rear's Nifty Nursery-Cart model) with a 25-gal tank and a 3 HP gasoline motor powering a diaphragm pump. Each tunnel consisted of three planted rows, ranging from 100–120 ft in length; only a single line was operated at a time in order to optimize spray pressure along the extent of the line.

# A FIXED-SPRAY SYSTEM FOR SWD MANAGEMENT IN HIGH TUNNEL RASPBERRIES

*(continued)*

To make an application, all lines were first filled by sequentially opening each valve to receive spray solution from the pump until the line pressure reached 20 psi, or just before the check valves opened. Then, one valve at a time was opened to increase the pressure to 30 psi and spray the pesticide solution from one line, for a total application time of 30 seconds, which thoroughly wet the canopy foliage adjacent to the line of nozzles. The next line's valve was then opened as the first one was closed, to continue the process similarly until all six lines were allowed to spray; total time for priming plus application therefore required approximately 5 minutes, and took approximately 15 gal for the area sprayed (ca. 0.08 acre). To recover pesticide solution remaining in the tubing after spraying was finished, a length of hose attached to a valve on the PVC manifold drained off much of the contents of the supply lines into a container; this was used to fill a backpack sprayer for treating check rows in an adjacent HT planting not fitted with the fixed spray system.

During the last week of July, SWD adult traps were deployed adjacent to the HT systems at each site to get an indication of local population pressure near each planting. Traps were plastic deli cups containing a fermented yeast+flour mixture, with apple cider vinegar as a drowning medium. Numbers of SWD adults captured were very low initially and began to increase starting in mid-August; however, to protect the fruit from attack by undetected SWD females, preventive insecticide treatments were also started at the end of July. The two principal products used were Delegate [spinetoram] (3–6 oz/A) and Assail [thiamethoxam] (5 oz/A), to each of which was added 2 lb sugar/100 gal as a feeding stimulant. Sprays were applied weekly, and rotated on the following schedule: Delegate, 29 Jul; 19 & 26 Aug; 16 & 23 Sept; Assail, 5 & 12 Aug; 2 & 9 Sept. At Stephentown, additional sprays of Mustang Max [zeta-cypermethrin] were applied during the two weeks following the 23 Sept Delegate spray. All applications were made at dusk to minimize exposure to foraging bees.

To assess efficacy of the insecticide treatments in preventing SWD fruit infestation, samples of maturing fruit were taken weekly beginning the first week of August, and held at room temperature in the lab to rear out any larvae in the fruit to the adult stage. Numbers of samples taken ranged from 8-13 per site, each consisting of 10–20 berries (~50–100 g total), taken from both the fixed spray planting and a check planting at each site. At Stephentown, a commercial site where ripe fruit was picked nearly daily, there were generally low numbers of flies reared from the fruit, with no major difference between the fixed spray and backpack sprayer treatments. At the Geneva HT system, twice as many flies were obtained from backpack-treated fruits as at the commercial site, and 5 times as many from the fixed spray treatment,. The Ithaca HT blackberries had the highest SWD adult emergence: 8 times more in the fixed spray treatment than the commercial site, and numbers comparable to Geneva in the backpack treatment (e.g., twice as many as the commercial planting).

On 25 Sept, to measure spray deposition from the system in the fully developed canopy, water-sensitive cards were stapled onto the leaves on the outside portion of the row as well as in the inside center of the canopy, both on the leaf tops and undersides, and on the left and right side of candidate rows. The system was run for 30 seconds with water only, and video imaging software was used to assess average card coverage. Results showed that spray coverage was highly variable, but predictably best on the outside of the canopy, and markedly better on the tops of the leaves (40-100% coverage, above the average seen in field trials) than on the undersides (1-26%). Cards in the inside center of the canopy were less well covered (16-67% on leaf tops, still acceptable levels; 1-8% on undersides).

Potential new areas of investigation next season include:

- Examine shortening the spray duration times, as it is possible the system is running too long and in effect washing off the active ingredient; changes in rates of water and insecticide may affect coverage and efficacy.
- Adding center overhead lines in the raspberry systems to improve coverage to the insides of the rows.
- Assessing spray coverage on the fruit, by using a fluorescent tracer dye.
- Examine the possibility of direct pesticide injection (dosing pump) rather than mixing pesticide solutions in the tank.
- Investigate whether there is a way to incorporate air-assist into the spray system.

# A FIXED-SPRAY SYSTEM FOR SWD MANAGEMENT IN HIGH TUNNEL RASPBERRIES

*(continued)*

• Quantify pesticide residue levels on the fruit, or conduct bioassays using lab-reared flies to see how efficacy changes over time.

• Look at cultural practices that might increase coverage (e.g., positioning of canes, cane pruning).

We believe that the availability of a fixed sprayer system could make growing high tunnel raspberries more feasible in the age of SWD. Fixed sprayer systems may also prove practical for smaller field plantings of high-value blueberries and raspberries. Importantly, the adoption of fixed sprayer systems for berry crops will reduce grower exposure to insecticides, as there will not be a need to travel through the planting to apply them.

**Acknowledgments**

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• Technical & engineering assistance: Bill Larzelere, Steve Hesler, Jordi Llorens, Changyuan Zhai, Johanna Elsensohn, Tessa Lessord, Chrissy Dodge, Gabrielle Brind-Amour, Mckenzie Schessl, Allison Wentworth

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# SEASON LONG EVALUATION OF WILD HOSTS FOR SPOTTED WING DROSOPHILA

*Johanna Elsensohn and Greg Loeb, Department of Entomology, Cornell University*

Spotted Wing Drosophila (SWD) is a serious pest to many soft-skinned fruit crops. This generalist vinegar fly has a wide host range of both cultivated and wild plant species. Known cultivated hosts include strawberries, raspberries, blackberries, blueberries, cherries, and to a lesser extent, grapes, stone fruit and tomatoes. In 2012, Cornell researchers surveyed vegetation surrounding multiple farms throughout the Finger Lakes and Lake Ontario region of New York. All plants bearing fruit that could potentially serve as a host for SWD were collected and brought back to the lab and monitored for fly emergence.

Building on this initial work, during the 2013 growing season we investigated the potential impact of these wild hosts on SWD populations. We asked the following questions; a) What, if any, plants serve as early season hosts? b) When do infestations occur in wild hosts? c) Which plant species produce the most SWD? Many of these wild hosts are found at the disturbed edges of wooded areas that are commonly found around NY farms. Eight sites were identified that possessed at least two or three wild hosts previously shown to support SWD reproduction. Plant species surveyed included wild black raspberry and blackberry, pokeweed, bush honeysuckle, buckthorn, bittersweet nightshade and dogwood. Study sites were visited weekly to look for ripe fruit, collecting a sample from up to five different plants of each species. Fruit samples were brought back to the lab, placed into a container at ambient temperatures and monitored for fly emergence. All flies were collected and identified. Fruit collections started in June when black raspberry ripened and continued through late November when most fruit was gone and flies ceased to be reared from collected samples. Figure 1 shows infestation rates for one of the sites. At this farm, the majority of emerged SWD came from honeysuckle and pokeweed.

Four monitoring traps were also placed at each sampling site throughout the season, starting in early June and continuing through the end of the year. Two traps were placed along the border of the woods where wild hosts were also found and two were placed within a fruit crop planting nearest the woods. Traps were baited with a fermenting wheat dough and an apple cider vinegar and ethanol drowning solution. Contents were collected weekly and traps were reset with fresh materials. Figure 2 shows the average weekly trap catch of SWD at the same site as in Figure 1. Across sites, woods traps caught more SWD than those placed in the crops. Data shown here is incomplete, as all traps from all weeks have not yet been sorted through.

While our data clearly show that uncultivated plants serve as hosts to SWD when crop fruit is unavailable, it is not clear at this point whether host removal would

# SEASON LONG EVALUATION OF WILD HOSTS FOR SPOTTED WING DROSOPHILA

*(continued)*

have a large impact on local population levels due to the high vagility of this fly. Future research should address the impact of on-farm removal of wild hosts on SWD crop infestation and also include an assessment of distantly distributed wild hosts to see if they are being utilized by SWD as well.

We would like to thank the growers who allowed access to their farms throughout the year for the survey work. We would like to thank Gabrielle Brind-Amour, McKenzie Schessl, and Allison Wentworth for their assistance both in the field and the lab in completing this research. Funding for this project was provided by the NY Dept. of Ag and Markets Specialty Crops Program and the New York Berry Growers Association.

## EASTERN NY SUMMER BERRY WORKSHOPS

- √ Wednesday, July 16th, Lawrence's Farms Orchards, 39 Colandrea Road, Newburgh, NY 12550, 3:00 –5:00 PM
- √ Monday, July 21, Rulf's Orchard, 531 Bear Swamp Road, Peru, NY 12972, 4:00-6:00 PM
- √ Wednesday, July 23, Bohringer's Orchard, 3992 NY 30, Middleburgh, NY 12122, 3:00-5:00PM

Monitoring for SWD, designing an effective pesticide rotation program, understanding when and how to collect leaves for a nutrient analysis and general troubleshooting will all be part of this workshop.

2 DEC Pesticide Re-certification credits will be available.

**No charge for this meeting, but please pre-register with Marcie Vohnoutka at 518-272-4210 or mmp74@cornell.edu.**

# SWD IMPACTS, 2013

***Editor's Note:*** *Thanks to those of you who responded to the SWD Impact Survey we sent out information on in NY Berry News. What follows are the summarized results from that survey, which are chiefly from the eastern seaboard.*

One of the missions of the eFly Spotted Wing Drosophila (SWD) Working Group is to assess the impact of SWD in affected host crops, particularly in the eastern United States. Affected crops have included blueberries, blackberries, cherries, grapes, raspberries, and strawberries. The first of these impact statements was developed in 2012, and drew upon expert observers in several eastern states to determine the extent of crop losses and input increases associated with SWD. The eFly SWD Working Group includes entomologists, extension professionals, fruit growers, and fruit marketers.

During the most recent eFly SWD Working Group meeting, held January 8 & 9 2014 in Savannah, GA, participants[i] determined that greater stakeholder response would improve impact assessments and therefore developed and subsequently distributed a mixed-mode survey instrument via either an online questionnaire or in person paper surveys distributed at grower meetings held throughout the eastern United States from January 9 through February 22, 2014. In total, 87 respondents completed the survey online, and 162 respondents completed paper surveys. Meetings where paper surveys were distributed were held in AL, GA, MO, NC, NJ, and PA. The online questionnaire was made available at the eFly SWD Working Group website (swd.ncsu.ces.edu); emailed as a link to grower email lists, grower organizations, and cooperative extension agents; and was available from January 20 through February 28, 2014.

***Respondent geographic diversity***

Survey respondents were from at least 28 different states (Figure 1); five respondents declined to provide their location or were from outside the United States. Demographic information in addition to state was collected from respondents to the online survey, and of those (n=87), 39% were conventional fruit growers, 8.5% were organic fruit growers, 9.4% were extension agents or specialists, 0.85% were fruit marketers, 1.7% were crop consultants, 3.4% were homeowners, and 3.4% were engaged in other activities or did not provide demographic information. Demographic information beyond state was not collected on paper surveys as all respondents were growers.

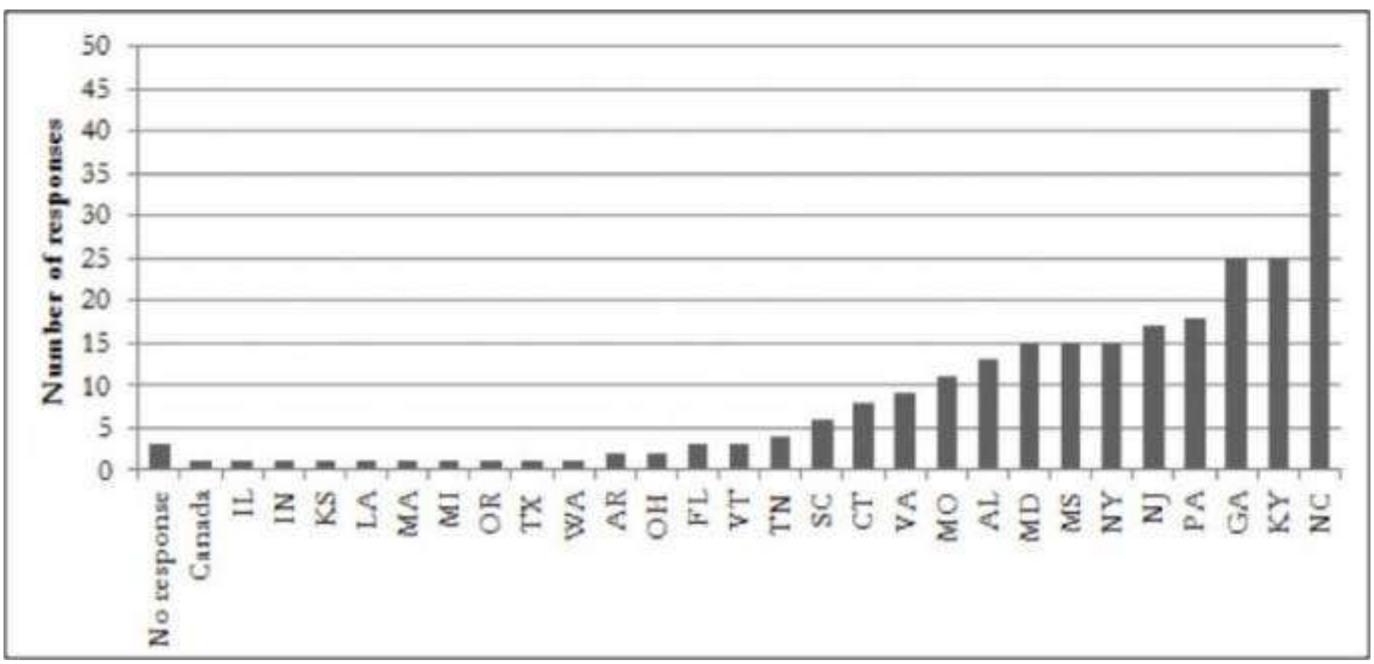


***Figure 1.*** *Number of respondents by state, combined online and paper surveys. Four respondents declined to provide state information.*

# SWD IMPACTS, 2013 *(continued)*

Because information about SWD infestation at the farm level is potentially sensitive, states or crops within a state with fewer than two responses are not presented separately in the tables below, but these data were included in pooled summaries over all states or across a crop.

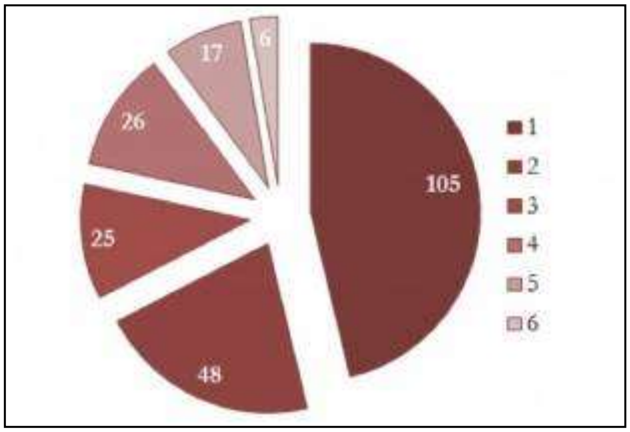


**Figure 2.** *Number of spotted wing drosophila host crops (1 to 6) grown by respondents, excluding unspecified "other" responses.*

### *Crop information for respondents*

Over half of the respondents grew multiple SWD host crops (Figure 2), and the greatest numbers of responses, representing the largest proportion of US acreage were from blueberry growers (Table 1). A relatively large number of blackberry and raspberry growers were also represented.

| Crop | Number of respondents growing crop | Total acres represented | Percentage of total US acres* |
|---|---|---|---|
| **Blueberries (highbush)** | 155 | 9,338 | 9.7% |
| **Blackberries** | 102 | 816 | 5.4% |
| **Raspberries** | 80 | 275 | 1.2% |
| **Strawberries** | 72 | 542 | <1% |
| **Cherries** | 32 | 120 | <1% |
| **Grapes** | 62 | 28 | <1% |

***Acreage used to calculate percent of total US area via 2012 Census of Agriculture.***

**Table 1.** *Spotted wing drosophila host crops grown by respondents.*

### *Crop level impacts*

The average, minimum and maximum reported percentage loss across all responses for each crop was calculated (Tables 2-7). In addition, average loss by crop was calculated for each state with more than two total responses and compared to the value of each crop within a state. Crop values for each reporting state were obtained either from the USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013 when available, or estimated based on reported acreage in 2012 Census of Agriculture and reported crop value and yield per acre from the USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013. Due to federal sequestration, final statistics for the 2013 crop year were not available, so these estimates were the most current available. The total observed losses for each crop were then summed. Potential crop losses were also calculated based on the total value of a crop within all reporting states and the average percentage loss observed across all states. In the case of blueberries, blackberries, and cherries, potential losses were higher than observed losses. However in some cases, notably raspberries, strawberries, and grapes, crop loss in reporting states was higher than averaged potential loss, due to particularly high loss percentages in states with high crop value.

When totaled across all crops, the observed loss due to SWD during 2013 in states represented in our survey was $27,558,238.

We further compared the effect of farm size on reported crop loss across all reporting growers (Tables 8-13). In general, small farms experienced higher crop loss than larger farmers across, and small farms were also more likely to experience 100% crop loss due to SWD than were larger farms. At least one blueberry, blackberry, or raspberry grower reported 100% crop loss, but no strawberry, cherry, or grape growers reported total crop loss. This suggests that SWD damage may be more severe in blueberries, blackberries, and raspberries than in the other reported crops.

### *Management practice impacts*

Reported crop losses did not occur in a management vacuum, so we also asked respondents about input

# SWD IMPACTS, 2013 *(continued)*

***Table 2.*** *Estimated blueberry crop value lost due to spotted wing drosophila in responding states. Crop value data via USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013 unless otherwise noted.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| **Blueberries (all)** | **139** | **4.7%** | **0%** | **100%** |
| **State** | **Number of responses** | **Average percentage crop loss** | **2012 estimated crop value** | **Estimated 2013 crop value loss** |
| **AL** | 8 | 3% | $1,484,000 | $445,20 |
| **CT** | 7 | 13% | $4,336,675* | $563,768 |
| **FL** | 2 | 0% | $62,073,000 | $0 |
| **GA** | 17 | 4% | $94,130,000 | $3,765,200 |
| **KY** | 10 | 3% | $3,593,819* | $107,815 |
| **MD** | 10 | 5% | $1,375,288* | $68,764 |
| **MO** | 8 | 4% | $1,947,488* | $77,900 |
| **MS** | 15 | 3% | $15,550,000 | $466,500 |
| **NC** | 19 | 2% | $71,000,000 | $1,420,000 |
| **NJ** | 15 | 5% | $80,805,000 | $4,040,250 |
| **NY** | 9 | 2% | $3,893,000 | $77,860 |
| **PA** | 12 | 3% | $10,369,874* | $311,096 |
| **SC** | 5 | 2% | $5,691,886* | $113,838 |
| **TN** | 3 | 39% | $3,573,742* | $1,393,759 |
| **VA** | 4 | 13% | $4,246,373* | $552,028 |
| | | | **Estimated observed loss across reporting states** | $13,003,298 |
| | | | **Potential total loss across reporting states** | $17,111,297 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($1.69/lb fresh and processed combined) and yield per acre (5940 lb) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013.*

***Table 3.*** *Estimated blackberry crop value lost due to spotted wing drosophila in responding states.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| **Blackberries (all)** | **88** | **12%** | **0%** | **100%** |
| **State** | **Number of responses** | **Average percentage crop loss** | **2012 estimated crop value** | **Estimated 2013 crop value loss** |
| **AL** | 6 | 0% | $2,623,700* | $0 |
| **CT** | 4 | 40% | $365,325* | $146,130 |
| **FL** | 2 | 18% | $5,081,344* | $914,642 |
| **GA** | 8 | 14% | $9,465,249* | $1,325,134 |
| **KY** | 11 | 14% | $4,068,397* | $569,576 |
| **MD** | 10 | 20% | $747,257* | $149,451 |
| **MO** | 6 | 0% | $4,300,879* | $0 |
| **NC** | 18 | 10% | $6,725,309* | $672,530 |
| **NJ** | 2 | 0% | $1,461,301* | $0 |
| **PA** | 8 | 23% | $2,441,038* | $561,439 |
| **SC** | 3 | 7% | $2,723,335* | $190,633 |
| **TN** | 3 | 6% | $5,131,161* | $307,870 |
| **VA** | 9 | 11% | $4,466,933* | $491,363 |
| | | | **Estimated observed loss across reporting states** | $5,328,768 |
| | | | **Potential total loss across reporting states** | $5,416,115 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($2.11/lb fresh) and yield per acre (7870 lb) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013. Eastern yield estimates in research trials range from 18,000 to 20,000 lb/acre, so values are likely*

increases associated with SWD, specifically insecticide usage and labor. A majority (59% of all respondents) said that they had increased their insecticide usage after SWD had been detected in their area or on their farm and 44% of respondents said that they had an increase in labor associated with SWD management (Table 14). Growers who experienced an increase in insecticide usage estimated that this cost 88% more per acre, and growers with an increase in reported labor costs estimated this increase to be 12%. Therefore, our crop loss figures should be viewed through the lens, in most circumstances, of significantly increased insecticide use and often an associated increase in labor costs.

Because the questions related to management practice increases were asked to respondents once on the survey, the responses are summarized for two different groups of growers for each crop (Table 14). First, reported management increases for all growers of a given crop are presented, and second, management increases for those growers who reported only growing a single crop are presented. As the majority of respondents grew more than one crop (Figure 2), the second summary statistic is more accurate when considering a given crop but applies to a narrower subset of respondents. In order to estimate the total potential costs associated with insecticide usage across all crops, we used reported cost increases for growers of single crops and scaled these values by the total acres represented in our survey (Table 1). Where single crop values were not reported due to low responses, the value for all growers of a given crop was used (raspberries, strawberries, cherries). The estimated cost of increased pesticide usage for respondents to our survey was $1,339,418. The greatest average increase in pesticide costs associated with SWD was observed by growers producing only blackberries ($314/acre), and 12 of these 13 growers experienced an increase in pesticide use in response to SWD.

# SWD IMPACTS, 2013 *(continued)*

***Table 4.*** *Estimated raspberry crop value lost due to spotted wing drosophila in responding states.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| **Raspberries** | **67** | **16.3%** | **0%** | **100%** |
| **State** | **Number of responses** | **Average percentage crop loss** | **2013 estimated crop value** | **Estimated 2013 crop value loss** |
| **CT** | 7 | 31% | $1,110,690* | $344,314 |
| **KY** | 6 | 4% | $555,345* | $22,214 |
| **MD** | 10 | 3% | $774,900* | $23,247 |
| **MO** | 3 | 7% | $400,365* | $28,026 |
| **NC** | 7 | 19% | $891,135* | $169,316 |
| **NJ** | 2 | 17% | $1,097,775* | $186,622 |
| **NY** | 9 | 31% | $8,846,775* | $2,742,500 |
| **PA** | 12 | 15% | $3,616,200* | $542,430 |
| **VA** | 7 | 14% | $1,743,525* | $244,094 |
| **VT** | 2 | 20% | $1,420,650* | $284,130 |
| | | | **Estimated observed loss across reporting states** | $4,586,893 |
| | | | **Potential total loss across reporting states** | $3,334,550 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($2.05/lb fresh) and yield per acre (6300 lb) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013. Eastern yield estimates in research trials range from 7,000 to 10,000 lb/acre, so values are likely conservative.*

***Table 5.*** *Estimated strawberry crop value lost due to spotted wing drosophila in responding states.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| **Strawberry** | **60** | **3.9%** | **0%** | **50%** |
| **State** | **Number of responses** | **Average percentage crop loss** | **2013 estimated crop value** | **Estimated 2013 crop value loss** |
| **AL** | 3 | 0% | $2,109,584* | $0 |
| **GA** | 5 | 8% | $1,869,252* | $149,540 |
| **KY** | 5 | 0% | $2,763,823* | $0 |
| **MD** | 11 | 3% | $2,937,396* | $88,122 |
| **NC** | 8 | 4% | $29,435,000 | $1,177,400 |
| **NY** | 9 | 4% | $6,880,000 | $275,200 |
| **PA** | 9 | 4% | $8,480,000 | $339,200 |
| **TN** | 3 | 0% | $3,818,614* | $0 |
| **VA** | 6 | 15% | $3,872,022* | $580,803 |
| | | | **Estimated observed loss across reporting states** | $2,610,265 |
| | | | **Potential total loss across reporting states** | $2,424,462 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($1.54/lb fresh, excluding CA values) and yield per acre (8,670 lb, excluding CA yields) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013.*

***Table 6.*** *Estimated cherry crop value lost due to spotted wing drosophila in responding states.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| Cherry | 24 | 3.1% | 0% | 20% |
| State | Number of responses | Average percentage crop loss | 2013 estimated crop value | Estimated 2013 crop value loss |
| KY | 3 | 0% | $37,386* | $0 |
| MD | 12 | 4% | $171,618* | $6,865 |
| PA | 3 | 0% | $1,220,706* | $0 |
| VA | 3 | 10% | $91,345* | $9,135 |
| | | | Estimated observed loss across reporting states | $15,999 |
| | | | Potential total loss across reporting states | $47,153 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($0.594/lb) and yield per acre (2,330 lb) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013 for tart cherry.*

***Table 7.*** *Estimated grape crop value lost due to spotted wing drosophila in responding states.*

| Crop | Number of responses | Average percentage crop loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|---|
| **Grape** | **49** | **2%** | **0%** | **20%** |
| **State** | **Number of responses** | **Average percentage crop loss** | **2013 estimated crop value** | **Estimated 2013 crop value loss** |
| **AL** | 4 | 0% | $2,649,219* | $0 |
| **GA** | 6 | 0% | $5,624,000 | $0 |
| **KY** | 12 | 2% | $3,195,398* | $63,908 |
| **MD** | 7 | 4% | $3,476,144* | $139,046 |
| **NC** | 16 | 2% | $4,469,000 | $89,380 |
| **PA** | 4 | 5% | $20,555,000 | $1,027,750 |
| **TN** | 3 | 15% | $4,619,545* | $692,932 |
| | | | **Estimated observed loss across reporting states** | $2,013,015 |
| | | | **Potential total loss across reporting states** | $891,766 |

**Values determined based on reported acreage in 2012 Census of Agriculture and crop value ($669/ton) and yield per acre (7.63 ton) estimates from USDA NASS Noncitrus Fruit and Nut Preliminary Summary, January 2013.*

# SWD IMPACTS, 2013 *(continued)*

***Table 8***. *Reported percentage crop loss in blueberries by farm size.*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Very large farms (Greater than 100 acres)** | | | |
| 22 | 5.3% | 0% | 30% |
| **Large farms (100-50 acres)** | | | |
| 11 | 2.4% | 0% | 10% |
| **Medium farms (10-50 acres)** | | | |
| 25 | 3.4% | 0% | 20% |
| **Small farms (Less than 10 acres** | | | |
| 81 | 5.2% | 0% | 100% |

***Table 9.*** *Reported percentage crop loss in blackberries by farm size.*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Large farms (100-50 acres)** | | | |
| 6 | 18.5% | 1% | 50% |
| **Medium farms (10-50 acres)** | | | |
| 11 | 11.4% | 0% | 35% |
| **Small farms (Less than 10 acres)** | | | |
| 71 | 11.7% | 0% | 100% |

***Table 10.*** *Reported percentage crop loss in raspberries by farm size.*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Medium farms (10-50 acres)** | | | |
| 6 | 5.8% | 0% | 25% |
| **Small farms (Less than 10 acres)** | | | |
| 61 | 17.4% | 0% | 100% |

***Table 11.*** *Reported percentage crop loss in strawberries by farm size.*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Medium farms (10-50 acres)** | | | |
| 13 | 4.3% | 0% | 20% |
| **Small farms (Less than 10 acres** | | | |
| 46 | 3.9% | 0% | 50% |

***Table 12.*** *Reported percentage crop loss in cherries by farm size.*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Small farms (Less than 10 acres)** | | | |
| 22 | 3.4% | 0% | 20% |

***Table 13.*** *Reported percentage crop loss in grapes by farm*

| Number of responses | Average loss | Minimum observed loss | Maximum observed loss |
|---|---|---|---|
| **Large farms (100-50 acres)** | | | |
| 2 | 0% | 0% | 0% |
| **Medium farms (10-50 acres)** | | | |
| | | | |
| 7 | 2.6% | 0% | 10% |
| **Small farms (Less than 10 acres)** | | | |
| | | | |
| 39 | 2.1% | 0% | 20% |

[i] eFly SWD Working Group participants, 2014: Hannah Burrack, Jesse Hardin, and Katherine Swoboda, NC State University Department of Entomology; Gina Fernandez, NC State University Department of Horticultural Sciences; Ric Bessin, University of Kentucky Department of Entomology; Elina Coneva, Auburn University College of Agriculture; Steve Dalton, Fruit of the Spirit Farms, Hendersonville, NC; Renee Holland, University of Georgia Cooperative Extension; Les Dozier, President of Arkansas Blueberry Growers Association; Powell Smith and Susan James, Clemson University Cooperative Extension, Ash Sial and Dan Horton, University of Georgia Department of Entomology; Donn Johnson, University of Arkansas Department of Entomology; Gerard Krewer, organic blueberry grower and consultant; Joseph LaForest, Southern Integrated Pest Management Center; Jackie Lee, Oklahoma State University Department of Entomology and Plant Pathology; Oscar Liburd, University of Florida

# SWD IMPACTS, 2013 *(continued)*

***Table 14.*** *Input increases associated with spotted wing drosophila summarized by crop. Note that growers were asked about input increases across their entire farm, not for individual crops. Categories with fewer than two responses are indicated by -.*

| Crop (n respondents) | Number of respondents increasing pesticide use | Reported percentage increase and reported additional cost per acre | Average reported cost increase/acre for additional pesticide use | Number of respondents with increasing labor costs | Average percentage of labor increase |
|---|---|---|---|---|---|
| **All respondents (248)** | 146 | 88% | $165/acre | 110 | 12% |
| **Respondents only growing blueberries (63)** | 37 | 108% | $95/acre | 25 | 18% |
| **All respondents growing blueberries** | 99 | 84% | $153/acre | 72 | 25% |
| **Respondents only growing blackberries (13)** | 12 | 139% | $341/acre | 7 | 15% |
| **All respondents growing blackberries (88)** | 75 | 87% | $192/acre | 56 | 27% |
| **Respondents only growing raspberries** | - | - | - | - | - |
| **All respondents growing raspberries (67)** | 59 | 87% | $202/acre | 49 | 29% |
| **Respondents only growing strawberries (6)** | 1 | 10% | - | 2 | 10% |
| **All respondents growing strawberries (60)** | 50 | 70% | $185/acre | 43 | 28% |
| **Respondents only growing grapes (20)** | 7 | 39% | $109/acre | 6 | 78% |
| **All respondents growing grapes (49)** | 36 | 59% | $178/acre | 24 | 31% |
| **Respondents only growing cherries** | - | - | - | - | - |
| **All respondents growing cherries (24)** | 24 | 71% | $184/acre | 17 | 75% |

Department of Entomology; Joel Lineberger, Kildeer Farms, Kings Mountain, NC; Doug Pfeiffer, Virginia Tech University Department of Entomology; Cesar Rodriguez-Saona Rutgers University Department of Entomology; Daniel Shires, North Carolina State University Cooperative Extension; Dave Trinka, Michigan Blueberry Growers, Inc; Debby Weschler, Executive Secretary, North American Blackberry and Raspberry Association; Albert Wildes, President, Georgia Blueberry Association.

*(Source: http://swd.ces.ncsu.edu/working-group-activities/swd-impacts-2013/)*

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New York Berry News (NYBN) is a monthly commercial berry production newsletter provided by Cornell berry team members. It is designed to help promote and strengthen commercial berry crop production in New York State. NYBN is available free of charge in pdf format at: http://www.fruit.cornell.edu/nybn/ .

Visit the NYBN web site to view back issues or to subscribe to monthly e-mail notices with table of contents and a link to the most current issue.

More on individual team members and their areas of expertise may be found at: http://www.fruit.cornell.edu/berry/berryteam.htm.

**Questions or comments about the New York Berry News?**

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# Upcoming Events

***October 3 2014.*** *Save the Date! Cornell Small Fruit Open House, Cornell Orchard, Dryden Road, Ithaca, NY. More information to follow.*