# Spotted Wing Drosophila Management Recommendations for Michigan Raspberry and Blackberry Growers

**Rufus Isaacs[1], Bob Tritten[2], Steve Van Timmeren[1], John Wise[1,3], Carlos Garcia-Salazar[4], and Mark Longstroth[5]**
1. Dept. of Entomology, 2. Genesee Co. MSU Extension, 3. Trevor Nichols Research Complex, 4. Ottawa County MSU Extension, 5. Van Buren County MSU Extension

## BACKGROUND

The spotted wing Drosophila (SWD) is an invasive pest of berries, stone fruit, grapes, and some other fruit crops. It is native to Asia but was first detected in North America in California during 2008. Since then, it has spread to many of the primary fruit production regions of the United States. In Michigan, the first SWD were found in late 2010 in 13 counties (Figure 1) and it is now found throughout the main fruit production regions. Detections in Michigan so far have primarily been in fields of blueberry, blackberry, raspberry, cherry, and grape, also in many wild habitats where the flies infest wild fruiting plants.

SWD flies look similar to the small vinegar flies that typically infest fruits and some vegetables in late summer. Unlike native vinegar flies, female SWD have a serrated ovipositor, or egg-laying device, to cut a slit into the skin of intact fruit to lay their eggs. This makes SWD a more significant pest than the native vinegar flies that require damaged fruit to lay eggs. Soft skinned fruit such as blueberries, raspberries, and blackberries are at the greatest risk.

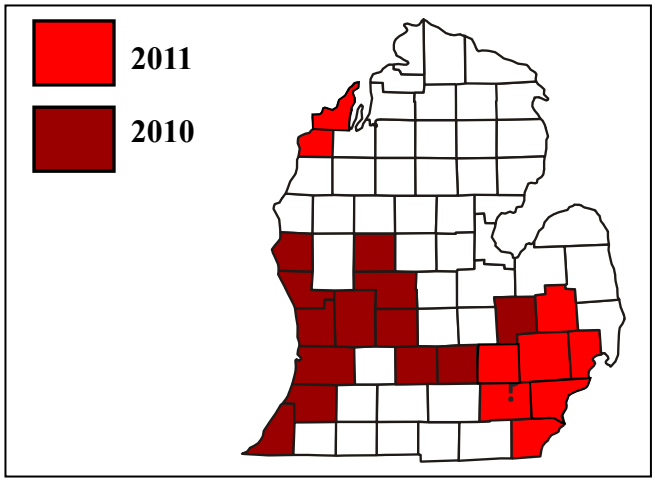


Figure 1. Counties where SWD was first detected in 2010 and in 2011.

Larval feeding by SWD causes fruit to collapse and increases the risk of larvae being found at harvest time. Because this insect has already been found in major fruit production regions of Michigan, it will be important to implement IPM programs in caneberry (raspberry or blackberry) fields to ensure that the impact of this new pest is minimized. Effective management of SWD consists of these key components:

1. Monitor fields with traps and check them regularly – this is an essential first step!
2. Check trapped flies to determine presence and number of male and female SWD.
3. If SWD is detected in traps, apply effective insecticides registered for caneberries to protect the fruit (see below).
4. Continue monitoring to evaluate your management program, and respond quickly if needed.
5. If possible, remove leftover fruit to reduce SWD breeding and food resources.
6. Stay informed. These recommendations are subject to change based upon new information. Find the latest information at our SWD website: www.ipm.msu.edu/SWD.htm

**Monitoring**

The most important step in managing SWD is to determine whether they are present in your fields, and when they may become active. Monitor for SWD from fruit set until the end of harvest to help identify the start of fly activity. The most important monitoring period is from fruit coloring until the crop is harvested, when the fruit are susceptible to SWD infestation.

These flies can be trapped using a simple monitoring trap consisting of a plastic 32oz cup with ten 3/16"-3/8" holes around the upper side of the cup, leaving a 3-4 inch section without holes to facilitate pouring out of the liquid attractant, or bait (Figure 2). The holes can be drilled in sturdy containers, burned with a hot wire or soldering iron, or made with a leather punch. The small holes allow access to vinegar flies, but keep out larger flies, moths, bees, etc. To help ensure that trapped flies do not escape, a small yellow sticky trap can be placed inside, hung on a paper clip. The paper clip can be attached with hot glue to the inside of the lid. The traps will also work without the yellow sticky insert, but then a drop of unscented dish soap should be added to the liquid bait to ensure flies remain trapped in the liquid.

Figure 2. Trap for capturing SWD adult flies.

Traps can be baited with apple cider vinegar to attract SWD (Figure 2). However, in 2011 and 2012, traps were much more attractive to SWD when they were baited with a yeast-sugar mix. SWD were trapped earlier and in greater numbers with the yeast-sugar mix. This is made by combining 1 tablespoon of active dry yeast (we use Red Star brand) with 4 tablespoons of sugar and 12 oz of water. This solution ferments and the flies are attracted to the odors. Although these traps are harder and messier to service, the yeast bait is less expensive overall than the apple cider vinegar traps, and the benefits of earlier detection are obvious when needing to protect crops from infestation. Traps baited with yeast will collect many flies, so sorting through these traps will take more time. For caneberry growers, we recommend a minimum of one yeast-baited trap for SWD every 1-5 acres, with an additional trap in a wooded field margin if present. SWD are typically trapped a week or two earlier in wooded habitat traps.

In crop fields, any traps for SWD should be hung in a shaded area in the fruit zone, using a wire attached to the top of the trap. Make sure the trap is clear of vegetation with the holes exposed so that SWD can easily fly in.

Traps should be checked for SWD flies once a week at a minimum, by looking on the yellow sticky trap and in the liquid. If you use a yeast-baited trap, checking only the sticky trap can be used as a way to reduce the amount of time needed to service the trap. However, checking the trap insert and liquid will provide the best ability to detect early fly activity. At each check, fresh bait should be swapped out and disposed of, away from the trap location. Spotted wing drosophila captures should be recorded each week in a log book.

***Identification of flies***

Vinegar flies are small (2-3 mm) with rounded abdomens. Traps baited with apple cider vinegar catch both male and female SWD flies. Native species of vinegar flies (and other insects) are also attracted and these need to be distinguished from SWD flies when checking the traps. Identification of SWD flies becomes easier with practice, especially when using a hand lens to examine the wings of trapped flies. Some native flies have dark patches on the wings, but will not have the distinctive dark dot found on the wings of SWD males (Figure 3).

Figure 3. Male spotted wing Drosophila fly with distinctive wing markings. (2 mm long).

Female SWD do not have dots on the wing, so their ovipositor needs to be examined closely in search of its serrated characteristics. Use of a 30 X magnification hand lens or microscope is needed to detect the distinctive saw-toothed ovipositor on female SWD. It is important to check traps for female flies as these often emerge first from overwintering sites.

If you check a trap that has flies matching these descriptions but you are unsure of their identification, contact your local Extension office or a trained scout or crop consultant for assistance.

For flies suspected of being SWD that are trapped in counties where this insect has not yet been reported (Figure 1), we encourage growers, scouts, and consultants to place flies trapped on the sticky traps into another container (or pull those floating in the vinegar out of the liquid and place in a small vial) then send them for identification to: Howard Russell, SWD Monitoring, Diagnostic Services, 101 CIPS, Michigan State University, East Lansing, MI 48824-1311. *Include the location and date of collection along with your contact information.*

Identification may also be aided by use of the online key provided by Oregon Department of Agriculture at swd.hort.oregonstate.edu/files/webfm/editor/ID_D_suzukii_060210_sm.pdf

***Sampling fruit for larvae***

If fruit are suspected of being infested, larvae can be sampled using a fruit dunk flotation method. Collect a standard sample of fruit (may be fruit for marketing, or suspicious fruit). Place the fruit in a plastic "ziplock" bag and crush lightly to break the skin. Make a salt solution by dissolving 1 Tbsp. of salt in 1 cup of water and add this solution to the bag to cover the berries. After 30 minutes, examine the liquid to see if larvae are visible in the liquid. Larger SWD larvae will be visible as small white pieces floating through the colored liquid. Placing this mix on a dark-colored tray is also an effective method for scoring the sample for SWD contamination. Detection of small larvae may require the use of a hand lens.

This fruit sampling method can be used in the field to assess different areas for infestation, such as before picking or to assess the performance of sprays.

## SWD CONTROL OPTIONS

***Given the potential for rapid population increase by SWD, active monitoring through the ripening period will be needed. This will allow rapid response to detections of spotted wing Drosophila. Most of what follows is based on recent experiences in the western United States. As research results are available from Michigan, we will update these recommendations.***

Since no action threshold is available for SWD, we are recommending a conservative approach in which a fly captured on your farm triggers protection of fields if berries are at a susceptible stage. If fruit are ripening and SWD flies are trapped, growers should: 1) Increase monitoring intensity to assess fly distribution; 2) Implement cultural controls where possible, 3) Protect fruit through to harvest using registered insecticides. This is particularly important if female flies are found on traps. Female SWD are able to lay eggs into fruit from the time of first coloring through to harvest, so this period is the window of susceptibility to SWD. If spotted wing Drosophila are found, the available management options and best strategies will depend on the scale of infestation, whether the field is certified organic or not, and the time of the season.

Because SWD populations tend to increase in the later part of the summer, we expect late-harvested fruit such as blackberries and fall raspberries to experience higher pressure from SWD than those that are harvested earlier in the summer such as strawberries and summer red raspberries.

### ***Cultural controls***

Cultural controls may help reduce reproduction and survival of flies. These include scheduling timely harvests and removing over-ripe fruit from fields to minimize host plant resource for SWD to lay eggs into and for larvae to develop on. For example, growers in other regions of the country are sending pickers through fields with buckets to collect good fruit and another container on a waist belt to collect over-ripe fruit to help remove these resources for SWD reproduction. In small fields this can be done by hand, but that may be impractical in large farms. A final cleanup picking to remove the last berries from the bushes may be worthwhile, but this approach has not yet been evaluated. Removing wild host plants that can harbor SWD such as wild grape, pokeberry, black raspberry, blackberry, etc. near crop fields is another potential strategy, but the efficacy of this has not been tested in our region.

Recent research in Oregon has compared various ways to prevent survival of SWD in infested berries. Infested fruit can be bagged inside clear or black plastic bags that are then placed in the sun or frozen to kill larvae. Additionally, solarizing large volumes of fruit can be done in which 1-2 ml clear plastic sheeting is placed over the fruit in a sunny location and sealed well around the edge using soil. Simply burying infested fruit is not effective, at least in the trials with fruit placed at 18 inches depth.

### ***Chemical controls***

Many Michigan caneberry growers already use IPM programs to manage insect pests during the summer months. Some of the insecticides already registered for caneberries will provide some protection against SWD. However, members of the neonicotinoid class (e.g. Provado, Assail, Actara) are considered weak on SWD and are not recommended for its control.

It is important to realize that spotted wing Drosophila females can start laying eggs one day after emergence. This means that monitoring should be a high priority, to detect the flies quickly so that

management decisions can be made. SWD will complete multiple generations under Michigan conditions and there will likely not be distinct generations but rather continuous increase in activity once the flies become active. For these reasons, if SWD are detected the spray intervals should be tightened to prevent crop infestation before and during harvest. In high pressure sites in western US states, this has required a 5-7 day spray interval. Sprayers should be calibrated to provide thorough coverage of fruit, especially in the center of the canopy where the flies like the shade. Applications that attempt to cover several rows at a time are unlikely to achieve good coverage of fruit on all the rows.

A number of registered insecticides have been very effective against SWD in laboratory trials, including some recent trials done at MSU on flies from a colony that was collected in Michigan. The most effective chemicals are organophosphate, pyrethroid, and spinosyn class insecticides. Pyrethrum class insecticides were less effective. Under field conditions, insecticides with fast knockdown activity have performed well at protecting fruit. Organic growers in the Pacific Northwest have used 2-3 applications of Entrust effectively to protect fruit in the pre-harvest period, and this should be rotated with Pyganic to stretch the period of coverage and also to reduce the chance of resistance developing. It is important to note that Entrust provides ~5 days residual control and Pyganic provides ~2 days of control. Note also that Entrust has a 9 oz/acre seasonal maximum (see below for more details).

The table below provides a list of insecticides registered for use in caneberries that have also shown high activity against SWD. Selection of insecticides for SWD control should take into account the other pests present, harvest date, re-entry restrictions, and potential impacts on existing IPM programs. Most of these insecticides are also active on other insects and most will have some activity on Japanese beetles that may be active at the same time. Always follow the specific label restrictions for caneberry. There may be supplemental labels available that have been developed specifically for spotted wing Drosophila. Details of label updates can be found at www.cdms.net (look under Services). The level of control achieved will depend on the SWD population, timeliness of application, coverage of fruit, and product effectiveness.

## Insecticides for SWD control in raspberry and blackberry

| Class | Trade name | Active ingredient | PHI (days) | Days of residual activity[#] |
|---|---|---|---|---|
| Organophosphate | Malathion | malathion | 1* | 5-7 |
| Pyrethroid | Mustang Max | zeta-cypermethrin | 1 | 7 |
| | Danitol | fenpropathrin | 3 | 7 |
| | Asana | esfenvalerate | 7 | 7 |
| | Brigade | bifenthrin | 3 | 7 |
| Spinosyn | Delegate | spinetoram | 1 | 7 |
| | Entrust (organic) | spinosad | 3 | 3-5 |
| Pyrethrum | Pyganic (organic) | pyrethrum | 0 | 2 |

*Check the label for the specific Malathion formulation you are using for the correct rate and PHI. Some may allow 0.5 day PHI.
# Estimated residual activity from experience with other insect pests in Michigan and from SWD studies in Oregon.

When selecting an insecticide for SWD control in caneberries, consider the REI, PHI, and especially the MRL restrictions in the destination country if exporting fruit. See the label for restrictions on distance to surface water and safety to pollinators and other beneficial arthropods. Remember to rotate classes of insecticides to delay development of insecticide resistance. This is especially critical in organic production where there are only two classes of insecticide registered for use against SWD.

***Organic caneberries:*** Organic fruit growers should be aware that the insecticidal control tools available to them are less effective than conventional insecticides against SWD, and will require more timely application. Experience in the west coast states indicates that SWD can be controlled in organic production through more intensive monitoring, timely application if flies are detected, and shorter intervals between sprays. In organic production systems, cultural controls will be even more important to help reduce the overall SWD population level.

Organic insecticide options are limited but Entrust and Pyganic are the two most effective options for SWD control in organic production. Entrust is limited to three applications per season in caneberries. There is a 2ee Entrust label for suppression of SWD, with a 2 oz/acre rate listed. Rotate Entrust (5 day residual) with the organic pyrethrum insecticide Pyganic (2 day residual) to achieve some resistance management.

**FOLLOW FUTURE DEVELOPMENTS**

Spotted wing Drosophila is a new pest to North America and has only recently been detected in Michigan. There is active research and monitoring underway to minimize its impact on fruit production, including multiple research approaches at Michigan State University and elsewhere. As new information is available, it will be posted online at www.ipm.msu.edu/SWD.htm and will be distributed to fruit growers via MSU Extension programs.