

SWD Management Recommendations for Michigan Blueberry Growers

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BACKGROUND

The spotted wing Drosophila (SWD) is an invasive pest of berries, stone fruit, grapes, and some pome fruit crops. It is native to Asia but was detected in North America for the first time in California during 2008. Since then, it has spread throughout many of the primary fruit production regions of the United States. In Michigan, the first SWD were found after blueberry harvest in 2010. So far, it has been detected in 13 counties across the state (Figure 1), and additional detections are expected as time progresses. For detailed fact sheets, identification guides, and how-to videos on monitoring for this pest, see the online resource at www.ipm.msu.edu/SWD.htm

SWD flies look similar to the many species of small vinegar flies that typically infest fruits and some vegetables in late summer. Unlike other vinegar flies, female SWD have a serrated ovipositor, or egg-laying device, used 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.

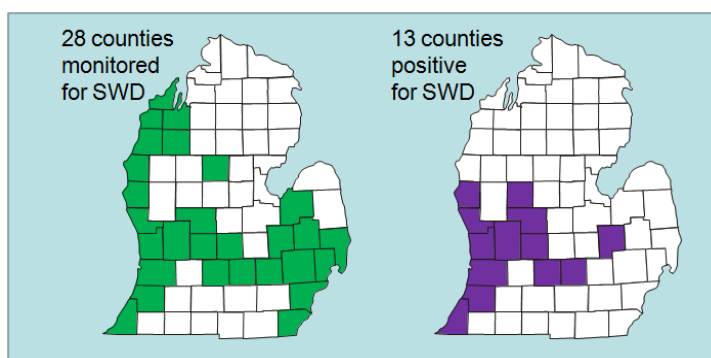


Figure 1. Counties monitored for SWD in 2010 (left) and the counties where one or more SWD were found in fall 2010 (right).

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 blueberry production regions of Michigan, it will be important to implement IPM programs in blueberry 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 blueberries 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 on the bush 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 first step is to determine whether SWD are present in your fields. Monitor for SWD from fruit set until the end of harvest. This will help identify the start of fly activity, although 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 several 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 or burned with a hot wire or soldering iron. The small holes allow access to vinegar flies, but keep out larger flies, moths, etc. Pour one inch of apple cider vinegar into the trap as bait. To help ensure that trapped flies do not escape, a small yellow sticky trap can be placed inside. The traps will also work without the yellow sticky insert, but then a drop of unscented dish soap should be added to the vinegar to ensure flies remain trapped in the liquid.



Figure 2. Trap for capturing SWD adult flies.

Traps should be hung in the bush canopy in the fruit zone, in a shaded area, 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 weekly for SWD flies, by looking on the yellow sticky trap and in the liquid. At each check, fresh vinegar 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 that is present on the wings of SWD males (Figure 3).

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.



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

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. Either collect a standard sample of fruit, or only suspicious (oviposition scars and soft spots) fruits. Place fruit in a plastic “ziplock” bag and crush lightly to break the skin. Add a sugar-water mixture (4 cups water to every 1/4 cup sugar). Spotted wing *Drosophila* larvae will float in the liquid and the fruit will sink. Detection of small larvae may require the use of a hand lens, and this works well with a light behind the bag to shine through onto the larvae.

Another method developed is to dissolve 1 Tbsp. of salt in 1 cup of water. Suspect berries are placed on a tray and the salt solution lightly poured over the fruit. Observe the fruit closely for 10-15 minutes to see if larvae exit through egg-laying holes. Larger SWD larvae will be visible emerging from the berries.

For both sampling methods, it should be noted that blueberry maggot larvae may also be present at the same time of the season, and these also have white larvae that can be present in ripe fruit. These larvae are very difficult to distinguish from SWD larvae, but specimens can be separated by trained entomologists.

SWD CONTROL OPTIONS

*Our 2010 trapping suggests that typical insect control programs kept this fly suppressed through the end of harvest. However, 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.*

We currently do not know the relationship between catches in individual traps and infestation risk in fruit in the surrounding area. Since no action threshold is available for SWD, we are recommending a conservative approach in which fly capture 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 blueberries 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. Laboratory tests showed no indication of blueberry varieties being more or less susceptible to infestation. But, because SWD populations tend to increase in the later part of the summer, we expect late-harvested cultivars to experience higher pressure from SWD than those that are harvested early.

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. In small fields this may be done by hand, but that is 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, raspberry, blackberry, etc. near crop fields is another potential strategy, but again this has not been tested in our region.

Recent research in Oregon has compared various ways to prevent survival of SWD in infested berries. Two methods that worked well for this were bagging fruit inside clear or black plastic bags, and solarizing 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 was not effective.

Chemical controls

Michigan blueberry growers already use IPM programs to manage insect pests (such as the blueberry maggot fly) during the summer months. Many of the insecticides used for this pest will provide some protection against SWD. However, members of the neonicotinoid class (e.g. Provado, Assail, Actara) are considered weakly active on SWD and are not recommended for its control.

It is important to realize that whereas blueberry maggot has only one generation a year, providing growers a week from emergence to egg-laying for protect their berries, 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 activity once the flies become active. For these reasons, if SWD are detected the spray intervals should be tightened to prevent crop infestation before harvest. Sprayers should be calibrated to provide thorough coverage of fruit, especially in the center of the bush 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 shown to be very effective against SWD in laboratory trials, including some recent ones done at MSU on flies from a colony that was collected in Michigan. The most effective chemicals are organophosphate and pyrethroid insecticides and one carbamate insecticide. The less effective options were spinosyn and pyrethrum class insecticides. 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 can 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 ~3 days of control. Note also that Entrust has a 9 oz/acre seasonal maximum (see below for more details).

The below provides a list of insecticides registered for use in blueberries 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 blueberry maggot and most will have some activity on Japanese beetles that may be active at the same time of the season. Always follow the specific label

restrictions for blueberry. 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 blueberry

Class	Trade name	Active ingredient	PHI (days)	Days of residual activity [#]
Organophosphate	Malathion	malathion	1*	5-7
	Imidan	phosmet	3	7
Pyrethroid	Mustang Max	zeta-cypermethrin	1	7
	Danitol	fenpropathrin	3	7
	Asana	esfenvalerate	14	7
	Brigade	bifenthrin	1	7
Carbamate	Lannate	methomyl	3	3-5
Spinosyn	Delegate	spinetoram	3	7
	Entrust (organic)	spinosad	3	3-5
Pyrethrum	Pyganic (organic)	pyrethrum	0.5	2-3

*Check the label for the specific Malathion formulation you are using for the correct PHI. Some formulations 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 blueberry, 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 blueberries: 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. However, 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. Where possible to implement, cultural controls will also be important to help reduce the overall population level.

Organic insecticide options are limited but the experience so far in California and Oregon indicates that Entrust and Pyganic are the two most effective options for SWD control in organic production. Entrust is limited to three applications in a 30 day period followed by 30 days without any Entrust application, and there is a 9 oz/acre seasonal maximum. There is a 2ee Entrust label for suppression of SWD, with a 2 oz/acre rate listed. Until there is more information available, we are recommending the 2 oz/acre rate of Entrust. Rotate Entrust with the organic pyrethrum insecticide Pyganic to achieve some resistance management. Pyganic EC 5.0 is labeled at 4.5-18 oz/acre in blueberries, and using the higher end of this rate range has provided five days of residual control in recent University of California trials.

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.