GUIDE SHEET Lincoln University Cooperative Extension • Integrated Pest Management Program

Management of Spotted Wing Drosophila

with Emphasis on High Tunnel-grown, Fall-bearing Primocane Raspberries

For more information:
Contact Dr. Jaime Piñero
State Extension Specialist - Integrated Pest Management, Lincoln University Cooperative Extension (LUCE)
PineroJ@LincolnU.edu
and Patrick Byers, MU Extension

Integrated Pest Management (IPM) options to manage SWD in high tunnels include monitoring, sanitation, exclusion and timely application of insecticide sprays. For the 2014 season, a monitoring program for susceptible crops is recommended throughout the harvest season. **Research aimed at identifying additional management options will be conducted by the LUCE IPM Program.**

LINCOLN University
Cooperative Extension

900 Chestnut Street, Allen Hall
Jefferson City, MO 65101
(573) 681-5543

LUCE GS#18-D-2013
Rev. 11/06/2013

The Spotted Wing Drosophila (SWD) *Drosophila suzukii* has very quickly become a devastating pest of berry crops in Missouri. Adults were first detected in monitoring traps in late June 2013. By early August, infestations of blackberry fruits had already been reported. By mid-August, SWD were reported infesting crops statewide. In addition to small fruit crops, this invasive insect pest also attacks some stone fruits (cherry, nectarine, peach), high tunnel tomatoes and wild hosts (including pokeweed, autumn olive, crabapple, nightshade, Amur honeysuckle and wild grape). Raspberries, blackberries, blueberries, elderberries and grapes are at the greatest risk.

SWD flies look similar to the small vinegar flies that are typically found around or on fermenting fruits and vegetables. However, unlike those native vinegar flies, SWD females have a serrated egg-laying device called an ovipositor, which is used to cut a slit into the skin of intact fruit to lay their eggs. This makes SWD a more significant pest than other vinegar flies. The affected crops also ripen later in the summer when the fly population increases, further increasing the risk.

This article discusses IPM options to minimize larval infestations by SWD to high tunnel raspberries in the fall. It is very important that farmers also learn how to identify and monitor for SWD and how to detect larval infestations. An identification and monitoring guide is available at: http://www.lincolnu.edu/web/programs-and-projects/ipm. Because SWD most likely have come to stay, successful SWD control will require planning and implementation of a program that integrates multiple components.

photo by Tim Baker, MU Extension

Female Spotted Wing Drosophila.

Exclusion: In high tunnels, screening might protect individual plants or crops. In Japan, extremely fine mesh with openings less than 0.98 millimeter (0.039 inches) wide (18 mesh or finer) was able to protect blueberries. If screening is used, passive venting can be problematic; thus, some means of increasing air flow, such as using ventilation fans, will be required. Mesh screens will also exclude pollinating insects, and pollinator introduction will be needed if the crop is in bloom. Raspberries blossom and set fruit over a long period of time, especially with the primocane crop in a high tunnel, so it might not be practical to screen the crop without introducing pollinators into the tunnel. One option would be to use removable screens with Velcro®, allowing for attachment at fruit set and during early development. If SWD are found by trapping inside the high tunnel, an insecticide application might provide SWD suppression for the rest of the season if exclusion is implemented.

Cultural Controls: (a) Canopy and Water Management: Thin the plant row to three to four strong canes per square foot, eliminating weaker shoots and opening the canopy. Consider a trellising system that similarly opens the canopy. This might make plantings less attractive to SWD and will improve spray coverage. Leaking trickle irrigation lines should be repaired, and overhead irrigation should be minimized. Allow the ground and mulch surface to dry before irrigating.

(b) Sanitation: Removing overripe fruit from production areas as soon as possible can minimize SWD egg lay and larval development. Growers in other regions of the country have sent pickers through fields with one container to collect good fruit and another container to collect overripe fruit; again, this will help to minimize egg-laying and larval development sites. This practice might be better suited for small-scale situations, such as a tunnel. A final cleanup picking to remove the last berries from the bushes might be worthwhile. Infested fruit that remains in the field allows eggs and larvae to develop fully; consequently, it serves as a food source for increased fly populations. Another potential option is the removal of wild host plants near production fields that could support SWD populations. Another method that worked well at eliminating SWD in infested fruits is bagging fruit inside clear or black plastic bags.

photo by Tim Baker, MU Extension

Male Spotted Wing Drosophila on a raspberry fruit.

Insecticidal Control: This pest is new to Missouri, so no research has been conducted within the state on the most effective treatments to manage SWD. In addition, SWD populations are building in some regions of the state due to the rapid reproductive potential of this fly, so control actions ought to be taken immediately using recommendations based on findings from other states. But before you spray, confirm that you have SWD in your area by placing monitoring traps or by inspecting fruit. Sprays must be timed to kill adults before they lay eggs, as sprays will not control larvae already in the fruit. After spraying an insecticide, take into account that fruit might still present infestations for a few more days. This is because eggs and larvae that were present in the fruit before spraying were not killed. Maintain monitoring traps, and reapply insecticides as needed in accordance with label restrictions. Always read product labels to make sure pesticides are registered for use on raspberries.

Pesticide Use in High Tunnels: In the Midwest states, the pesticide regulatory agencies vary in their interpretation of whether a high tunnel is a type of greenhouse. For example, Indiana considers a high tunnel to be a form of greenhouse. That means the pesticides one selects for high tunnel use must be appropriately labeled for greenhouse use. Other states consider high tunnels to be the same as fields when it comes to pesticide use. In Missouri, an intermediate approach is followed: a high tunnel is considered to be a greenhouse when the sides are closed, but a high tunnel is considered to be a "field" when the sides are open.

Specific Insecticide Options: For conventional farmers, the most effective chemicals are the organophosphate, pyrethroid, and spinosyn classes of insecticides. Under field conditions, insecticides with fast knockdown activity have performed well at protecting fruit from SWD. Delegate 25WG® and Radiant SC® are reduced-risk, broad-spectrum insecticides that have been labeled for control of SWD in various crops in all states. Both products maintain populations of most beneficial insects, do not result in mite flare-ups, and have short re-entry (four hours) and preharvest (e.g., one day for Radiant® on strawberries) intervals. Neonicotinoids such as Provado® and Actara® are considered

photo by Jaime Piñero, Lincoln University Cooperative Extension

Numerous SWD adults resting on blackberry fruit.

weakly active on SWD flies and are not recommended for control (according to Dr. Rufus Isaacs and collaborators at Michigan State University). For organic farmers, Entrust® (spinosad) is the only product with residual activity (five to seven days of control). Organic growers in the Pacific Northwest have used two to three applications of Entrust® to effectively protect fruit in the preharvest period. It is important to note that Entrust® provides about five days of residual control and Pyganic® provides about two days of control. Note also that Entrust® has a 9 oz./acre seasonal maximum (see Table 1. for more details). In some studies by Michigan State University, Azera® and Pyganic® were found to be weakly active options compared with Entrust (spinosad). Because the Entrust® label requires rotation to another product for resistance management, Pyganic® or Azera® can very well fit that need. While it doesn't appear to provide residual control, Pyganic® applied at five-day intervals at the high labeled rate has shown to reduce SWD populations in California.

Table 1 (on next page) lists the current insecticide options for SWD. Please note that both spinosad and spinetoram are naturally derived substances created through a fermentation process. However, spinetoram is a mixture of chemically modified spinosyns J and L and therefore is not approved for certified organic production. Spinetoram is the active ingredient of Delegate® 25WG and Radiant® SC, two reduced-risk, broad-spectrum insecticides that have been labeled for control of SWD in various crops in all states. Both products maintain populations of most beneficial insects, do not result in mite flareups and have short re-entry (four hours) and preharvest (e.g., one day for Radiant® on strawberries) intervals.

Caprile, J. L., Flint, M. L., Bolda, M. P., Grant, J. A., Van Steenwyk, R., and D. R. Haviland. "Spotted Wing Drosophila: Integrated Pest Management for Home Gardeners and Landscape Professionals." M. L. Fayard, ed., University of California Pest Notes Publication 74158. 2011.

Dreves, A. J., and G.A. Langellotto-Rhodaback. "Protecting Garden Fruits from Spotted Wing Drosophila (Drosophila suzukii)." 2011. Corvallis: Oregon State Univ. Ext. Serv. EM 9026. Accessed August 2013.

Guédot, C. "Spotted Wing Drosophila Management Recommendations for Wisconsin Raspberry Growers." Department of Entomology, University of Wisconsin. http://labs.russell.wisc.edu/swd/files/2013/06/Recommendations-for-SWD-Management-in-Raspberry.pdf.

Isaacs, R., Tritten, B., Van Timmeren, S., Wise, J., Garcia-Salazar, C., and M. Longstroth. "Spotted Wing Drosophila Management Recommendations for Michigan Raspberry and Blackberry Growers." 2011. www.ipm.msu.edu/SWD/ManagementRecommendations-RaspberryBlackberryAug2011.pdf.

Isaacs, I., Wise, J., Garcia-Salazar, C., and Longstroth, M. "SWD Management Recommendations for Michigan Blueberry." 2013. http://www.ipm.msu.edu/uploads/files/SWD/SWDManagementforMichiganBlueberries_-June25-2013.pdf. SWD Management Recommendations for Michigan Blueberry.

Lee, J. C., Bruck, D. J., Dreves, A. J., Ioriatti, C., Vogt, H., and P. Baufeld. "In Focus: Spotted Wing Drosophila, Drosophila suzukii, across Perspectives." Pest Mgt. Sci. 67 (2011): 1349–51.

McDermott, L., Heidenreich, C., Carroll, J. Helms, M., Agnello, A., and G. Loeb. "How Do I Manage Spotted Wing Drosophila (SWD) in My Garden?" Fruit Resources Cornell University. http://www.fruit.cornell.edu/spottedwing/pdfs/SWDgarden.pdf.

Walton, V., Lee, J., Buck, D., Shearer, P., Parent, E., Whitney, T., and A. J. Dreves. "Recognize Fruit Damage from Spotted Wing Drosophila." Corvallis: Oregon State Univ. Ext. Serv. EM 9021. 2010.

After Harvest

Materials with longer pre-harvest intervals can be used immediately after harvest to eliminate back populations that will feed on any remaining overripe or dropped fruit. Residual activity (the amount of time a pesticide continues to work after administered) has sometimes been reported to be shorter than what is listed on Table 1. (next page) so a close watch of traps for return of adults will be needed.

Table 1. Insecticides for use on raspberries.

Class (IRAC)	Trade name	Active ingredient	REI	PHI (days)	Rate (per acre)	Comments
Carbamates (1A)	Sevin® 80S	Carbaryl	12 hrs	7	1-2 quarts	No more than 10 quarts/acre/year. Max of 5 applications/year. 7 day interval between applications
Organophosphates (1B)	Malathion 5EC	Malathion	12 hrs	1	3 pints	Use higher rates when insect pressure is heavy. Max application rate is 3.2 pints per acre. Max of 3 applications/year. 7 day interval between applications
Pyrethroids and Pyrethrins (3A)	Bifenture®	Bifenthrin	12 hrs	3	8 – 16 oz.	Max of 32 oz./acre/year
Pyrethroids and Pyrethrins (3A)	Asana® XL	Esfenvalerate	12 hrs	7	4.8 – 9.6 fl. oz.	Max of 28.8 fl. oz./acre/year
Pyrethroids and Pyrethrins (3A)	Danitol® 2.4EC	Fenpropathrin	24 hrs	3	10-⅔ – 16 oz.	Max of 32 oz./acre/year 14 day interval between applications
Pyrethroids and Pyrethrins (3A)	Brigade® 2EC	Bifenthrin	12 hrs	3	6.4 oz.	Max of 32 oz./acre/year
Pyrethroids and Pyrethrins (3A)	Mustang Max™	Zeta-cypermethrin	12 hrs	1	4 oz.	Max of 24 oz./acre/season 7 day interval between applications
Pyrethroids and Pyrethrins (3A)	Pyganic® EC5.0 **OMRI**	Pyrethrins	12 hrs	0	16 – 64 oz.	Apply when non-targets including honey bees are least active. Pyrethrins degrade rapidly in sunlight.
Pyrethroids and Pyrethrins (3A)	AZERA® **OMRI**	Pyrethrins + Azadirachtin	12 hrs	0	2 Pints (32 fl. oz.)	Greenhouse and field use. Do not apply more than 1 time per day. Do not apply more than 10 times per season. Do not reapply within 3 days except under extreme pest pressure
Compounds of unknown or uncertain MoA	Aza-Direct® **OMRI**	Azadirachtin	4 hrs	0	maximum rate of 3½ pints/acre	Greenhouse and field use. When pest pressure is heavy or plant canopy is dense, use higher rates and increase spray frequency stated in the label
Neonicotinoids (4A)	Actara®	thiamethoxam	12 hrs	3	2 – 3 oz.	Max of 6 oz./acre/season 7 day interval between applications
Spinosyns (5)	Delegate®	Spinetoram*	4 hrs	1	3 – 5 oz.	Max of 19.5 oz. /acre /season. Max of 6 applications/year. 4 day interval between applications
Spinosyns (5)	Entrust® **OMRI**	Spinosad*	4 hrs	1	1.25 – 2 oz.	Max of 9 oz./acre/season Max of 6 applications/ year. 5 day interval between applications

Table 1. Insecticides labeled for use on raspberries. Products are not complete listings of all available options. Organic Materials Review Institute (OMRI) indicates an organically compatible insecticide. Where brand names or company names are used, it is for the reader's information. No endorsement is implied nor is any discrimination intended against other products with similar ingredients. Read labels to ensure that your product matches the site. Alternate the MoA (mode of action) of the product you choose on a yearly basis to minimize resistance buildup. For insecticides that work primarily through ingestion (e.g., spinosad), adding a small amount of cane sugar (2 tsp./gallon of water) to the spray tank mix can improve results.