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Vegetable & Fruit Headline News

The University of Maryland Extension Agriculture and Natural Resources Profitability Impact Team proudly presents this publication for the commercial vegetable and fruit industry.

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Special Alert # 2: SWD Larval Infestations in Central Maryland

Spotted Wing Drosophila Management

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Spotted wing drosophila (SWD), *Drosophila suzukii*, populations are starting to rise in Maryland. Fruit samples from central Maryland taken in the last few weeks were beginning to have larger larvae in them. Most commercial fruit becomes susceptible at first color, and it is important to regularly monitor fruit early in the season to time applications and evaluate the efficacy of your spray program. Sampling 30-40 fruit per block from random locations including border rows and either directly inspecting fruit for larvae by breaking open the fruit or extracting larvae from fruit with salt or sugar water solutions can help you determine if SWD are a problem in your field. See the June 2015 issue (Volume 6 Issue 3) of UME Vegetable & Fruit News for a more detailed description of fruit monitoring. Insecticide spray programs should rotate modes of action (IRAC activity groups). Most insecticides used to target SWD are only effective against adults and lose activity in about 7-10 days. Further details on insecticides that can be used can be found below.

Figure 1. SWD larva in a ripe blueberry. Image: Bugwood.org, taken by Frank A. Hale, University of Tennessee.

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SWD Hosts:

Figure 2. SWD adults and damage on a ripe raspberry. Image: Washington State University Extension, taken by Bev Gerdeman.

SWD, continues to be an insect pest problem for growers of soft-skinned fruit such as blackberry, blueberry, cherry (sweet and tart), raspberry (black and red), and strawberry (see examples of damage Figures 1-5). Unlike other vinegar fly species that lay their eggs in over ripe fruit, SWD will infest fruit as it ripens, and it can also lay eggs in a wide range of wild hosts and damaged and overripe fruit. In this region, wild relatives of common cultivated fruit [e.g. Allegheny (aka common) blackberry (*Rubus allegheniensis*), wild black raspberry (*Rubus occidentalis*), American red raspberry (*Rubus strigosus*), wild blueberry (*Vaccinium* spp.), wild cherry (*Prunus* spp.)] are present in the landscape surrounding fruit farms and may harbor SWD. In addition to these close relatives of commercial hosts, SWD successfully develops on wild, ornamental, and non-crop fruiting plants in the landscape. Recent work in other regions has suggested that species of Honeysuckle (*Lonicera* spp.) (which are abundant in many Mid-Atlantic habitats) and Sweet box (*Sarcococca confusa*) (sometimes planted as an ornamental) may serve as early season hosts in some regions allowing SWD populations to build in the landscape prior to the fruiting of commercial hosts. Other non-crop hosts of interest that are present in the Mid-Atlantic region (either in wild woody areas or as cultivated ornamentals) include species of dogwood (e.g., Red osier dogwood, *Cornus sericea*), species of mulberry (e.g., White mulberry, *Morus alba*), and other *Prunus* species (e.g., Cherry laurel, *Prunus laurocerasus*). Because SWD may also develop on damaged and overripe fruit of commercial crops that are not hosts when intact, un-harvested or dropped fruit may also contribute to SWD populations in commercial settings. Examples of this second category of hosts include split citrus, melons, as well as pome and thicker skinned stone fruits that SWD cannot directly damage but can persist on if they are damaged. The broad host range of SWD provides many alternate hosts within and outside commercial fields, and it is likely that these alternate hosts play a role in commercial infestation, though the impact of alternate hosts on SWD populations is unclear at this time.

Cultural Management:

Figure 3. SWD adult and damage on a ripe blackberry. Image: Penn State Extension, taken by Kathleen Demchak.

Because SWD has many alternate hosts and populations can build in many types of overripe fruit even after the crop season, it is important to not only manage the crops that are currently in production but also manage other crops after they are harvested. Field sanitation within the current host crop may reduce on-farm SWD populations, therefore **remove all ripe and cull fruit** from the planting as frequently as possible, remembering that fruit in the center of the plant are harder to see and spray and SWD may prefer them. Avoid allowing over ripe fruit to build up in plantings. **Disposal of cull fruit** can be a challenge and it is not sufficient to compost the fruit because SWD may still emerge and reproduce in these fruit. Removing and destroying it offsite, burying it at least 2 feet deep, heating it (bagging it in plastic and exposing it to full sun for at least a week) or freezing it to kill the eggs and larvae will prevent cull fruit from contributing to SWD populations on-site. **Removal of cultivated alternate host fruit** that is not under management such as pre-harvest floricane fruit or post-harvest fruit should be performed as quickly and often as possible. Renovating early cultivars and fruit types promptly, destroying produce that is left in fields, and removing culls is important to help manage SWD on later susceptible crops because these fruit can be reservoirs for SWD. **Removal of non-cultivated alternate hosts** that may be reservoirs of SWD may help reduce SWD population pressure; however, we do not know how far SWD may migrate to enter a host crop or the relative

importance of different hosts. Additionally, these alternate host plants provide habitat for several species of pollinators and natural enemies and may provide reservoirs of susceptible SWD to help prevent insecticide resistance. **Isolate plantings** by planting them away from alternate hosts, instead surrounding them with crops that cannot serve as hosts such as agronomic crops and some vegetables.

Figure 4. SWD damage on a ripe strawberry. Image: University of California Agriculture and Natural Resources.

When establishing new plantings, we recommend selecting **earlier ripening** fruit crops and varieties to avoid the later season high SWD pressure. **Exclusion** with extremely fine mesh with openings less than 0.98 mm (0.039") may protect crops, though venting and pollination can be problematic and may adversely affect yield. Additionally, this is more feasible for fruit grown in tunnels because the infrastructure to hang the mesh is already in place.

Biocontrols:

Several **natural enemies** that feed on SWD adults and pupae are likely present in the Mid-Atlantic, including predatory insects and other arthropods as well as a parasitoid wasp that lays its eggs in SWD pupae. These natural enemies feed on a variety of insects and do not reproduce as quickly as SWD. In other regions of the U.S. where the impact of natural enemies on SWD populations is being researched, biological control has not been effective, therefore control with natural enemies is unlikely to reduce SWD populations below a damaging level on its own.

Chemical Management:

Figure 5. SWD damage on a ripe tart cherry. Image: University of Maryland Extension, taken by Bryan Butler.

Pesticide sprays for SWD primarily target adult flies, which tend to be the smallest part of the population during most parts of the year. Because most active ingredients are unlikely to impact eggs and larvae, applications will not remove infestation that is already present in the field. **Good spray coverage** is critical as most materials work primarily by contact, so ensure that the sprayer is calibrated and use adequate volumes of spray solution (100 gallons/acre or greater spray volume is recommended for all susceptible fruit crops) and spray pressure. Coverage should be evaluated throughout the entire canopy with water sensitive paper (spray cards). Increasing water volume, including a spreader/sticker surfactant, and driving at optimal speed through every row when using an airblast sprayer can help increase coverage. Manipulating the canopy via pruning or using a trellising system that improves spray access will also improve coverage. Residual activity for most products under ideal conditions is around 7-10 days. However, most pesticides that are effective against SWD are not rainfast, and reapplications may be necessary after rainy conditions. Evaluate the efficacy of your spray program by monitoring larvae in fruit (see previous article).

Most commercial fruit becomes susceptible at first color, though early crops and varieties may escape periods of high SWD pressure in this region. Checking fruit regularly early in the season to time applications and evaluate their efficacy is critical because SWD reproduces quickly, and populations can increase several fold within a short period. However, applying sprays before SWD is present in fruit plantings may negatively impact natural enemies and pollinators and may cause outbreaks of secondary pests. Indeed, secondary pest outbreaks (e.g. spider mites and scale insects) are becoming more common in crops that are managed for SWD, particularly with pyrethroid intensive programs. Do not make pesticide applications during bloom period and when pollinators are active.

Blueberry

Table 1. Examples of SWD-active insecticides for blueberry production. This is not an exhaustive list, and other formulations of these active ingredients or other active ingredients in these chemical classes may be similarly effective. **ALWAYS read and follow all instructions on the pesticide label; the information presented here does not substitute for label instructions.**

Trade Name	Active Ingredient	Reentry Interval	Preharvest Interval	Effectiveness[A]	Application Restrictions	Maximum AI
Pyrethroids and pyrethrins (IRAC activity group 3A)						
Asana XL	Esfenvalerate	12 hrs	14 days	Excellent	Not specified	0.2 lb ai/acre per season
Brigade WSB	Bifenthrin	12 hrs	1 day	Excellent	Not specified	0.5 lb ai/acre per season
Danitol 2.4 EC	Fenpropathrin	24 hrs	3 days	Excellent	2 per season	0.6 lb ai/acre per season
Mustang Maxx	Zeta-cypermethrin	12 hrs	1 day	Excellent	Not specified	0.15 lb ai/acre per season
Bifenture 10DF	Bifenthrin	12 hrs	1 day	Good-Excellent	Not specified	0.5 lb ai/acre per season
Pyganic EC 5.0 II[B]	Pyrethrins	12 hrs	0 days	Weak-Fair	10 per season	Not specified
Spinosyns (IRAC activity group 5)						
Delegate WG	Spinetoram	4 hrs	3 days	Good-Excellent	6 per year	0.305 lb ai/acre per year
Entrust SC[B]	Spinosad	4 hrs	3 days	Good	3 per crop or 6 per year	0.45 lb ai/acre per crop
Spintor 2SC	Spinosad	4 hrs	3 days	Good-Fair	3 per crop or 6 per year	0.45 lb ai/acre per crop
Diamides (IRAC activity group 28)						
Exirel	Cyantraniliprole	12 hrs	3 days	Good	Not specified	0.4 lb ai /acre per year
Organophosphates (IRAC activity group 1B)						
Imidan 70W	Phosmet	24 hrs[C] 3 days[D]	3 days	Excellent	5 per year	3.63 lbs ai/acre per year
Diazinon 50W	Diazinon	5 days	7 days	Good	1 in season foliar	Not specified
Malathion 8 Flowable	Malathion	12 hrs	1 day	Good	3 per year	Not specified
Carbamates (IRAC activity group 1A)						
Sevin XLR Plus	Carbaryl	12 hrs	7 days	Fair-Good	5 per year	10 quarts/acre per year
Lannate SP	Methomyl	48 hrs	3 days	Good-Excellent	4 per crop	4 lbs/acre per crop

[A]Efficacy rankings summarized by Rufus Isaacs at Michigan State University and determined by surveys of WERA-1021 SWD Coordinating Committee members.
[B]OMRI approved for use in organic production
[C]REI for employees in high bush blueberries.
[D]REI for low bush blueberries and non-employees in high bush blueberries, i.e. general public at pick-your-own farms.

Rotate modes of action by selecting materials from different IRAC activity groups for each application to delay the development of insecticide resistance. Ideally no activity group should be applied back to back to the same planting even if targeting different pests. Tables 1-5 provide some insecticides that have been effective (survey of WERA-1021 SWD Coordinating Committee members) against SWD for some host fruit [blueberry, brambles (blackberry and raspberry), strawberry, sweet cherry, and tart cherry]. This is not an exhaustive list, and other formulations of these active ingredients or other active ingredients in these chemical classes may be similarly effective in managing SWD populations in these fruit crops. These insecticides may also be important components of management programs for other pests so consider the maximum number of applications and active ingredient allowed per season or year when designing spray programs. In some crops, post-harvest application of insecticides may be applied to control remaining SWD adults if later susceptible crops are nearby. Materials with long preharvest intervals may be useful after harvest in this situation. ALWAYS **read and follow all instructions on the pesticide label; the information presented here does not substitute for label instructions.**

Brambles (Blackberry and Raspberry)

Table 2. Examples of SWD-active insecticides for bramble (blackberry and raspberry) production. This is not an exhaustive list, and other formulations of these active ingredients or other active ingredients in these chemical classes may be similarly effective. **ALWAYS read and follow all instructions on the pesticide label; the information presented here does not substitute for label instructions.**

Trade Name	Active Ingredient	Reentry Interval	Preharvest Interval	Effectiveness[A]	Application Restrictions	Maximum AI
Pyrethroids and pyrethrins (IRAC activity group 3A)						
Asana XL	Esfenvalerate	12 hrs	7 days	Excellent	Not specified	0.15 lb ai/acre per season
Brigade WSB	Bifenthrin	12 hrs	3 days	Excellent	1 post bloom	0.2 lb ai/acre per season
Danitol 2.4 EC	Fenpropathrin	24 hrs	3 days	Excellent	2 per season	0.6 lb ai/acre per season
Mustang Maxx	Zeta-cypermethrin	12 hrs	1 day	Excellent	Not specified	0.15 lb ai/acre per season
Bifenture 10DF	Bifenthrin	12 hrs	3 days	Good-Excellent	1 post bloom	0.2 lb ai/acre per season
Pyganic EC 5.0 II[B]	Pyrethrins	12 hrs	0 days	Weak-Fair	10 per season	Not specified
Spinosyns (IRAC activity group 5)						
Delegate WG	Spinetoram	4 hrs	1 day	Good-Excellent	6 per year	0.305 lb ai/acre per year
Entrust SC[B]	Spinosad	4 hrs	1 day	Good	6 per year	0.45 lb ai/acre per crop
Spintor 2SC	Spinosad	4 hrs	1 day	Good-Fair	6 per year	0.45 lb ai/acre per crop
Organophosphates (IRAC activity group 1B)						
Malathion 8 Flowable	Malathion	12 hrs	1 day	Good	3 per year	Not specified
Carbamates (IRAC activity group 1A)						
Sevin XLR Plus	Carbaryl	12 hrs	7 days	Fair-Good	5 per year	10 quarts/acre per year

[A]Efficacy rankings summarized by Rufus Isaacs at Michigan State University and determined by surveys of WERA-1021 SWD Coordinating Committee members.
[B]OMRI approved for use in organic production.

Strawberry

Table 3. Examples of SWD-active insecticides for strawberry production. This is not an exhaustive list, and other formulations of these active ingredients or other active ingredients in these chemical classes may be similarly effective. **ALWAYS read and follow all instructions on the pesticide label; the information presented here does not substitute for label instructions.**

Trade Name	Active Ingredient	Reentry Interval	Preharvest Interval	Effectiveness[A]	Application Restrictions	Maximum AI
Pyrethroids and pyrethrins (IRAC activity group 3A)						
Brigade WSB	Bifenthrin	12 hrs	0 days	Excellent	Not specified	0.5 lb ai/acre per season
Danitol 2.4 EC	Fenpropathrin	24 hrs	2 days	Excellent	2 per year	0.8 lb ai/acre per year
Bifenture 10DF	Bifenthrin	12 hrs	0 days	Good-Excellent	Not specified	0.5 lb ai/acre per season
Pyganic EC 5.0 II[B]	Pyrethrins	12 hrs	0 days	Weak-Fair	10 per season	Not specified
Spinosyns (IRAC activity group 5)						
Entrust SC[B]	Spinosad	4 hrs	1 day	Good	5 per year	0.45 lb ai/acre per crop
Radiant SC	Spinetoram	4 hrs	1 day	Good	5 per year	0.305 lb ai/acre per year
Spintor 2SC	Spinosad	4 hrs	1 day	Good-Fair	5 per year	0.45 lb ai/acre per crop
Organophosphates (IRAC activity group 1B)						
Diazinon 50W	Diazinon	3 days	5 days	Good	1 foliar per crop	Not specified
Malathion 8 Flowable	Malathion	12 hrs	3 days	Good	4 per year	Not specified
Carbamates (IRAC activity group 1A)						
Sevin XLR Plus[C]	Carbaryl	12 hrs	7 days	Fair-Good	5 per year	10 quarts/acre per year

[A]Efficacy rankings summarized by Rufus Isaacs at Michigan State University and determined by surveys of WERA-1021 SWD Coordinating Committee members.
[B]OMRI approved for use in organic production.
[C]May injure Early Dawn and Sunrise strawberries (older varieties that are not frequently planted in Mid-Atlantic; however, injury may not have been assessed on newer varieties).

Sweet Cherry

Table 4. Examples of SWD-active insecticides for sweet cherry production. This is not an exhaustive list, and other formulations of these active ingredients or other active ingredients in these chemical classes may be similarly effective. **ALWAYS read and follow all instructions on the pesticide label; the information presented here does not substitute for label instructions.**

Trade Name	Active Ingredient	Reentry Interval	Preharvest Interval	Effectiveness[A]	Application Restrictions	Maximum AI
Pyrethroids and pyrethrins (IRAC activity group 3A)						
Asana XL	Esfenvalerate	12 hrs	14 days	Excellent	Not specified	0.3 lb ai/acre between bloom and harvest
Danitol 2.4 EC	Fenpropathrin	24 hrs	3 days	Excellent	2 per season	0.8 lb ai/acre per season
Mustang Maxx	Zeta-cypermethrin	12 hrs	14 days	Excellent	Not specified	0.15 lb ai/acre per season
Warrior II	Lambda-cyhalothrin	24 hrs	14 days	Good	Not specified	0.16 lb ai/acre post bloom
Pyganic EC 5.0 II[B]	Pyrethrins	12 hrs	0 days	Weak-Fair	10 per season	Not specified
Spinosyns (IRAC activity group 5)						
Delegate WG	Spinetoram	4 hrs	7 days	Good-Excellent	4 per year	0.438 lb ai/acre per year
Entrust SC[B]	Spinosad	4 hrs	7 days	Good	Not specified	0.45 lb ai/acre per year
Spintor 2SC	Spinosad	4 hrs	7 days	Good-Fair	Not specified	0.45 lb ai/acre per year
Diamides (IRAC activity group 28)						
Exirel	Cyantraniliprole	12 hrs	3 days	Good	Not specified	0.4 lb ai/acre per year
Organophosphates (IRAC activity group 1B)						
Diazinon 50W	Diazinon	4 days	21 days	Good	1 in season foliar	Not specified
Malathion 57%[C]	Malathion	12 hrs	3 days	Good	4 per year	Not specified
Carbamates (IRAC activity group 1A)						
Sevin XLR Plus	Carbaryl	12 hrs	3 days	Fair-Good	3 per year	9 quarts/acre per season

[A]Efficacy rankings summarized by Rufus Isaacs at Michigan State University and determined by surveys of WERA-1021 SWD Coordinating Committee members.
[B]OMRI approved for use in organic production.
[C]May injure certain varieties of sweet cherries.

References:

Lee, J.C., D.J. Bruck, H. Curry, D. Edwards, D.R. Haviland, R.A. Van Steenwyk, and B.M. Yorgey. 2011. The susceptibility of small fruits and cherries to the spotted-wing drosophila, *Drosophila suzukii*. Pest Management Science 11: 1358-1367.

Lee, J.C., A.J. Dreves, A.M. Cave, S. Kawai, R. Isaacs, J.C. Miller, S. Van Timmeren, and D.J. Bruck. 2015. Infestation of wild and ornamental noncrop fruits by *Drosophila suzukii* (Diptera: Drosophilidae). Annals of the Entomological Society of America DOI: 10.1093/aesa/sau014

Rossi Stacconi, M.V., A. Grassi, D.T. Dalton, B. Miller, M. Ouantar, A. Loni, C. Ioriatti, V.M. Walton, and G. Anfora. 2013. First field records of *Pachycrepoideus vindemiae* as a parasitoid of *Drosophila suzukii* in European and Oregon small fruit production areas. Entomologia 1:e3.

Van Timmeren, S., and R. Isaacs. 2013. Control of spotted wing drosophila, *Drosophila suzukii*, by specific insecticides and by conventional and organic crop protection programs. Crop Protection 54: 126-133.

Wiman, N.G., V.M. Walton, D.T. Dalton, G. Anfora, H.J. Burrack, J.C. Chiu, K.M. Danne, A. Grassi, B. Miller, S. Tochen, X. Wang, and C. Ioriatti. 2014. Integrating temperature-dependent life table data into a matrix projection model for *Drosophila suzukii* population estimation. PLoS ONE 9: e106909.

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