Wisconsin Fruit News

Volume 2, Issue 6 – June 23, 2017

In This Issue:

General Information

New spotted wing drosophila publication now available!

We have a new publication, Spotted Wing Drosophila: A Detrimental Invasive Pest of Soft-skinned Fruit, now available for you to access through the Learning Store. This publication has a lot of information on spotted wing drosophila, including on phenology, damage symptoms, identification, life cycle, monitoring, and management. This publication will be relevant for both homeowners and commercial growers.

You can access a pdf or purchase a paper copy at the UW Learning Store.

We hope you will find this publication interesting and informative!

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Spotted Wing Drosophila

A detrimental invasive pest of soft-skinned fruit

Christelle Guédot and Janet van Zoeren

UW Extension University of Wisconsin-Extension

Spotted wing drosophila (SWD, *Drosophila suzukii*) is an invasive pest of many of Wisconsin's soft-skinned fruit crops. Since it was first detected in Wisconsin in 2010, SWD has rapidly expanded its range and increased in population density. Unlike many of the closely related "vinegar flies" which only affect damaged or overripe fruit, SWD females can lay eggs directly into economically viable fruit, potentially causing a large portion of a crop to be unmarketable. Left uncontrolled, SWD can cause significant economic damage to raspberry, blackberry, strawberry, blueberry, cherry, and other Wisconsin fruit crops. In addition to fruit crops, SWD has been observed developing inside over 40 wild hosts such as buckthorn, honeysuckle,

Wisconsin phenology

In Wisconsin, SWD adults begin to appear in traps from late June to early July, although earlier emergence has been the trend every year since the first detection of SWD. Because SWD is known to develop on several wild berries in Wisconsin woodlands, populations may build up in the spring outside of agricultural landscapes before spilling over onto cultivated crops in midsummer. SWD adults are thought to overwinter in Wisconsin as distinct winter morphs. Winter morphs are able to withstand colder temperatures for extended periods of time, and are found in the fall in Wisconsin.

Damage symptoms

IPM tools: host plant resistance

By: Janet van Zoeren and Christelle Guédot, UW Extension

This summer we are discussing the many tools available to control insect pests and diseases in a series on the essentials of integrated pest management (IPM). So far, we have discussed monitoring pest populations, action thresholds, prevention, and cultural controls. Another aspect of an IPM program involves taking advantage of adaptations that many plants have to avoid or tolerate insect or disease pests. Host plant resistance (HPR) makes use of the fact that all wild plants have many adaptations to protect themselves from insect herbivores and diseases. These adaptations can be used to protect crops from herbivores and diseases in agricultural systems.

As cultivars are developed, plant breeders often focus on a narrow range of desirable traits, such as flavor, color, and storage potential. Unfortunately, many cultivars with exemplary flavor and other marketable traits end up being especially susceptible to disease and insect pressure. In order to implement HPR, plant breeders find cultivars or wild relatives of crop plants with certain resistant characteristics, then cross those genes with other cultivars to try to develop a plant with resistant traits along with the other desirable traits.

There are several ways a plant can show HPR, each with advantages and disadvantages:

Mullein foliage is covered in downy trichromes, which form a physical barrier to herbivory. Photo by Forest and Kim Starr, Starr Environmental, Bugwood.org.

Antibiosis occurs when feeding on a resistant plant has a negative effect on the pest's health or fitness. In general, this is caused by chemicals in the plant tissue which can either directly kill, slow the development of, or reduce the reproductive capacity of a pest.

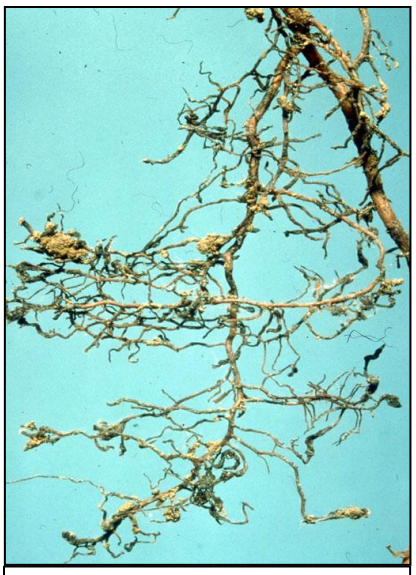
Antixenosis occurs when a pest is less likely to find or feed on a resistant plant. This can be in the form of physical characteristics (such as dense hairs or a waxy surface) or chemical characteristics that deter feeding or disease infection.

Tolerance occurs when a plant is able to continue to thrive despite being attacked. This does not decrease the likelihood of a pest to attack a resistant plant, but rather indicates an ability of the tolerant plant to continue to thrive despite being attacked.

Scab resistant variety (Liberty) at left, and scab susceptible variety (McIntosh) at right. Photo courtesy of Lorraine P. Berkett, Ph.D., University of Vermont.

Some HPR breeding programs have been extremely successful. For example, a cooperative apple breeding program from Purdue, Rutgers, and the University of Illinois have developed a number of apple cultivars which are resistant to apple scab, rust, fire blight and/or powdery mildew. In other cases, instead of specifically breeding for resistance, growers can simply make use of naturally resistant

cultivars. A classic example of insect HPR comes from the European grape industry, where the introduction of resistant American rootstocks saved the industry from grape phylloxera root damage. In a more passive form of HPR, summer-bearing raspberries show some HPR to spotted wing drosophila in Wisconsin simply due to a temporal disjunction (called phenological resistance) between when spotted wing traditionally is present and when the fruit is ripe.



Grape phylloxera root galls. Photo by Central Science Laboratory, Harpenden , British Crown, Bugwood.org.

Putting it into practice. Host plant resistance can be a very economical control method, since resistant cultivars often cost the same or only slightly more than susceptible cultivars. It is also generally easy to combine with other control methods, such as biological and chemical controls, and can avoid some of the environmental and health worries that can be associated with pesticide use.

Host plant resistance in perennial crops can be hard to keep up with, since the decision to implement this tactic takes place before planting and can't be changed unless you are willing to tear out and replant a crop block. Of course, that's easier to do with something like strawberries or raspberries than with apples or cherries. For that reason, using HPR in your IPM program requires a good deal of research into the susceptibilities of various cultivars to the insects and diseases most prevalent in your area PRIOR to planting a new block.

Finally, as with other control tactics we've described in this series, HPR is meant to be a single tool in the IPM toolbox and should never be relied on for complete insect and disease management. It will always be necessary to continue to scout and monitor (as discussed in previous issues), and may be necessary to apply cultural, biological or chemical controls as needed, even when making use of host plant resistance.

UW-Madison/Extension Plant Disease Diagnostic Clinic (PDDC) update

By: Brian Hudelson, Sean Toporek, and Ann Joy

The PDDC receives samples of many plant and soil samples from around the state. There have been no reports of fruit diseases turned in to the PDDC from June 10, 2017 through June 17, 2017.

For additional information on plant diseases and their control, visit the PDDC website at pddc.wisc.edu.

UW Insect Diagnostic Lab—Fruit Insect Report: June 22nd, 2017

By: PJ Liesch

There has been quite a bit of fruit insect pest activity in the last two weeks coming through the UW Insect Diagnostic Lab:

Aphids seem to be having a solid year and many cases of aphids on fruit trees and landscape plants have come in from around the state.

Rose chafers are perhaps the biggest insect story I'm seeing in the state at the moment related to fruit crops. Rose chafers began emerging in parts of the state with sandy soil roughly two weeks ago and significant damage to fruit (grapes, fruit trees, and strawberries) have occurred in many parts of the state. Adult beetle pressure will most likely remain high for the next 2-3 weeks. We discuss rose chafers in grapes in this issue on page 7, and much of that information will be relevant to other growers as well.

Japanese beetles have not yet officially been reported to the UW Insect Diagnostic Lab, but these beetles may have already emerged in localized warm areas (such as south-facing slopes). The main beetle emergence typically begins around the Fourth of July, so growers with a history of Japanese beetle activity should begin scouting for these insects in the near future.

Reports of **pearleaf blister mites** continue to come in to the UW Insect Diagnostic Lab, especially from southern parts of the state. These tiny eriophyid mites should now be readily visible under magnification when affected leaves are dissected.

Gypsy moth caterpillars feed on a wide variety of trees and shrubs, including fruit trees. Recent reports of gypsy moth activity have come in from around the state. In southern Wisconsin, the caterpillars are approaching their full size and should be pupating soon, but the smaller caterpillars in the northern part of the state will continue to feed for some time.

Another caterpillar, the **white-marked tussock moth** has been seen reported in southern Wisconsin on Apples and other hardwood trees. These fuzzy caterpillars are typically present in low numbers and cause minimal damage.

A report of **linden looper caterpillars** came in this week from fruit trees in Bayfield county. This species feeds on a wide variety of hardwood trees, including fruit trees. This species only had one generation per year and has likely pupated already in southern parts of the state.

A few other minor/uncommon sightings have also come in in the last two weeks:
1) **Grape leaf galls** caused by tiny gall midges (Family Cecidomyiidae; *Vitisiella brevicauda*) from grapes in Door County.
2) **Brown leaf weevil** (*Phyllobius oblongus*)—a common European weevil species that caused negligible damage to a range of trees, including fruit trees. Found in an orchard setting in Door county.
3) **Fruit-tree pinhole borer** (*Xyleborinus saxeseni*) adults were extracted and identified from a damaged apple tree brought in by a consultant. Close attention was paid to rule out the possibility of the black stem borer (*Xylosandrus germanus*).

Harvest schedule and sanitation for managing spotted wing drosophila

By: Christelle Guédot, Fruit Crop Entomology UW-Madison

Spotted wing drosophila (SWD) has now been detected in Wisconsin and growers are strongly advised to monitor for the presence of SWD on their farm and implement management practices as soon as the first adult flies are trapped or the first larvae inside fruit are detected in susceptible crops. Numbers have been ramping up in our traps (~20 adults/trap) in Dane county and the populations are building up to levels that may become damaging for growers. Make sure you start monitoring for SWD on your farm, especially if you have a history of SWD populations on your farm.

Besides chemical controls that growers may apply to reduce SWD populations in their crops, we have discussed other management strategies in the past, including exclusion netting, planting varieties that escape SWD populations because of the timing, sanitation, and prompt harvest. We addressed two of these topics in previous issues of this newsletter last summer. You may refer back to them by clicking on these links: Exclusion barriers and varietal susceptibility. Here I will discuss harvest schedule and sanitation as recent research has addressed both of these topics.

Typically, fruit tends to be harvested a few times a week. Recent research addressed harvest frequency by harvesting raspberry fruit every day, every other day and every 3 days to assess the impact on SWD egg and larval infestation. Ripe fruit were picked based on the different schedules and the study was conducted over two years. The average daily yield was found to be highest with 2 day harvest intervals followed by 3 days and then 1 day intervals. The fruits were then placed into a salt water test and screened thoroughly for eggs and all larval stages. Fewer eggs and larvae were found in fruit harvested every 1 or 2 days compared to fruit harvested every 3 days. Increasing harvest frequency to decrease the number of larvae, especially the bigger final (3^{rd}) instars, is particularly important for marketability. Eggs and larvae were lower but still present on a 1 day harvest interval; thus, relying entirely on prompt harvest for reducing SWD populations is not advised. Instead prompt harvest should be combined with short pre-harvest interval insecticides. In addition, rapid post-harvest cooling of the fruit will reduce fruit damage and kill or stop development of the eggs and larvae.

Sanitation is another important aspect of SWD management. Flies continue to emerge from infested culled fruit and thus we recommend to dispose of infested fruit by burial, freezing, or bagging. Recent research addressed the impact of bagging fruit on SWD survival. SWD-infested fruits were placed in clear, white or black plastic bags that were placed in an open sunny field. Bagging the fruit for 32 hours killed 99% of the larvae inside the bags, regardless of the color of the plastic used. Bagging the fruit for shorter periods of time (1hr, 4hrs) did not reduce adult emergence.

Harvesting fruit every 2 days and bagging culled fruits for 32 hours will significantly reduce SWD populations and should be integrated as much as possible into an IPM plan to combat SWD.

Happy growing season!

Reference:

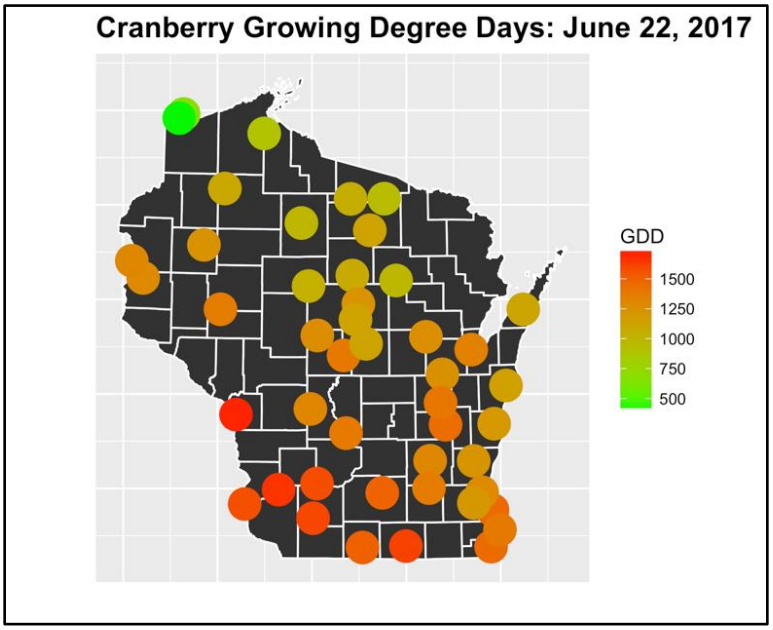
Leach et al. 2017. Rapid harvest schedules and fruit removal as non-chemical approaches for managing spotted wing Drosophila. Journal of Pest Science. DOI: 10.1007/s10340-017-0873-9

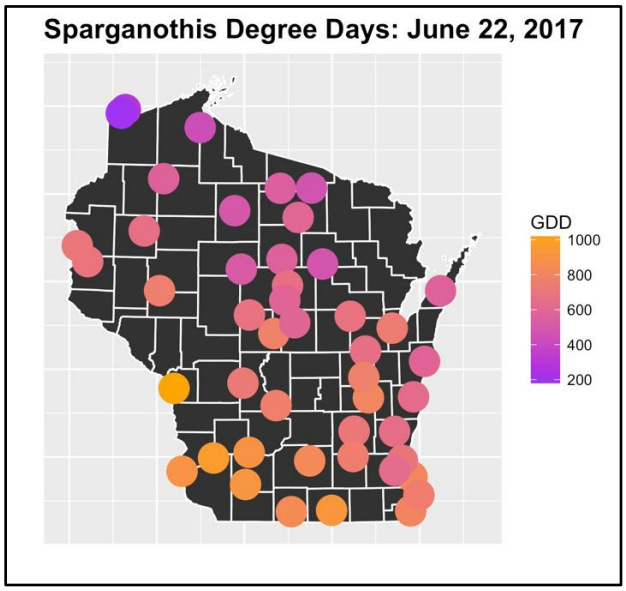
Cranberries

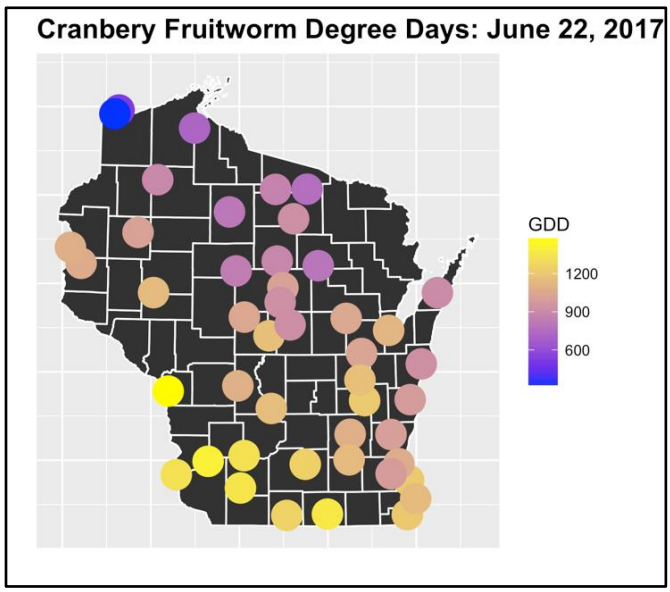
Cranberry plant and pest degree-days: June 22, 2017

By: Elissa Chasen and Shawn Steffan, USDA-ARS and UW Entomology

Happy official start of summer! The maps below show how summer is progressing across Wisconsin. Developmental thresholds for each are: cranberry plant - 41 and 85˚F; sparganothis fruitworm - 50 and 86˚F; and cranberry fruitworm - 44 and 87˚F. Interactive maps are posted online. The interactive feature allows you to click on the map locations, prompting a pop-up that names the location and gives exact degree-days. These are available through the Steffan lab website (http://labs.russell.wisc.edu/steffan/cranberry-growing-degree-days/). Once on the website, follow the link to the interactive maps.







The table below allows for comparison of degree-days over the last three years.

June 22	Cranberry DDs			Sparg DDs			CFW DDs		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Northern WI (Minocqua)	1098.4	1120.2	1056.5	564.7	601.4	552.1	901.3	928.4	867.6
Central WI (Wisconsin Rapids)	1460.8	1451.8	1388.1	836.9	840.5	785.7	1235.6	1224.6	1167.5

The table below shows the predicted life benchmarks and their associated Sparg DDs.

Event	DDs from March 1 (approximate)
Flight initiation	595.7
First eggs laid	681.0
Peak flight	884.12
First egg hatched*	895.4
End of egg laying	1,634
Last egg hatched*	1,890

* Egg hatch window: 895 – 1,890 DDs

Grapes

Grape insect scouting report – rose chafer

By: Janet van Zoeren and Christelle Guédot, UW-Extension

Common Name: Rose chafer

Order: Coleoptera

Family: Scarabaeidae

Scientific Name: *Macrodactylus subspinosus* (Fabricius)

Rose chafer. Photo by Ben Bradford.

As mentioned in the last issue in the Insect Diagnostic Lab update, rose chafer adults typically begin to appear around this time of year in Wisconsin. In this article we will specifically discuss rose chafer as a pest of grape vines in the state; however, they feed on and can be a pest of many fruit crops in the state, including apple, cherry, raspberry, and strawberry.

Identification and Life Cycle

Rose chafers overwinter in Wisconsin as larvae in the soil, pupate in the spring, and emerge as adults, seemingly all

at once, generally in late May or early June. The adults are conspicuous ½ inch long beetles, sandy-colored, with long legs which get darker towards the feet. Adult rose chafers feed, mate and lay eggs during their approximately 3-week life-span. The eggs are laid in the soil, and larvae are C-shaped grubs which look similar to the larvae of Japanese beetle. These larvae feed in the soil on grass and other plant's roots. There is only one generation of rose chafer per year in Wisconsin.

Damage Symptoms

Rose chafers feed on the flowers, fruit and leaves of grapes. Leaf feeding can be mistaken for that of the Japanese beetle, as both skeletonize the leaves, leaving the leaf veins intact. The more damaging rose chafer injury comes when the early-emerging adults feed on and destroy flower buds and flowers.

Monitoring and Control

Monitoring for the conspicuous adult beetles should begin in late May and continue until they are no longer found in the vineyard. Because feeding on flower buds can cause such extensive crop loss, an economic threshold as low as two beetles per vine is recommended for chemical controls.

When monitoring, it is best to inspect 25 vines near the edges and corners of the vineyard, and 25 from within the vineyard block. By inspecting vines throughout each block, you can determine if the entire vineyard is affected, or if infestations are localized and a spot treatment could sufficiently control these beetles.

Cultural control

Rose chafers prefer to oviposit (lay eggs) in sandy soil, so vineyards on or near sandy soil sites are at greater risk of rose chafer infestation. We recommend monitoring earlier in the season and more carefully in these sandy sites. Cultivating between the rows of the vineyard in early spring may destroy some rose chafer pupae. This generally only works when populations are already relatively low, or in combination with a chemical control. The use of mass trapping or monitoring using a trap is not recommended, as the trap may attract beetles in to the crop more quickly than it is able to trap them out of the crop, leading to an increase in damage.

Chemical control

Chemical control for rose chafer, when necessary, can begin immediately pre-bloom and continue through around pea-sized berries. A list of available insecticides to control rose chafer in grape is provided in the following table. For other fruit crops, be sure to read the label to ensure they are registered in Wisconsin for that specific crop. There are many other tradenames available, and we do not recommend these that are listed above other options. All product recommendations can be found in the 2017 Midwest Fruit Pest Management Guide. Additionally, you should always fully read and follow the label before spraying any pesticide.

Class (IRAC code)	Tradename	Active ingredient	PHI (days)	Effectiveness
Physical deterrent (n/a)	Surround **(Reduced Risk, OMRI Organic)**	Kaolin clay	0	Fair
Pyrethroids (3A)	Danitol	Fenpropathrin	21	Excellent
	Baythroid	beta-Cyfluthrin	3	Good
Organophosphates (1B)	Imidan	Phosmet	(see label)	Good
Carbamates (1A)	Sevin	Carbaryl	7	Excellent
Neonicotinoids (4A)	Assail	Acetamiprid	3	Excellent

Wine and Table Grape Developmental Stages

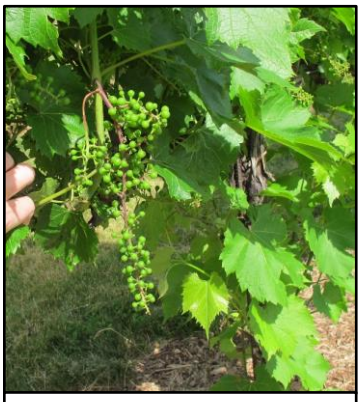
By: Janet van Zoeren, Annie Deutsch, Jean Riesterer-loper and Amaya Atucha, UW-Extension

At the West Madison Agricultural Research Station (WMARS) berries are beginning to set. The vines range from stage E-L* developmental number 26 ("cap fall complete") to 31 ("pea sized berries") depending on the cultivars. At the Peninsular Agricultural Research Station (PARS), inflorescences are just beginning to open. The vines at PARS are between E-L* developmental number 17 ("inflorescence well developed") to 20 ("10% caps off").

* *Eichhorn-Lorenz Phenological stages to describe grapevine development*

Following photos taken on June 19th at West Madison Agricultural Research Station.

Brianna at WMARS; "pea sized berries" E-L number = 31



La Crescent at WMARS; "bunches tending downward" E-L number = 29

La Crosse at WMARS; ""setting, bunch at right angle to stem" E-L number = 27

Marquette at WMARS; "bunches tending downward" E-L number = 29

Frontenac at WMARS; "bunches tending downward" E-L number = 29

St. Croix at WMARS; "cap fall complete" E-L number = 26

Somerset at WMARS; "pea sized berries" E-L number = 31

Einset at WMARS; "cap fall complete" E-L number = 26

Following photos taken on June 20th at the Peninsular Agricultural Research Station.

Brianna at PARS; "flower caps still in place" E-L number = 18

La Crescent at PARS; "inflorescence well developed" E-L number = 17

La Crosse at PARS; "inflorescence well developed" E-L number = 17

Marquette at PARS; "inflorescence well developed" E-L number = 17

Frontenac at PARS; "10% flower caps off" E-L number = 20

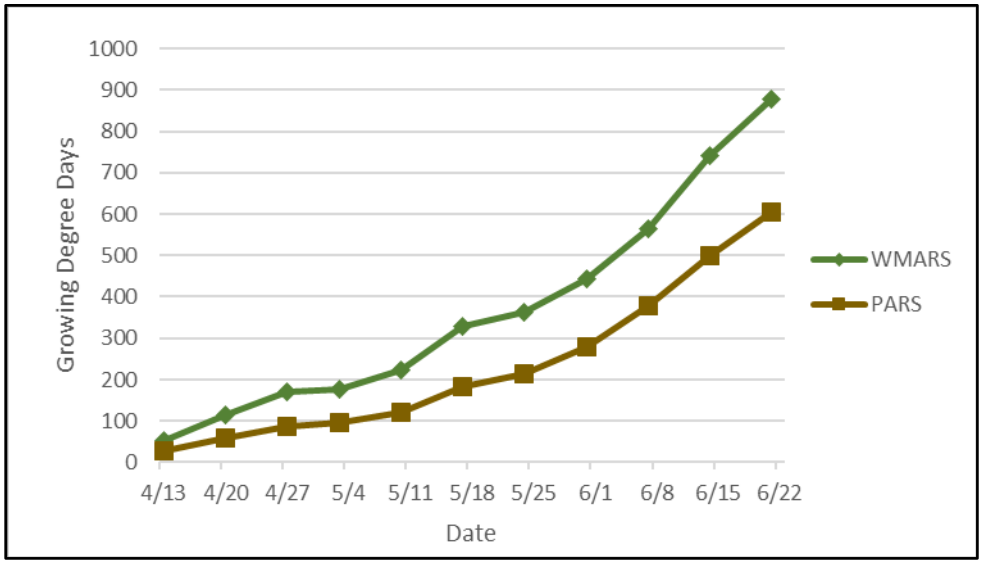
St Croix at PARS; "inflorescence well developed" E-L number = 17

The growing degree-day accumulations as of June 22nd for this year are: 878 GDD at WMARS and 606 GDD at PARS. PARS is a little less than two weeks behind WMARS at this point. Interestingly, we have now accumulated more degree days at PARS this year than we had at this time last year, although at WMARS we are still a little behind the degree day accumulation from last year. Degree-days are calculated using a base of 50°F, starting on April 1st as a biofix.

Grape Growing Degree Days

April 1 - June 21, 2017

	2107	2016
WMARS	878	904
PARS	606	597



Tree Fruits

Nutrient Management for Apple Orchards-update

By: Amaya Atucha, UW Extension Specialist, UW-Madison Department of Horticulture

After an unusual beginning of the season, things have started to look more "normal" during this last month and the apple crop looks good for this year. I'm updating some of the recommendations from last year's nutrient management program and also including some new information on bitter pit control strategies.

- Nitrogen demand and mobilization in the tree can be divided in 4 periods: 1) budbreak to bloom, 2) petal fall to end of shoot growth, 3) end of shoot growth to harvest, and 4) harvest to budbreak. The period with the highest demand for nitrogen is from petal fall to end of shoot growth, and nitrogen supplies at this point come primarily from the soil. The best timing for ground applications of N is between bud break to shortly after petal fall. Rates of N application range between 15 to 50 lbs per acre. However, in a wet year more N is released from the soil, and N applications rates should be reduced. On the contrary on a dry year there is less N mineralization from the soil and application rates should be increased. Foliar N applications are a good way to provide nitrogen to fruitlets and new spur leaves. Dr. Cheng, at Cornell University, recommends to supply extra nitrogen to blocks that had low N in last year's tissue test results by applying foliar urea at a rate of 5 lb of urea per 100 gallons at petal fall, first cover (7 days after petal fall), and second cover (2 weeks after 1st cover). However, in blocks with light fruit crop it is critical to control vigorous shoot growth by reducing or eliminating nitrogen application for this season.

- Potassium is the most used/removed nutrient element by fruit, that's why we need to supplement with fertilizer. However, if there is a light crop potassium applications should be reduced or eliminate. This is particularly important to control bitter pit, because trees with light crops produce bigger fruit with higher concentration of potassium and low concentration of calcium, which intensifies the bitter pit problems in susceptible varieties such as Honey Crisp. If last year's leaf analysis showed low levels of K and you are expecting a normal to heavy crop this year, then you need to increase the amount of potassium. Timing of potassium application should be from petal fall until 2 weeks before harvest. Leaf level for potassium should be between 1.2 to 2.5%.

- Calcium is a key nutrient for fruit quality as it increases fruit firmness and storage life. Calcium uptake happens during petal fall to harvest, and to ensure maximum calcium uptake during this period it is critical to maintain adequate soil moisture and pH, as well as a balanced potassium and nitrogen fertility program. In cultivars that are more susceptible to bitter pit (i.e., Honey Crisp) starting after petal fall apply 3 to 4 cover sprays of 1-2 lbs of calcium chloride (78% $CaCl_2$) per 100 gallons at a 14 day interval, then continue with 2 extra applications at 4 and 2 weeks before harvest of 3-4 lbs calcium chloride per 100 gallons. The effectiveness of these sprays is positively correlated with the coverage of the fruit, complete coverage is critical. In blocks with light crop loads fruit will be bigger and the concentration of calcium in the fruit will be diluted, which exacerbates bitter pit problems, especially in susceptible varieties as Honey Crisp. In blocks with low crop load it is recommended to reduce potassium supply to avoid competition with calcium.

Potato leafhopper

By: Janet van Zoeren and Christelle Guédot, UW- Extension and Entomology

Common Name: Potato leafhopper

Order: Hemiptera

Family: Cicadellidae

Scientific Name: *Empoasca fabae* (Harris)

Potato leafhopper adult. Photo by Steve L. Brown, University of Georgia, Bugwood.org.

Potato leaf hoppers are small isnsects that are easily overlooked until the damage called "hopperburn" starts showing up on plant leaves. They can affect a wide range of fruit crops, including apple, pear, grape, raspberry and strawberry, as well as many vegetable and field crops.

Identification and Life Cycle

Potato leafhoppers cannot withstand Wisconsin winters, and overwinter in the southern gulf coast states. The adults are blown up on wind currents into Wisconsin in May and June; however, this species is highly polyphagous (feeds on many different types of plant), and so often doesn't show up in apple until immediately after the first cutting of hay in the area – usually around mid-June. Potato leafhopper adults are wedge-shaped and about 1/10 inch long. They are similar in appearance to the white apple leafhopper (*Typhlocyba pomaria*, McAtee), but have a more greenish coloration to the body. Both the adult and nymph potato leafhoppers move in a crab-like sideways manner, which is another distinguishing characteristic of this species.

The potato leafhopper eggs are laid in the upper canopy of the tree, generally on youngw leaves or stems. The nymphs are smaller than the adults, orange/yellow-colored, and lack wings, although the later instars (stages) have wingpads. From egg to adulthood typically takes around 25 days, and there are generally two to three overlapping generations of potato leafhopper in Wisconsin.

Damage Symptoms

Leafhoppers are most likely to affect young pre-bearing trees. They feed on the underside of foliage using a piercing/sucking mouthpart, and inject a toxin into the plant's vasculature which slows water and nutrient movement. This can cause characteristic "hopperburn", in which the edges of the leaves of an apple tree or other affected crop yellow and roll upwards. Hopperburn damage can resemble aphid damage, so it is important to look on the underside of the leaf to find either the leafhopper or aphid culprits. Additionally, potato leafhopper feeding damage has been shown to increase the prevalence of fire blight in an orchard, although the specific relationship between potato leafhopper and fire blight has still not been completely determined.

Hopperburn on a young apple shoot. Photo by Mark Longstroth (MSUE).

Monitoring and Control

Monitoring for curled leaves or shoots that are not growing vigorously can take place weekly beginning in June. If leafhopper damage is suspected, turn over the leaf slowly to be able to identify and count the leafhoppers on the bottom side of the leaf. No specific economic threshold has been determined as of yet in apple orchards, but it has been noted that one to two leafhoppers per shoot can cause curling damage. In an orchard with a history of fire blight, control is recommended when a single potato leafhopper is identified in the orchard.

Cultural control

Ideally, it would be best to avoid planning apple orchards near hay fields, as those can be breeding grounds for an influx of potato leafhoppers. Of course, that is often not possible to achieve, in which case it may simply be helpful to be aware of when hay is cut to be sure to begin a frequent potato leafhopper scouting program at that time.

Chemical control

A list of available insecticides to control potato leafhopper in apple is provided in the following table. For other affected fruit crops, be sure to read the label to make sure they are registered for that specific crop in Wisconsin. There are many other tradenames available, and we do not recommend these that are listed above other options. All product recommendations can be found in the 2017 Midwest Fruit Pest Management Guide. Additionally, you should always fully read and follow the label before spraying any pesticide.

Class (IRAC code)	Tradename	Active ingredient	PHI (days)	Effectiveness
Sodium channel blockers (22)	Avaunt **(Reduced Risk)**	Indoxacarb	14	Good
Butenolides (4D)	Sivanto **(Reduced Risk)**	Flupyradifurone	14	Excellent
Pyrethroids (3A)	Baythroid	beta-Cyfluthrin	7	Good
Organophosphates (1B)	Imidan	Phosmet	7	Excellent
Carbamates (1A)	Lannate	Methomyl	14	Excellent
Neonicotinoids (4A)	Assail	Acetamiprid	1	Excellent
	Admire Pro (foliar) **(Reduced Risk)**	Imidacloprid	7	Excellent

Verticillium on stone fruits

By: Sara Thomas-Sharma and Patricia McManus

About the pathogen:

Verticillium spp. is a soil-borne fungal pathogen that infects around 300 woody and herbaceous plants. Given the wide host range, many weeds and crops harbor the pathogen and it is commonly found in Wisconsin fields. It is usually present at a soil depth of 6-12" (up to 35") and infects the plant via the root. Disease develops in wet soils and temperatures of 70-80°F. The pathogen produces two kinds of spores – conidia and microsclerotia – the latter surviving in the soil for many years (Fig.1). Spread of *Verticillium* spp. occurs by movement of contaminated soil blown in the wind or soil moved on equipment and roots of transplants.

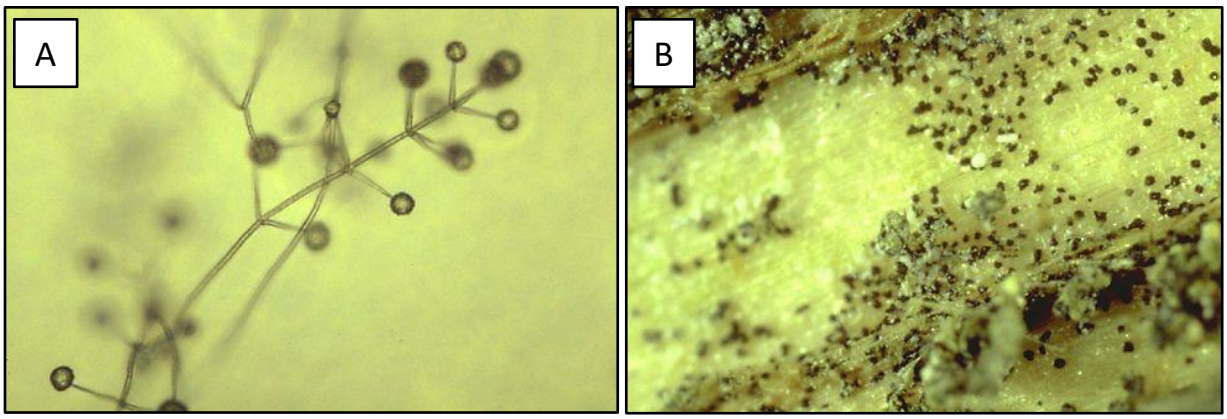


Fig. 1. *Verticillium spp.* produce clusters of conidia that cause in-season spread (A) and microsclerotia that survive in the soil for many years (B). Photos by M. Powelson, apsnet.org.

Verticillium wilt of stone fruits:
The disease affects most stone fruits and in Wisconsin it has been reported on cherry. Apple varieties are mostly resistant. For most stone fruits, younger trees are usually more susceptible than mature trees and maybe killed by the disease. However, in cherry, older trees are also highly susceptible.

Symptoms: The disease is observed as sudden wilting of one or more branches in mid to late summer (Fig. 2A). Random branches in the canopy may be wilted, or wilting may be restricted to one side of the tree. Wilted leaves usually remain attached. The wilting is caused due to clogging of vascular tissue preventing water from reaching upper parts of the plant. In some plants, this clogging can be observed as internal discoloration and streaks of the sapwood (Fig.2 B, C).

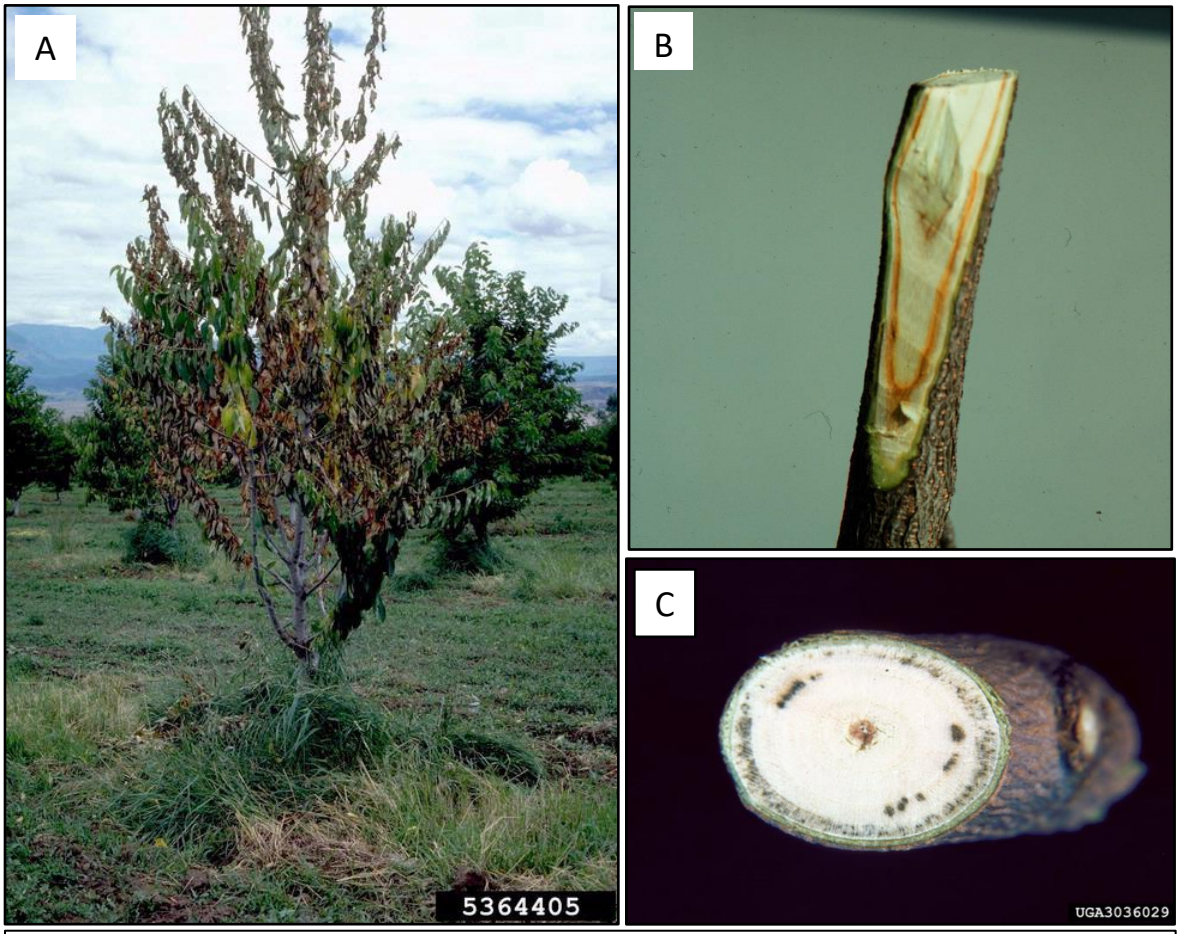


Fig. 2. Symptoms associated with Verticillium wilt includes sudden wilting of one or more branches (A), due to clogging of vascular tissues. The clogged channels are often discolored (B, C). (Photo: (A) H.J. Larsen, Bugwood.org, (B) Robert L. Anderson, USDA Forest Service, Bugwood.org, and (C) Brian Hudelson, uwex.edu).

Management:

- There are no resistant rootstocks for stone fruits.
- There is no cure for a plant infected with the pathogen, but some stone fruits may recover with age.
- Pruning of infected branches may allow trees to recover (except for cherry which is highly susceptible). The pruned branches should be burned since microsclerotia can survive burying.
- Maintain optimum soil fertility to promote plant vigor – nutrient deficiency may exacerbate disease.

- Cherry should not be planted in sites known to have Verticillium. Grasses and cereals are resistant to the disease. Thus, establishing new plantations in land that has been under grass for several years may lower the risk of disease.
- Diseased, unproductive trees (with roots) should be removed. Pre-plant soil fumigation of such sites may help newly planted seedlings survive the disease. However, fumigation kills all organisms in the soil and bad organisms tend to rebound more quickly than good ones.

Reduced risk insecticide: Intrepid

By: Christelle Guédot, University of Wisconsin, Entomology

Insecticide: Intrepid

- Available as 2F (2 lbs. of Flowable = liquid AI per gallon; 23% AI)
- Restricted re-entry interval (**REI**): 4hours
- Pre-harvest interval (**PHI**) on pome fruit: 14 days and stone fruit: 7 days
- Do not exceed a total of 64 fl. oz. per acre per season on pome and stone fruits ***except*** sweet and tart cherry max of 58 fl. oz. per acre per season
- Rate of use per acre: 6-16 fl. oz.

Intrepid is registered for use in Wisconsin on pome fruits, including apple, crabapple, pear, loquat, and quince as well as stone fruits, including apricot, sweet and sour cherry, nectarine, peach, plums, pluot, plumcot, and prune. It has been registered with EPA since 2000. It is marketed by Dow AgroSciences under the formulation 2F (2 lbs of active ingredient per gallon, Flowable). Similar to Confirm, Intrepid is an Insect Growth Regulator (IGR) with the active ingredient methoxyfenozide (IRAC code 18, class of diacylhydrazines). It mimics the action of a natural insect hormone that induces molting in lepidopterous larvae. It is highly active against most lepidopterous larvae by inducing premature lethal molt primarily after ingestion from treated crop surfaces. Feeding generally ceases within hours of ingestion and affected larvae will often become lethargic and discolored. The larvae may take several days to die. Intrepid is very selective to Lepidoptera larvae and should pretty much have no effect on other insect orders.

Intrepid 2F is registered on for control of lesser appleworm, oriental fruit moth, codling moth (suppression only), oblique banded leafroller, pandemis leafroller, eyespotted bud moth, fruittree leafroller, light brown apple moth, redbanded leafroller, variegated leafroller, tufted apple bud moth, spotted tentiform leafminer, western tentiform leafminer, lacanobia fruitworm, peach twig borer, European grapevine moth, omnivorous leafroller, threelined leafroller, cherry fruitworm, green fruitworm, and redhumped caterpillar.

Intrepid 2F may be applied by ground equipment and by air (see label for specific application regulations). For ground applications, conventional ground sprayers need to be calibrated to deliver a minimum of 50 gpa to trellised trees or trees 10 feet tall or less and 100 gpa to trees taller than 10 feet to ensure thorough coverage. For pome fruit, aerial applications are allowed only for the last two applications prior to harvest.

A chemical is considered toxic to bees if its toxicity (measured as the LD50 or Lethal Dose required to kill 50% of the test population) is below 11 µg/bee. Intrepid has an LD50 of 100µg/bee, thus it is not considered toxic to bees. While Intrepid is considered safe to spray during bloom, as a general rule, avoid spraying when bees are actively foraging and concentrate your spraying outside of the bloom period. If you need to apply Intrepid during bloom, plan to apply earlier or better yet later in the day.

Drift or runoff from applications of Intrepid 2F may be hazardous to sensitive aquatic invertebrates. Do not apply directly to water.

As always, make sure to read the label before using any pesticide. You can find the label of Intrepid 2F by clicking here or by copying this address in your browser: https://greenbook-assets.s3.amazonaws.com/D02-846-009_Intrepid_2F_Specimen_Label.pdf

Calendar of Events

July 11-13, 2017 – Wisconsin Farm Technology Days
Ebert Enterprises, E5083 Co Rd K, Algoma, WI

July 18, 2017 – WAGA Summer Apple Field Days
Green's Pleasant Springs Orchard, 2722 Williams Dr, Stoughton, WI

Aug 3, 2017 – PARS Vineyard Walk
Peninsular Agricultural Research Station, 4312 Hwy 42 North, Sturgeon Bay, WI

Useful Links:

Wisconsin Fruit Website: https://fruit.wisc.edu/

You can purchase ($10) the 2016 Midwest Fruit Pest Management Guide from the UW Learning Store: http://learningstore.uwex.edu/Midwest-Fruit-Pest-Management-Guide-2016-P1785.aspx

Insect Diagnostics Lab: http://labs.russell.wisc.edu/insectlab/

Plant Disease Clinic: https://pddc.wisc.edu/

Soil and Forage Analysis Lab: https://uwlab.soils.wisc.edu/

Weed Identification Tool: http://weedid.wisc.edu/weedid.php

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