Wisconsin Fruit News

Volume 3, Issue 9– August 10, 2018

General Information

UW-Madison/Extension Insect Diagnostic Lab update

By: PJ Liesch

Insect activity has remained high over the past two weeks. A summary of fruit-crop insects submitted to the UW Insect Diagnostic Lab can be found below:

Japanese beetles remain one of the top fruit pests in the state at the moment with activity spread throughout much of the state other than the far northern counties. Reports of beetle pressure and severity have varied in the state and pressure can be somewhat localized.

Pearslug sawfly has been reported in several cases on fruit trees in the state (La Crosse, Racine, and Washington counties). The slimy, slug-like larvae of this insect feed on the undersides of leaves of fruit and some ornamental trees. Larvae tend to only feed part-way through the leaf, leaving behind brownish, lace-like patches. A second generation can occur in the state, so growers should keep an eye out for this pest.

Spotted Wing Drosophila reports have started to increase for the year at the UW Insect Diagnostic Lab. Recent reports of activity have come in from Brown, Kenosha, Marathon, and Sauk counties. While only a few cases have been reported to the UW Insect Diagnostic Lab, this pest is likely active across much of the state, so growers should be vigilant about SWD activity.

Stink Bug activity continues in the state. Brown marmorated stink bug adults have recently been reported in Dane county and nymphs have been reported from Dane and Washington counties within the last week. Growers should be on alert for BMSB in their orchards and vineyards. Other stink bugs including, *Banasa dimidiata*, green stink bugs (*Chinavia hilaris*), and brown stink bugs (*Euschistus* sp.) have all been reported in the last two weeks from locations around the state.

Spider mites have been recorded in some fruit samples, as well as samples of landscape ornamentals. Some portions of Wisconsin have experienced drier conditions the past few weeks, and two-spotted spider mites thrive under hot/dry conditions. While no reports of significant fruit damage have occurred, growers should monitor for mites and stippling damage, especially if dry conditions continue. Be careful with insecticide choices, as some products can exacerbate or induce mite problems.

Tarnished plant bug damage was recently noted on a peach sample from La Crosse county.

Scab-like lesions of the **pearleaf blister mite** have been somewhat common at the UW Insect Diagnostic Lab lately, with a handful of recent reports from around the state.

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

By: Brian Hudelson, Sue Lueloff, John Lake and Ann Joy

The PDDC receives samples of many plant and soil samples from around the state. The following diseases/disorders have been identified at the PDDC from July 28, 2018 through Aug 3, 2018.

PLANT/ SAMPLE TYPE	DISEASE/ DISORDER	PATHOGEN	COUNTY
FRUIT CROPS			
Apple ('Gala')	*Cytospora Canker* *Root/Crown Rot* *Sphaeropsis Canker*	*Cytospora sp.* *Phytophthora sp., Pythium sp.* *Sphaeropsis sp.*	*Jefferson* *Jefferson* *Jefferson*
Apple ('September Wonder Fuji')	*Blister Spot*	*Pseudomonas syringae pv. papulans*	*Dane*
Apple ('Sweetango')	*Blister Spot*	*Pseudomonas syringae pv. papulans*	*Dane*
Raspberry	*Root/Crown Rot* *Verticillium Wilt*	*Phytophthora sp.* *Verticillium sp.*	*Bayfield* *Bayfield*

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

Raspberry rust diseases

By: Janet van Zoeren and Patty McManus

Rust diseases frequently show up on raspberry plants in the late summer and fall. Here is some information on the similarities and differences between late leaf rust and orange rust, including a table to compare/contrast the two diseases, at the end of the article.

Late leaf rust (*Pucciniastrum americanum*) affects red and purple raspberries. Blackberries and black raspberries are not susceptible. As the name implies, symptoms appear later in the season, generally beginning in July in Wisconsin. For this reason, summer-bearing varieties usually are not affected. Unfortunately, this pathogen can cause significant damage to fall-bearing varieties; in Ohio, commercial raspberry growers have reported late leaf rust on up to 30% of fall-bearing red raspberries. This disease is commonly observed in Wisconsin, both in home gardens and commercial plantings.

Initial symptoms include yellowing on the upper-sides of the infected leaves, followed by powdery, orange spores appearing on the undersides of the leaves (see Figure 1). As the disease progresses into the fall, leaves begin to wilt and fall off and pale yellow spores begin to appear on the berries themselves (see Figure 2). Late leaf rust overwinters in the raspberry plant. White spruce can serve as an alternate host in the spring, but white spruce is not necessary for pathogen survival.

Figure 1. Late leaf rust leaf symptoms – masses of dusty yellow spores on the underside of a leaf. Photo courtesy of Ontario Ministry of Agriculture, Food and Rural Affairs.

Figure 2. Late leaf rust berry symptoms –dusty yellow spores on the berry. Photo courtesy of Ontario Ministry of Agriculture, Food and Rural Affairs.

As with most diseases, pathogen-free planting stock, good sanitation habits, adequate air flow in the canopy, and avoiding excessive nutrient applications can help reduce the likelihood of late leaf rust in your raspberry plantings. Removing white spruce and wild raspberries from the surrounding area may serve to reduce the risk of late leaf rust; however, as mentioned above, white spruce is not a necessary host of this pathogen, so its removal will not eliminate the disease altogether. Fungicide applications, when necessary, should begin when symptoms first appear, and can be reapplied approximately every two weeks.

Orange rust (*Arthuriomyces peckianus*) does not affect red raspberries; all other cane berries are susceptible. The orange rust pathogen is systemic in the plant, so once symptoms appear in the spring it will be impossible to eradicate from the plant. This can be a very damaging disease for blackberries and black raspberries.

Early signs of orange rust appear in the spring, generally in May or June, often when weather conditions are cool and wet. Initially the main symptom is that the new growth is spindly, weak and stunted. Soon, waxy orange blisters appear on the underside of the leaves (see Figure 3). In early summer, these break open, releasing spores that can infect neighboring plants, while the pathogens in the infected plants become systemic inside the canes and roots. Although the blisters may disappear that fall, and may not reappear, the canes will remain weak and yield decreased on that plant.

Figure 3. Orange rust on the leaves of a purple raspberry plant.

Prevention of orange rust includes planting disease-free stock, using thorough sanitation practices, allowing air flow through the canopy, and avoiding excessive nutrient applications. Once symptoms can be seen on a cane, it is advisable to remove and dispose of the entire plant, ideally before the spores are released to infect neighboring plants. Fungicides can be used in combination with plant removal – the following spring after infected plants have been identified, you can spray a suitable fungicide on the leaves and canes of remaining plants to help prevent their infection.

Please see the 2018 Midwest Spray Guide for more information on suitable fungicides for all raspberry rusts and other diseases, and remember to always read the label using any pesticide.

Common Name	**Late leaf rust**	**Orange rust**
Scientific Name	*Pucciniastrum americanum*	*Arthuriomyces peckianus*
Plants affected	Red and purple raspberry (not black raspberry or black berry)	Black and purple raspberry and blackberry (not red raspberry)
Symptoms	Yellow spots on upper leaf surface in late summer; blisters with powdery light-orange spores on undersides; rusty/orange spore masses on fruit. Can defoliate canes, and cause direct loss to fruit.	Young shoots are pale, weak, and spindly. By late spring and early summer, bright orange waxy spore pustules on leaf undersides. New growth looks okay, as if plant is growing out of it, but it isn't.
Life Cycle	Not systemic. Alternate host is white spruce, but it is not required. Overwinters in canes.	Both local and systemic infection. No alternate hosts. Late spring, fungus infects leaves causing local lesions. Mid summer, spores from infected leaves penetrate invade tips of new shoots, grow down to crowns and roots. Can spread in root grafts (so you should remove infected plants). Fungus not active at 77F or higher. Overwinters in crowns and roots.
Treatment	Fungicides may be justified on fall-bearing plants: Cabrio, Pristine, Rally, starting when symptoms first appear, repeat at 10-14 day intervals if wet weather. Because it shows up late, summer bearing varieties usually escape significant fruit infection.	Spray two times (Pristine, Cabrio, Rally): 1st in spring to prevent "local" lesions; 2nd in late summer to prevent systemic infection of crowns. Remove systemically infected plants to prevent spread.

Strawberry root health

By: Janet van Zoeren and Amaya Atucha

Many factors affect the health of strawberry root systems. These include the chemical, physical and biological properties of the soil. These all work together to provide a good foundation for vigorous and high-yielding strawberry plants.

Chemical and physical properties of the soil:

Traditional views on soil health have focused on the chemical make-up of the soil, such as nutrient levels and pH. These aspects of the soil are convenient to understand, with simple tests providing concrete amendment suggestions. Pre-planting soil tests are a valuable way to assess the pH and nutrient levels of the soil, and amending the soil to balance nutrient levels provides a good starting point for a healthy root system. More information about nutrient management for strawberry health can be found at Cornell University's "Berry Soil and Nutrient Management – A Guide for Educators and Growers".

Beyond the nutrient levels in the soil, the soil physical properties (i.e., porosity, structure, texture) can affect drainage, nutrient uptake, and susceptibility to pathogens. Strawberries thrive best in sandy or sandy clay-loam soils, which are characterized by good drainage. High clay content soils will require some more effort to avoid excessive water-logging. Regardless of the soil texture, soil compaction can have a substantial impact in soil drainage. However, research studies at Cornell University have shown that strawberry plants can tolerate relatively compact soil if there is still good drainage, showing only a 10% reduction in yield due to heavy pre-planting soil compaction in one New York state study (Pritts et al. 2015). Additionally (and conveniently), between-rows compaction was found to have very minimal effect on strawberry root health. However, compaction leading to poor drainage can have strong negative effects on the plants' health, especially when combined with soil pathogens, which will be discussed below. Overall, adding organic matter, in the form of compost or turning in cover cropping, increases drainage, along with nutrient and water holding capacities, and improves the physical characteristics of the soil.

Biological properties of the soil:

The biological health of the soil can be more complex to evaluate and to change. However, biological soil health is increasingly being shown to have a huge impact of plant health. After a field has been planted in strawberries for three to four years, pathogens begin to build up in the soil, leading to poor root health (for instance increased prevalence of black root rot). Some ways to promote soil health include: rotating crops, minimizing fumigation, adding beneficial soil inoculants, and avoiding some herbicides.

Cover cropping, or rotating crops, helps improve drainage, as well as preventing pathogen build-up. Some of the best plants for cover cropping, according to Dr. Marvin Pritts from Cornell University, include mustards (i.e. *Brassica spp.*), corn, rye, and marigolds. A mix of grasses, legumes, and mustards provides the advantages of a large amount of biomass (from the grasses), nitrogen acquisition (from the legumes), and bio-fumigation (control of root pathogens, from the mustards). These can be put in immediately after removing the strawberries. Maintain the cover crops for at least a year, until you are ready to re-plant strawberries.

Chemical fumigation can provide short-term removal of soil pathogens, but in the long-term the pathogens generally rebound, and sometimes are able to colonize more strongly following fumigation due to the removal of beneficial soil organisms. For that reason, bio-fumigation is preferable, and fumigation should be used with caution.

Some products are available to inoculate strawberry soil with beneficial organisms in order to improve the biological properties of the soil. Vermicompost (worm castings compost), applied during strawberry planting, may increase strawberry root biomass and changing the soil microbial community, potentially leading to increased yields and larger berries. Arbuscular mycorrhizal fungi in the soil interact directly with the plants' roots, creating healthier roots that are better able to uptake nutrients, as well as reducing pathogens' ability to colonize the strawberries' roots directly. These are both available commercially.

Further Reading / Literature Cited:

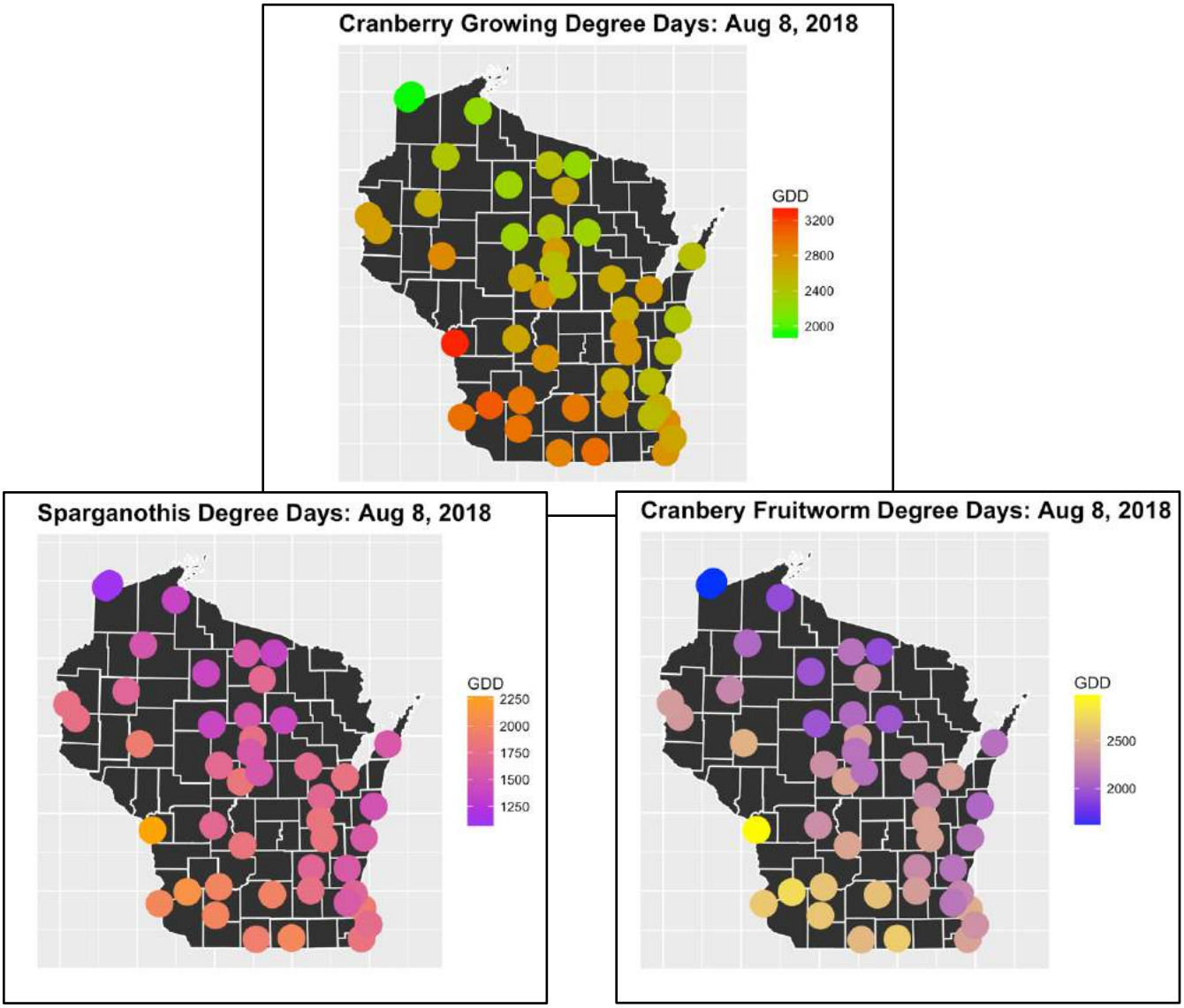
Herrick, C. 2018. *Managing Soil Health Can Improve Strawberry Productivity*. Growing Produce.

Pritts, M., M.J. Kelly and C. Heidenreich. 2015. *Effect of Soil Compaction on Strawberry Root Health and Yield*. New York Fruit Quarterly: 23 (pp. 25-29).

Cranberry plant and pest degree-days: August 8, 2018

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

Check out the maps below for the degree-days of the cranberry plant and associated pests.[1]



Use the table below to compare degree-day accumulations for all three organisms across the last couple of years and between Northern and Central WI.

Aug 8	Cranberry DDs			Sparg DDs			CFW DDs		
	2016	2017	2018	2016	2017	2018	2016	2017	2018
Northern WI (Minocqua)	2374.2	2171.5	2490.9	1435.7	1248	1585.5	2041.4	1841.6	2178.7
Central WI (Wisconsin Rapids)	2876.8	2709.6	2832.1	1842.5	1685.9	1884.7	2508.6	2348	2504.5

[1] Recall that degree-days are calculated based on the daily high and low temperature accumulations and that they vary by species according to species specific temperature thresholds. Developmental thresholds for each species are: cranberry plant - 41 and 85°F; sparganothis fruitworm - 50 and 86°F; and cranberry fruitworm - 44 and 87° F.

Based on the predicted life-cycle of sparganothis fruitworm (at right), in central WI, the last eggs are hatching and becoming larvae.

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

New cranberry early rot scouting guide available

By: Patty McManus

Cranberry early rot is an important fungal disease that become apparent in late July and through August. On the Wisconsin fruit website (fruit.wisc.edu) there is a scouting guide to help growers and consultants identify early rot and distinguish it from other maladies that show up in late summer. You can find the "Identifying early rot in the field" guide by visiting the cranberry page, and scrolling down to the "disease management" section. There you will also find other links to information about the most common cranberry diseases.

Grapes

UW-Extension Door County vineyard walk next week on August 13th

Join UW-Extension and UW-Madison specialists on **Monday, August 13, from 1:00pm – 4:00pm** for a walk through the research vineyard at the Peninsular Agricultural Research Station located at 4312 Hwy 42 N in Sturgeon Bay! It's not too late to register – you can sign up online at https://uwex.co1.qualtrics.com/jfe/form/SV_5drk3WtRC59twSp or by calling 920-746-2260. ***This event is free and open to the public.***

Speakers will include:

- Dr. Patty McManus, UW-Extension Fruit Crop Plant Pathologist-- Diseases in the vineyard and fungicide selection
- Dr. Amaya Atucha, UW-Extension Fruit Crop Specialist -- Best management practices for healthy and productive grape vines
- Dr. Nick Smith, UW-Madison Food Science Outreach Specialist – Grape management and harvest considerations for optimal wine quality
- Annie Deutsch, UW-Extension Door County Agriculture Agent – Insects in the vineyard

Grape Variety Developmental Stages: Aug 9, 2018

By: Janet van Zoeren, Annie Deutsch, Jacob Scharfetter, and Amaya Atucha

South Central Wisconsin-Dane County:

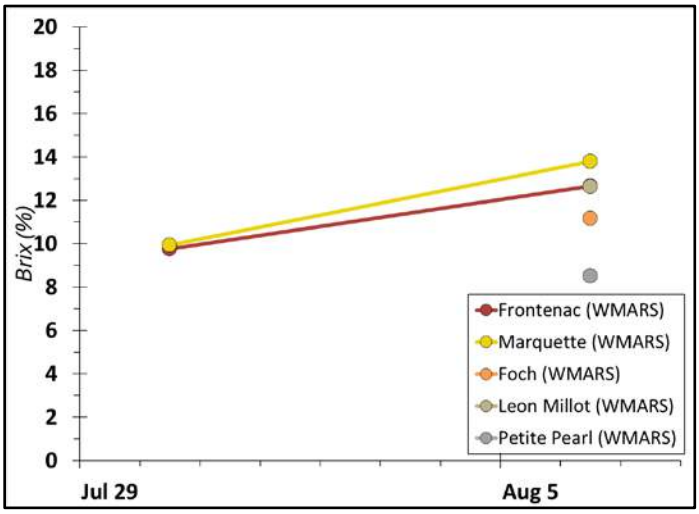
At the West Madison Agricultural Research Station (WMARS) acidity is dropping quickly and Brix are steadily increasing, with some cultivars at developmental stage E-L 37 ("berries not quite ripe"), while others are still at stage 35 ("berries begin to color and enlarge, early veraison").

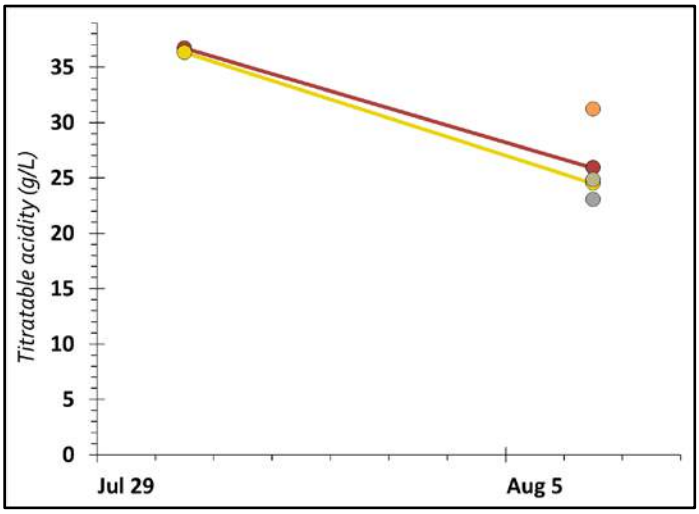
E-L stands for Eichhorn-Lorenz Phenological stages to describe grapevine development

Sugar (Brix) and TA (titratable acidity) concentrations as of August 6th are shown in the chart below, along with graphs below to track their progression throughout the ripening period. The earliest cultivar, Brianna, will be reaching full maturity within the next two weeks in Southern Wisconsin. All cultivars are at higher Brix (2 to 4% higher) compared to the same period in 2017, but slightly lower (1 to 2% lower) compared to the same period in 2016. Conversely, all cultivars have lower TA (6 to 10 g/L less) concentrations this year compared to the same period in 2017, and slightly higher (2 to 6 g/L less) concentrations compared to the same period in 2016.

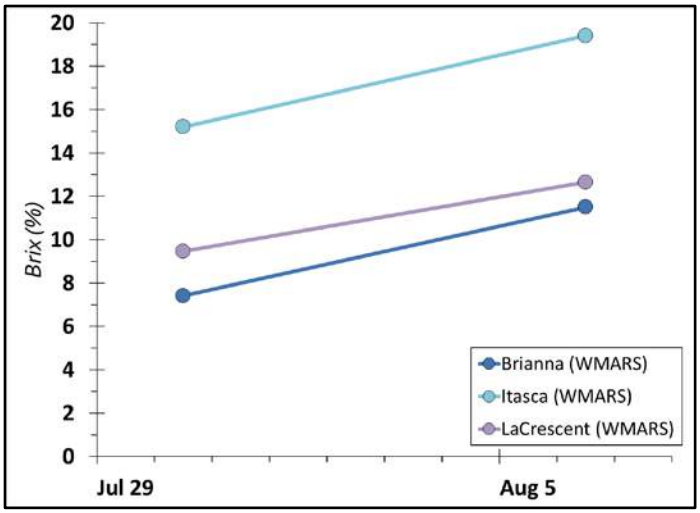
Aug 6, 2018 **Grape Brix and Titratable Acidity (TA)**

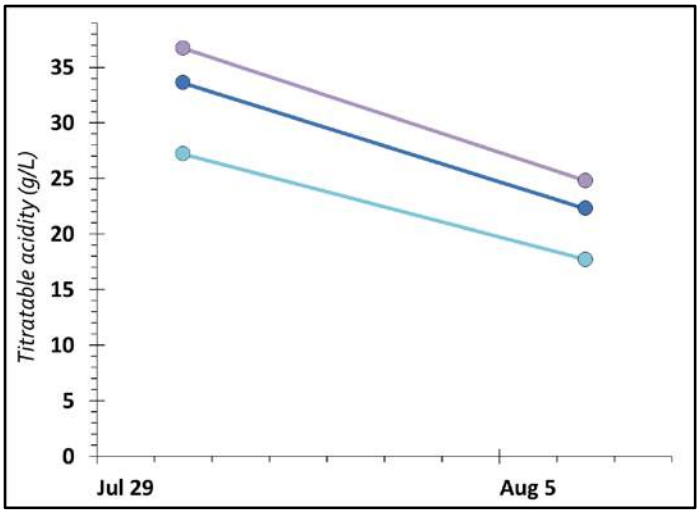
	WMARS	
Grape Variety (Reds)	**Brix (%)**	**TA (g/L)**
Frontenac	12.7	25.9
Marquette	13.8	24.5
Foch	11.2	31.2
Leon Millot	8.51	23.0
Petite Pearl	12.6	24.8
Grape Variety (Whites)	**Brix (%)**	**TA (g/L)**
Brianna	11.5	22.3
Itasca	19.4	17.7
La Crescent	12.6	24.8





Brix (above left) and Titratable acidity (above right) of red wine grape varieties as WMARS.





Brix (above left) and Titratable acidity (above right) of white wine grape varieties as WMARS.

Following photos taken on Aug 8th at West Madison Agricultural Research Station.

Brianna at WMARS;
"berries not quite ripe"
E-L number = 37

La Crescent at WMARS;
"berries begin to color,
early veraison"
E-L number = 35

La Crosse at WMARS;
"berries with
intermediate sugar"
E-L number = 36

Itasca at WMARS;
"berries with
intermediate sugar"
E-L number = 36

Marquette at WMARS;
"berries not quite ripe"
E-L number = 37

Frontenac at WMARS;
"berries with
intermediate sugar"
E-L number = 36

Foch at WMARS;
"berries with
intermediate sugar"
E-L number = 36

Petite Pearl at WMARS;
"berries with
intermediate sugar"
E-L number = 36

Door County:

At the Peninsular Agricultural Research Station (PARS), berries are in the second stage of development referred to as the lag phase, in which berries continue to develop but there is minimal change in berry size. All cultivars are still at developmental stage E-L 33 ("bunch closure, berries still hard and green").

Following photos taken on Aug 8th at Peninsular Agricultural Research Station (PARS)

Brianna at PARS;
"bunch closure, berries
still hard and green"
E-L number = 33

La Crosse at PARS;
"bunch closure, berries
still hard and green"
E-L number = 33

Marquette at PARS;
"bunch closure, berries
still hard and green"
E-L number = 33

Frontenac at PARS;
"bunch closure, berries
still hard and green"
E-L number = 33

St Croix at PARS;
"bunch closure, berries
still hard and green"
E-L number = 33

Growing degree days:

April 1 - Aug 8	Grape Growing Degree Days (Base 50, BE)	
	2018	2107
WMARS	1931	1705
PARS	1496	1267

The growing degree-day accumulations as of Aug 8th for this year are: 1,931 GDD at WMARS and 1,705 GDD at PARS. We continue to be "ahead" of where we were on this date in 2017 at both locations in terms of degree day accumulations, and correspondingly, all cultivars have higher Brix and lower acidity than at this time last year. We calculated degree-days using a base of 50°F, starting on April 1st as a biofix. "BE" (Baskerville-Emin) refers to a specific way in which to calculate degree days, using a sine wave instead of a simple average temperature calculation – this gives a somewhat more accurate estimation of degree days. We calculated degree days using the NEWA website, and you can visit their "About degree days" page to learn more about the formulas they use for their calculations (http://newa.cornell.edu/index.php?page=about-degree-days).

Grape scouting report: spotted wing drosophila review

By: Christelle Guédot, Janet van Zoeren and Emma Pelton – Department of Entomology, University of Wisconsin

Insect pests seen during our vineyard scouting sessions continue to include Japanese beetles (although numbers continue to decrease) and phylloxera. Additionally, we've begun to see low numbers of Asian ladybeetles and yellow jackets. These both have some beneficial effects early in the season as biocontrol agents, and are not yet at high enough levels (or close enough to harvest) to be considered a pest. Additionally, some growers have begun to report sightings of the ubiquitous spotted wing drosophila (SWD) in their vineyards; for that reason we've decided to repost this article first published in volume 1, issue 12 of this newsletter.

The key takeaway message of the article is that **cold hardy wine grape varieties are largely resistant to SWD as long as the skin is intact, and that the presence of SWD in the vineyard does not necessarily correlate to their presence in your fruit**. For that reason, we recommend that wine grape growers test for larvae in the fruit, rather than for adults in the vineyard, before considering control measures for SWD. Note that table grapes were not included in this study, and some studies suggest that they may be more susceptible than wine grapes to SWD infestation.

Spotted wing drosophila is a vinegar fly that was first detected in Wisconsin in 2010 and as now spread throughout most of the state. SWD prefers soft skinned fruit such as raspberry, blueberry, strawberry, cherry, and blackberry. SWD females lay their eggs under the skin of the fruit after cutting a slit in the skin of intact, ripening fruit. Larvae feed on the flesh of the fruit, causing soft spots on the surface of the berry (Figure 1A and B) and a wrinkling of the fruit skin. The fruit will subsequently collapse (Figure 1C).

Figure 1: Damage from SWD larvae feeding on grape, 3-4 days after egg laying. A) Dark area in light-colored fruit and B) light area in darker-colored fruit (white arrows). C) Damage from SWD larvae feeding on grape, more than 5 days after egg laying with emerging larvae (black arrow). Photos: Parent, Whitney, Shearer, Reitmajer, Dalton and Walton; USDA-ARS Corvallis and Oregon State University.

Work in our lab during the summer of 2014 by graduate student Emma Pelton found that cold hardy wine grape varieties are largely resistant to SWD if fruit is intact, but highly susceptible if the skin is damaged, even slightly. The study consisted of 1) field monitoring for adults and larvae and 2) laboratory no-choice assays to understand if there were varietal differences. Varieties assessed included cold hardy wine grapes: four reds (St. Croix, Marquette, Frontenac, and Marechal Foch) and two whites (La Crescent and Edelweiss). Monitoring occurred in conventional vineyards in southern Wisconsin. Adults and larvae were found in all varieties and vineyards throughout the season. However, larval infestation was quite low on intact fruit (2 larvae/kg fruit) compared to raspberry (480 larvae/kg fruit). There was no difference in the number of larvae between varieties. There were statistically higher numbers of adults in the white variety Edelweiss; however, this may be due to the earlier harvesting of this variety.

Varieties assessed in laboratory no-choice assays included cold hardy wine grapes: six reds (St. Croix, Marquette, Frontenac, Marechal Foch, Leon Millot and Concord) and two whites (La Crescent and St. Pepin). Grapes were sourced from no-spray vines to minimize the impacts of insecticides and fungicides. Each variety was exposed to adult SWD for 48 hours and then placed in a growth chamber for three weeks to determine if any eggs, larvae, or adults developed. Half the grapes were "damaged" by creating a cut in the skin of the grape and the other half of the grapes were "undamaged". Raspberries were also included in the study as a positive control. The results of the study showed that, while females did attempt to lay eggs on undamaged grapes, the eggs were not viable and did not develop into larvae or adults. However, on the damaged grapes, eggs developed at rates similar to SWD on raspberries. These results suggest that undamaged fruit is highly resistant to SWD, but damaged fruit is similarly suitable to infestation as raspberry, one of the favorite hosts of SWD.

Based on the results of this study, the best recommendation for vineyard management is monitoring fruit for damage and larvae rather than for adults. The presence of larvae can be assessed with a salt-water test by placing a sample of fruit in a Ziploc bag (~40-50 berries). In a separate container, dissolve 2 Tbsp. table salt in 2 cups warm water. Pour salt water into Ziploc bag so it covers the fruit, close, and lightly crush to break the skin and let sit for 30 minutes to 1 hour before examining. You can examine the fruit through the bag or pour the sample in a shallow glass baking dish with white paper underneath and a bright light shined on top in order to maximize visibility of larvae.

If you find damaged fruit and/or larvae, management recommendations include removing damaged/infested fruit (and properly disposing by solarization or bagging fruit so larvae cannot develop to adulthood) or applying a registered insecticide. DO NOT compost fruit, it might actually speed up SWD development in warm areas of the compost piles. Freezing berries will kill SWD and refrigerating berries will stop further development of larvae inside the fruit and may kill larvae after longer refrigeration periods. It is thus recommended to keep berries cool as much as possible, from processor to market, to consumer as it will minimize the chance that larvae will continue developing in fruit. Low larval infestations may not necessitate management actions if fruit will be made into juice or wine as the larval would be filtered out and there are no known taste or human health impacts of low levels of SWD.

Please note that table grapes were not assessed in this study. As table grapes may have a thinner skin than wine grapes, they may be more susceptible to SWD. Follow-up work will aim to assess some of these table grape varieties for their susceptibility.

If you decide to spray an insecticide to reduce adult populations, below is a list of insecticides that have been shown to be effective against SWD in grape. So far, there are no registered insecticides that will control larvae within fruit. The insecticides listed below target adults with the intent to eliminate flies before they mate and lay eggs. Make sure to calibrate your sprayers to provide thorough coverage, especially in the center of the bush where flies like to hide. This is not a comprehensive list. Trade names are provided as examples of specific active ingredients.

Insecticides effective against SWD and registered on grape:

Class (IRAC)	Trade name	Active ingredient	REI	PHI	Toxicity to bees	Efficacy against SWD
Carbamates (1A)	Sevin XLR Plus	Carbaryl	2 days	7 days	Highly toxic to bees	Good
Organo-phosphates (1B)	Malathion 5EC	Malathion	3 days	3 days	Highly toxic to bees	Good
	Imidan 70W	Phosmet	7-14 days	14 days	Highly toxic to bees	**Excellent**
Pyrethroids and Pyrethrins (3A)	Brigade 2EC	Bifenthrin	12 hrs	30 days	Highly toxic to bees	Good
	Danitol 2.4EC	Fen-propathrin	24 hrs	21 days	Highly toxic to bees	**Excellent**
	Mustang Max	zeta-Cypermethrin	12 hrs	1 day	Highly toxic to bees	**Excellent**
	Pyganic **OMRI**	Pyrethrum	12 hrs	12 hrs	Moderately toxic to bees	Fair
Spinosyns (5)	Delegate WG	Spinetoram	4 hrs	7 days	Moderately toxic to bees	**Excellent**
	Entrust **OMRI**	Spinosad	4 hrs	7 days	Moderately toxic to bees	Good

REI: Re-entry interval
PHI: Pre harvest interval
OMRI: Organic Materials Review Institute approved

Tree Fruits

Apple Summer Diseases

By: Patty McManus

Sooty blotch and flyspeck are caused by several different fungi that feed on waxy cuticles of apple and some other fruit and the waxy stems of wild grapevines and brambles that are common in woodlots and hedgerows. Sooty blotch and flyspeck usually are considered together as a disease complex (SBFS), because they show up on apple fruit at about the same time and cause similar types of black specks and smudges on fruit (Figure 1). The SBFS fungi start infecting apple fruit and plants in woodlots in late May and early June. With enough moisture (and we have had more than enough this year in most parts of the state), those early infections produce large spore loads by mid July. Many growers back off on fungicide sprays by mid July, because the threat of scab is less than earlier in the season, but this leaves fruit vulnerable to infection by SBFS pathogens.

Figure 1. Sooty blotch and flyspeck blemishes. Photo by P. McManus.

In 2016 I wrote an article on using wetness hour accumulation to guide sprays for SBFS (check the WFN archives for Volume 1, Issue 8, July 22, 2016). Disease prediction models are more valuable in drier or normal seasons when it's not clear whether conditions have been met for disease. In looking at SBFS risk summaries on the NEWA weather site, it's clear that we've had enough accumulated "leaf wetness hours" to make conditions favorable for SBFS on apple fruit statewide. Different models use different wetness thresholds, ranging from 175 hours to 225 hours of accumulated wetness, but even the higher threshold has been exceeded statewide. The actual severity of disease will depend on conditions now through harvest and what measures you take to control flyspeck and sooty blotch.

The main fruit rot diseases in Wisconsin are black rot, white rot, and bitter rot. The fungi that cause black rot and white rot can also infect branches and trunks and cause cankers. Historically black rot has been the most common fruit rot in Wisconsin, but Honeycrisp is especially susceptible to bitter rot, and white rot is becoming more common as well. Black rot and white rot lesions, sometimes appear relatively dark or light, respectively. However, when symptoms develop during cooler conditions, white rot lesions are firmer and brown, making them hard to distinguish from those of black rot (Figure 3). In advanced stages, black rot and white rot lesions develop black fungal fruiting bodies. Bitter rot lesions superficially resemble those of black rot and white rot, but under wet or very humid conditions, advanced bitter rot lesions do not develop black fungal fruiting bodies but rather exude masses of orange/salmon colored spores (Figure 2). If fruiting bodies or spore masses are not visible on lesions, the pattern of internal rot is useful in distinguishing bitter rot (dark, V-shaped decay) from white rot (pale, cylindrical-shaped decay) (Figure 4).

Figure 2. Bitter rot lesion with orange/salmon colored spores on the surface. Photo by P. McManus.

Figure 3. Black rot (left) and white rot (right). Photos courtesy of APSnet.

Figure 4. White rot (left) forms a cylindrical-shaped decay , while bitter rot (right) forms a V-shaped decay. Photo courtesy of J. Hartman, Univ. Kentucky.

There are several fungicide options for SBFS and fruit rot control in conventional orchards. Of course, you need to consider how many sprays and how much product you used earlier in the year so that you do not exceed maximum amounts permitted, and you need to be aware of pre-harvest intervals listed on labels. Some options:

- Captan alone is effective on SBFS and the summer fruit rots if a higher rate is used and spray intervals are no more than 2 weeks.
- Topsin + captan is very effective, and you could get away with a lower rate of captan if mixed with Topsin. The addition of Topsin would also help with fruit rot control.
- Captan + phosphorous acid is good for SBFS, but phosphorous acids are not effective on fruit rots.
- Strobilurins (e.g., Flint, Pristine, Sovran) alone are effective on SBFS and fruit rots, but mixing with a low rate of captan is even better.
- Products that are mixes of SDHI fungicides and strobilurins, such as Luna Sensation and Merivon are effective on SBFS and the fruit rot diseases. Note that Luna Tranquility, with a 72-day PHI, is NOT labeled for use on summer diseases. See below for my concerns about preserving the SDHI and sterol inhibitor (SI) fungicides for scab control early in the season.
- Indar and Inspire Super, which are sterol inhibitor (SI, group 3) fungicides, are effective against SBFS but not the fruit rot diseases. However, you should not use SI or SDHI fungicides on summer diseases if apple scab is seen in the orchard and you depend on SI and/or SDHI fungicides for scab control in the spring. Exposing active scab lesions to the SI fungicides (Indar or Inspire Super) or the SDHI fungicides (Luna, Merivon) enhances the development of scab resistant to these two important groups of fungicide. If resistance develops, then you will have trouble controlling scab in the future with any SI or SDHI fungicide.

Is it time already to start apple harvest?

By: Amaya Atucha and Janet van Zoeren

It is again that time of year to start thinking about when to begin harvesting apples. Whether you are planning to sell your apples at a farmers' market, wholesale, for processing, or considering regular or controlled atmosphere storage, harvesting at optimal maturity for the targeted consumer will be key to ensure a high quality product. There are many maturity indices that can be used to establish harvesting windows for apples, and we briefly discuss below several of them. ***This information was first published in Volume 1, Issue 12 of this newsletter***. For further information about apple maturity indices, you can refer to the series we published last year reporting on some of these maturity indices for Honeycrisp variety apples in Dane and Door County (Volume 2, Issue 9 through Volume 2, Issue 12). Also, more in-depth information about the indices discussed here can be found on our UW Extension publication, "Determining the Optimal Apple Harvest Date".

Fruit firmness

As apples mature, the flesh becomes softer and this can be measured using a penetrometer. Penetrometers with a 7/16" diameter plunger tip can be purchased at farm supply stores; some of the common brands are Wagner Fruit Test FTX, Magness-Taylor, and McCormick. To get accurate readings it is critical to adjust the speed with which the plunger tip is inserted in the flesh. Here's a link to Measuring Fruit Firmness with a Penetrometer from Washington State University.

Soluble solids

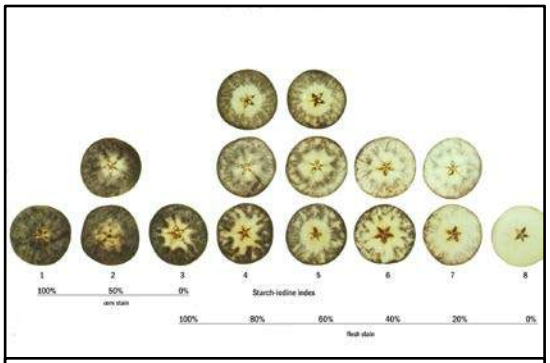
Sugar concentration increases as the fruit ripens. A refractometer can be used to measure sugar concentration in degrees Brix in apples. To measure sugar concentration, a small amount of juice from the fruit needs to be squeezed and placed onto the prism of a digital or optical handheld refractometer.

Acidity

Unripe apples have a high concentration of acids, mainly malic acid, however as the fruit ripens, the acid concentration decreases. Measuring acidity can be more complicated than other maturity indicators, as it requires a higher level of training and more sophisticated laboratory equipment, such as a titrator. There are a couple new tools that can be used in the field to measure acidity, Accuvin titratable acidity test kit and the Atago Pal-BX/ACID5, however the precision of the readings is not as high as with a titrator.

Starch Content

During the ripening process of apples, starch in the flesh is converted into sugar. This process can be measured using the starch-iodine test, which allows us to visually evaluate the conversion of starch into sugars. The iodine binds to the starch molecules in the apple flesh and turns into a very dark purple/black color. As the fruit matures, there is less concentration of starch and thus less dark color of the flesh (Figure 1). Each variety has a different pattern of starch disappearance, and variety specific visual charts can be found online.



Iodine stain conversion pattern for McIntosh apples. The McIntosh ripening pattern can be used for many apple cultivars. Photo courtesy of Blanpied and Silsby, 1992.

To determine the stage of maturity of apple fruits, cut an apple horizontally and apply the iodine solution to the cut surface, draining any excess, and rate the fruit after 2 minutes. The reaction of the iodine with the starch is temperature dependent, and it will take longer under cold conditions. The iodine solution to perform the test can be purchase online (iodine solution) or it can be prepared (see our publication "Determining the Optimal Apple Harvest Date" for a recipe).

Store the iodine solution in an amber bottle, or a clear container wrap in aluminum foil to avoid light exposure (iodine color will degrade if exposed to the light). Old iodine solution will deteriorate, so make sure to test it before using it

on an immature apple that should turn black within seconds if the solution is still good.

DA meter

By measuring the absorption of different wavelengths, the DA meter can gauge the level of *chlorophyll a* in the fruit's flesh, which corresponds to the ripeness of the fruit (*chlorophyll a* levels go down as the fruit ripens). However, the rate and degree in which chlorophyll a breaks down in the fruit skin varies by cultivar and region, making it difficult to provide simple target values. The DA meter has the advantage of being non-destructive, whereby you can sample and gauge the maturity of the fruit while it is continues to ripen on the tree. For more informaiton about the DA meter, you can visit the Washington Tree Fruit Research Commission's page "DA Meter Maturity Index", or go to the manufactors webpage at www.trturoni.com.

Calendar of Events

August 13, 2018 – PARS Vineyard Walk
1 pm – 4 pm, Peninsular Agricultural Research Station, 4312 Hwy 42 N., Sturgeon Bay, WI

August 14, 2018 – Women Caring for the Land Workshop
8:30 am – 3 pm, Buser Cattle Company, 6440 Wiesner Rd, Omro, WI

August 23, 2018 – WBGA Fall Field Day
8 am – 5 pm, Nature's Finest Foods, 4902 County Rd S, Oshkosh, WI

There are more "Women Caring for the Land" Workshop dates and locations. Please see the events section of our website for more information about this series.

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: http://labs.russell.wisc.edu/pddc/

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

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

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