

## In This Issue:

### General Information:

Biological control Part II: Our favorite natural enemies page 1

Plant Disease Diag. Clinic update page 4

Insect Diagnostic Lab update page 5

### Berry Crops:

Blueberry Maggot page 5

Nematode diseases of berry crops page 8

### Cranberries:

Cranberry degree-day map and update page 9

### Grapes:

Canopy Management Practices to Improve Grape Qualities page 11

Wine and table grape developmental stages page 13

### Tree Fruits:

Preharvest bitter pit prediction in Honeycrisp page 16

Apple maturity index report page 16

### Calendar of Events:

page 18

## General Information

### Biological control Part II: Our favorite natural enemies

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

In this Biological control Part II, we will familiarize you with these natural enemy allies found in Wisconsin. For a summary of biocontrol, please read part I of this series ([Biological control Part I](#)), where we introduced the concept of biocontrol, considered different types of biocontrol strategies, and discussed the advantages and difficulties of integrating biological control into an IPM management plan. To recap, biological control, which is the reduction of a pest population by natural enemies due to human intervention, is carried out by a host of allies including predacious flies, bugs and beetles, parasitoid wasps and flies, mites, pathogens and nematodes.



Convergent ladybeetle larva (left) and adult (right). Photos by Louis Tedders, USDA Agricultural Research Service, Bugwood.org.

photo to the left). The eggs are bright yellow clumps of ovular eggs, usually laid on the underside of leaves.

There are many species of ladybeetle native to Wisconsin, and more that have been introduced specifically to control insect pests. It's worth mentioning here the multicolored Asian ladybeetle, which can be a pest in the fall when adults feed on wine grapes and congregate in houses. Although this species can be pestiferous, it is also beneficial throughout much of its life, and can be a great natural enemy in some cropping systems such as soybean. Other species of ladybeetle are available commercially for augmentative biocontrol. The black ladybeetle called spider mite destroyer (*Stethorus punctum*) is a valuable natural enemy for pest mites, and is resistant to some organophosphates.

**Ladybeetles (order Coleoptera, family Coccinellidae)** are very important biological control agents against soft-bodied insect pests, such as aphids. Being predacious throughout their life, each ladybeetle larva consumes hundreds to thousands of pests during its development, and their ability to increase population size rapidly to keep up with pest outbreaks makes them very good natural enemies. Ladybeetle larvae are alligator-shaped and very mobile (see

### Augmentative biocontrol

refers to the regular release of a natural enemy, which was reared in a lab and bought on the farm, to increase (augment) existing natural enemy populations.

### Lacewing larvae (order Neuroptera)

are voracious predators that feed mainly on aphids, but also on scale insects, leafhoppers, mites, caterpillar eggs and pear psylla. The larvae are also alligator-shaped and feed using their hollow sickle-shaped mandibles, which they pinch into their prey and suck out their innards (see at right). Lacewing eggs are easy to recognize as each egg is laid on a thread-like stem, raising it up in the air to prevent early-hatching voracious larvae from feeding on their siblings! Each lacewing larva can eat up to 600 aphids during its development.

Because lacewing larvae are active earlier in the season than many other predators, they are often used against early-season pests. Their eggs can be purchased for augmentation biocontrol, or the mobile adults can be encouraged to lay eggs on your property by providing them with floral nectar resources.



Lacewing eggs. Photo by Gerald J. Lenhard, Louisiana State University, Bugwood.org.



Lacewing larva feeding on aphids. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org.



*Orius sp.* feeding on an insect egg. Photo by John Ruberson, Kansas State University, Bugwood.org.

**Minute pirate and other predacious bugs (order Hemiptera)** are related to stink bugs and aphids, and similarly feed using a piercing sucking “beak”, but suck the juices out of pest insects instead of your crops. There are a few species of predacious bugs within this group, which feed mainly on soft-bodied insects like aphids, spider mites, and the eggs of many pest insects. *Anthrenorhis nemoralis* is a European species that has been imported to control pear psylla. *Orius spp.* are native and can be abundant in Wisconsin fruit crops. They are predaceous as both adults and immatures.

A convenient aspect of predacious bugs is that, when prey are not present, they can subsist by feeding on plant juices (although they may feed on your crops, they do not cause any economic damage). This means they can survive even when pest populations are low, and so can maintain pests at a lower density than can many other natural enemies. Because of this tendency to occasionally feed on plant tissue, predatory bugs are extremely susceptible to pyrethroid and other insecticides.

**Predacious flies (order Diptera, families Syrphidae and Cecidomyiidae)** feed mainly on aphids. Syrphids are especially important natural enemies in the fall, since their predaceous larvae thrive in cooler temperatures than many other aphid predators. The larvae are legless and feed using a triple-pointed hook-like mouthpart. The adults look somewhat similar to bees, but with large fly-eyes and only one pair of wings; a common name of the “hoverfly” comes from their ability to hover in place above flowers and when looking for mates. They do not sting. Although syrphids are predaceous only as larvae, the adults are also beneficial in that they serve as excellent pollinators.

Cecidomyiid fly larvae are conspicuously bright orange colored, and also feed on aphids, as well as mites, scale insects, and mealybug eggs. Although only a few species of cecidomyiid fly larvae feed on our pests (the others cause galls in various species of plant), those that do are valuable allies. They feed from June through late summer, and are available commercially for augmentative biocontrol. They are especially



Cecidomyiid fly larva in aphid colony. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org.



Syrphid fly larva feeding on a winged aphid, in characteristic “rearing up” pose. Photo by Merle Shepard, Gerald R. Carner, and P.A.C Ooi, Insects and their Natural Enemies Associated with Vegetables and Soybean in Southeast Asia, Bugwood.org.

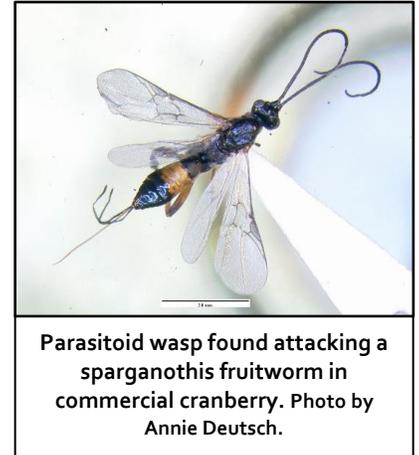
important in conventional farming systems, since they show partial resistance to some broad-spectrum insecticides.

**Parasitoid wasps (order Hymenoptera, families Trichogrammatidae, Ichneumonidae, Braconidae, and more)**, like other parasitoids, develop inside (endoparasitoids) or attached to the outside of their hosts (ectoparasitoids), feeding on the host and thus killing the host before emerging. If you're having visions of the movie *Alien*, that's because the concept for the aliens in that movie was based on the parasitoid life history. Luckily there are no vertebrate parasitoids!

Trichogrammatid wasps are among the smallest parasitoids, generally developing inside the eggs of other insects, often Lepidoptera (moths and butterflies). Historically, they have been used to control codling moth and leafrollers, although results have not been definitively successful. Some challenges to the use of these tiny parasitoids include that they may be generalist feeders, they need to be present in very high numbers to maintain pests below economic levels, and are extremely susceptible to even the softer insecticide chemistries.

The aphelinid wasps are tiny parasitoid wasps often used to control aphids and scale insects. For example, *Aphelinus Mali*, when plentiful, can control populations of wooly apple aphid. Some species of aphelinids are available commercially.

Ichneumonid and braconid wasps are abundant and speciose, with 120,000 known species in the world and probably many others that have not yet been described. Because of this diversity, there is a potential for untapped biocontrol resources in this group. Historically, parasitoid wasps have been known to effectively control fruit pests' populations, especially of Lepidopteran pests, in low- or no-spray situations. However, with the large numbers of pests present in most of our fruit crops, and the greater number of insecticide applications necessary on a yearly basis, parasitoid wasps have ceased to be a regularly important factor in most biocontrol programs. However, with increasing emphasis on IPM programs, it is likely their use will increase in the coming years.



**Parasitoid flies (order Diptera, family Tachinidae)** are all endoparasitoids, feeding entirely inside of their hosts. The over 1,000 species of tachinid flies found in North America often have relatively polyphagous feeding habits, and, between them, can provide biocontrol of pest moths, beetles, sawflies and stink bugs. You may be able to recognize tachinid flies on your pests in two ways: some species lay their white eggs directly onto the body of the pest, and often the fly will pupate nearby to the dead pest carcass. Adult tachinid flies look like bristly houseflies, and are difficult to distinguish without magnification. Further research could help clarify the efficacy of tachinid fly species at controlling our pest populations.

**Predacious mites (Acari subclass, family Phytoseiidae and more)** feed on pest mites, such as spider mites, as well as eggs and immature scale insects, thrips, and other small insects. As a reminder, mites are not insects, they are more closely related to ticks and spiders, but can be significant pests of fruit crops. The many species of predacious mites are, despite their small size, potentially important biocontrol agents in Wisconsin. Some can be purchased for augmentative biocontrol, while many others are naturally occurring and can be conserved by providing habitat and minimizing broad-spectrum insecticides.

**Spiders (order Araneae)** are abundant and diverse predators. Their diet is generally polyphagous, meaning they are likely to feed on not only your pests, but also on beneficial and other insects on your property. Because there are so many species of spiders, they can fit into nearly any natural enemy niche available, feeding on many different pest species, in the canopy as well as at ground level, and throughout the growing season. Some (including jumping spiders and wolf spiders) actively hunt their prey, others (including crab spiders



and lynx spiders) sit and wait for prey to run by, and another group (including orb weavers) catch prey in their webs. Spiders are very sensitive to broad-spectrum insecticides, so reducing insecticide applications is the best way to increase spider populations.

**Pathogens** that attack and control fruit pests include bacteria, viruses and fungi. Many of these are naturally present in the environment, and some are available commercially. These are commonly used in organic agriculture. Many are relatively host-specific, which helps reduce toxicity to beneficials, but also require a good degree of understanding of the pests and agroecosystem to be effective requires an understanding. For example, the commonly used bacterial insecticide *Bacillus thuringiensis* (Bt) offers control against different orders of pest insect depending on the subspecies of Bt is being used – Btk is primarily effective against butterfly and moth caterpillars while Bti is effective against flies. Fungi and viruses are available for many common fruit pests, including codling moth and some species of aphid, thrips, and weevils.

More information about natural enemy species can be found on the following online resources:

Beers, E., J. F. Brunner, M. J. Willett and G. Warner. [Orchard Pest Management Online](#). Washington State University.

Biddinger, D. (2017). [Natural Enemies/Biological Control in Orchards](#). Penn State University Extension.

Dreistadt, S. H. (2014). *Biological Control and Natural Enemies of Invertebrates: Integrated Pest Management for Home Gardeners and Landscape Professionals*. University of California, Davis, Agriculture and Natural Resources.

### 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. The following diseases/disorders have been identified at the PDDC from July 15, 2017 through July 28, 2017.

| <b>PLANT/ SAMPLE TYPE</b> | <b>DISEASE/ DISORDER</b>                         | <b>PATHOGEN</b>   | <b>COUNTY</b>                    |
|---------------------------|--|---|----------------------------------|
| <b>FRUIT CROPS</b>        |  |   |                                  |
| Apple                     | Blister Spot<br><br>Cedar-Apple Rust             | <i>Pseudomonas syringae</i> pv. <u><i>papulans</i></u><br><br><i>Gymnosporangium juniperi-virginianae</i> | Winona (MN)<br><br>Sauk          |
| Apricot                   | Bacterial Canker                                 | <i>Pseudomonas syringae</i>   | Milwaukee                        |
| Blueberry                 | Botrytis Blight<br>Fusicoccum Canker<br>Root Rot | <i>Botrytis</i> sp.<br><i>Fusicoccum</i> sp.<br><i>Pythium</i> sp.  | Washburn<br>Washburn<br>Washburn |
| Cherry                    | Cherry Leaf Spot                                 | <i>Blumeriella jaapii</i>   | Milwaukee                        |
| Rhubarb                   | Root/Crown Rot                                   | <i>Pythium</i> sp.  | Rock                             |
| Strawberry                | Root/Crown Rot                                   | <i>Pythium</i> sp., <i>Fusarium</i> sp.   | Bayfield, Wood                   |

For additional information on plant diseases and their control, visit the PDDC website at [pddc.wisc.edu](http://pddc.wisc.edu). Follow the clinic on Facebook and Twitter @UWPDDC.

## UW Insect Diagnostic Lab—Fruit Insect Report: August 3<sup>rd</sup>, 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:

**Japanese beetles** have been extremely active in many parts of the state and are one of the most significant fruit and landscape pests active at the moment. Other than the far northern parts of the state, Japanese beetle damage has been very common throughout the state on both fruit and landscape plants. Reports from surrounding states indicate that Japanese beetle populations are high in surrounding states as well. Japanese beetle pressure is expected to remain high for the next month or so.

**Spotted Wing Drosophila** reports have been coming into the diagnostic lab recently. Many growers already have a history of this pest and have likely been scouting for and treating to minimize damage, but growers of late season raspberries and blackberries should be especially vigilant.

**Slugs** are problematic in some crops due to ideal (rainy) conditions this year. While slugs generally aren't an issue for tree fruit, crops closer to the ground, such as strawberries, can face issues. With the damp conditions, slug pressure will likely remain elevated for the foreseeable future.

Images of **raspberry cane borer** damage recently arrived at the UW Insect Diagnostic Lab. The damage is often conspicuous with wilted cane tips. Female beetles chew two rings around the cane before depositing eggs; this girdling activity causes the tip of the cane to wilt and sometimes fall off. Pruning out the top few inches of the cane will remove the larva developing inside. Insecticide sprays typically aren't used for this pest as physical controls can be very effective.

**Millipedes** and **springtails** won't damage fruit crops but have been extremely abundant this year due to the rainy conditions. Both of these creatures feed on decaying organic plant matter but occasionally show up in and around fruit plantings. Finding them shouldn't be a concern and simply reflects the damp conditions this year.



Raspberry cane borer adult.  
Photo by Jon Yuschock,  
Bugwood.org.

## Berry Crops

### Blueberry Maggot

By: Christelle Guédot and Janet van Zoeren

The blueberry maggot fly was first detected in Wisconsin in the summer of 2016, and is now considered established in the state. We had reports in the last week from a couple of blueberry plantings that blueberry maggot seem to be present in Dane and Portage counties. Blueberry maggot, which is closely related to the apple pest apple maggot, can become a significant pest of blueberry, as reported for commercial blueberry production in the eastern and southern United States and eastern Canada.

So far in Wisconsin, blueberry maggot has been confirmed in Adams and Sauk counties, now suspected in Dane and Portage counties, and its range is expected to expand in coming years. If you suspect that you have found blueberry maggots, please contact the University of Wisconsin-Madison/Extension Insect Diagnostic Lab at (608) 262-6510, [idl@entomology.wisc.edu](mailto:idl@entomology.wisc.edu) or <http://labs.russell.wisc.edu/insectlab/contact-us/>. We are not formally monitoring the spread of blueberry maggot but will continue to keep you updated of its distribution as it becomes relevant.

We discussed the biology of blueberry maggot in a previous issue of this newsletter that you can access [here](#). Briefly, the larvae develop entirely within a single fruit and damage becomes apparent in mid-July and continues until harvest. Larvae will drop to the ground, pupate in the soil and overwinter there.

**Scouting Suggestions:** Scouting should begin several weeks before blueberries begin to ripen (usually in early June). Commercially available yellow sticky cards, along with a feeding attractant (ammonium acetate or ammonium carbonate), can be placed at a rate of 2 traps per 5 acres. Yellow sticky cards will be most effective if folded in a V-shape with the yellow side facing down (see image at right). These should be checked as often as possible until first detection. Because the feeding attractant is not specific to blueberry maggot, there will be many other species of fly present on the card – for this reason it is important to learn to identify the characteristic wing pattern of blueberry maggot, and may be helpful to bring a hand-lens or magnifying glass into the field when you check traps.



Adult blueberry maggot. Photo by Rufus Issacs, Michigan State



Larva in blueberry. Photo taken from <http://msue.anr.msu.edu>.



Blueberry maggot trap. Photo taken from <http://msue.anr.msu.edu>.

Following first detection, if you would like to continue to scout, yellow sticky cards can be removed and replaced with green sticky sphere traps combined with a synthetic fruit-volatile lure. You can also test the fruit directly for infestation rates. To do so, collect approximately 100 berries from throughout your planting, and then spread the berries on a screen above a tray of sand. After four or more hours, you can strain through the sand to find the mature larvae or pupae that have dropped down from the berries. Alternatively, you can mix the berries with a salt-water solution, which causes maggots to float out of the berries.

**Control:** Some cultural control methods can help prevent blueberry maggot infestations. These include:

- Removing weeds in the blueberry patch, as these can provide habitat for blueberry maggot.
- Removing wild blueberry and huckleberry alternate-host refuges near your plantings.
- Harvesting thoroughly, and solarizing or freezing any damaged or unsalable fruit. Never compost crop waste without first solarizing it, as blueberry maggot pupae can survive in the compost and infest crops in future years.
- Being careful to clean soil away from any equipment or honeybee hives that are moved between blueberry farms, so as not to introduce blueberry maggot pupae in the soil.

Chemical control is recommended if you find on average more than one blueberry maggot adult per trap for several days in a row. In general, spraying should begin about a week after the first blueberry maggot flies appear in your traps, and should continue every 7 to 10 days through harvest. Some of the reduced-risk chemistries, such as Rimon, Delegate, and Entrust, are most effective when used as soon as flies are found in the traps.

Because you will need to spray while berries are ripe, it is especially important to pay attention to the pre-harvest interval when choosing which chemistry to use. Additionally, it may be beneficial to choose an insecticide that also shows efficacy against spotted wing drosophila. As always, it is recommended to rotate IRAC chemical classes to delay insecticide resistance, and to consider the effects on non-target and beneficial insects.

The following insecticides are registered for use in blueberries in Wisconsin. The list is not inclusive of all chemistries that can be used against blueberry maggot, and does not signify that we recommend these insecticides above others. As always, be sure to read and follow label directions for the most up-to-date legal requirements and recommendations.

Effectiveness codes are for blueberry maggot (BM) and spotted wing drosophila (SWD), and are designated as “excellent”, “good”, or “poor” levels of control.

| Class (IRAC code)             | Tradename          | Active ingredient | PHI (days) | Effectiveness (BM and SWD)        | Optimal Spray Timing                                    |
|-------------------------------|--------------------|-------------------|------------|-----------------------------------|---|
| Spinosyns (5)                 | Delegate WG (RR)   | Spinetoram        | 3          | BM – Good<br>SWD – Excellent      | <b>Immediately following</b> first adult fly trap-catch |
|                               | Entrust (OMRI, RR) | Spinosad          | 3          | BM – Good<br>SWD – Excellent      | <b>Immediately following</b> first adult fly trap-catch |
| Diamides (28)                 | Exirel (RR)        | Cyantraniliprole  | 3          | BM – Good<br>SWD – Excellent      | <b>Seven days after</b> first adult fly trap-catch      |
| Benzoylureas (15)             | Rimon EC (RR)      | Novaluron         | 8          | BM – Good<br>SWD – Poor           | <b>Immediately following</b> first adult fly trap-catch |
| Organo-phosphate (1A)         | Imidan W           | Phosmet           | 3          | BM – Excellent<br>SWD – Excellent | <b>Seven days after</b> first adult fly trap-catch      |
| Carbamate (1B)                | Sevin XLR Plus     | Carbaryl          | 7          | BM – Good<br>SWD – Excellent      | <b>Seven days after</b> first adult fly trap-catch      |
| Pyrethroids / Pyrethrins (3A) | Danitol 2.4EC      | Fenpropathrin     | 3          | BM – Good<br>SWD – Excellent      | <b>Seven days after</b> first adult fly trap-catch.     |
|                               | Mustang Maxx EC    | zeta-Cypermethrin | 1          | BM – Good<br>SWD – Excellent      | <b>Seven days after</b> first adult fly trap-catch      |
|                               | Asana XL           | Esfenvalerate     | 14         | BM – Good<br>SWD – Good           | <b>Seven days after</b> first adult fly trap-catch      |
| Neonicotinoids                | Actara             | Thiamethoxam      | 3          | BM – Good<br>SWD – Poor           | <b>Seven days after</b> first adult fly trap-catch      |
|                               | Assail SG          | Acetamiprid       | 1          | BM – Good<br>SWD – Poor           | <b>Seven days after</b> first adult fly trap-catch      |

**OMRI** indicates registered by the Organics Material Review Institute as organic certified

**RR** indicates reduced-risk chemistry

## Nematode diseases of berry crops

By: Sara Thomas-Sharma and Patricia McManus

### About the pathogen:

Nematodes are microscopic, slender, worm-like organisms that are ubiquitous in the soil. Most nematodes are beneficial or harmless, but some are plant parasites. Nematodes are present as eggs, juveniles, and adults, in soil or plants. They prefer sandy soils and higher numbers are detected in summer. Since nematodes do not move much in undisturbed soils, infected plants often are found in groups or patches in the field. Movement of infested planting material and soil can cause long-distance spread of nematodes. Damage by nematodes is caused by:

- Direct feeding on roots, thereby reducing plant vigor and yield
- Predisposing plants to other pathogens (causing 'disease complexes')
- Weakening plants, thereby making them prone to environmental stresses
- Spreading plant viruses

### Dagger nematode in raspberry

Dagger nematodes can directly damage raspberry plants by feeding on the roots. The nematode also transmits *Tomato ringspot virus* (ToRSV).

**Symptoms:** Root feeding by dagger nematode can cause galling on roots with characteristic 'fish hooking' symptoms. In plantings with significant nematode infestation, stunting of the root system can cause poor cane growth. ToRSV results in small, crumbly raspberries and is particularly problematic in red raspberries. Leaves may or may not show viral symptoms such as yellow lines/rings. Note, however, that poor pollination and/or hot weather can also lead to small, crumbly berries.

**Management:** Since nematodes survive in the soil for a long time, red raspberries should not be planted in sites known to have ToRSV. Prior to planting, test soil for nematodes to determine if there are high populations of pathogenic species. Samples can be sent to the UW nematode diagnostic lab. Information on collection, handling, submitting soil samples and fees is available at <http://labs.russell.wisc.edu/uw-nematode-diagnostic-lab/>. Pre-plant fumigation of fields with a history of nematodes can reduce nematode populations. *Brassica* spp. (indian mustard, broccoli, cabbage, raddish, kale, cauliflower) produce compounds inhibitory to nematodes and can be used as a biofumigant by growing these crops, and burying them into the soil. Encouraging good plant health by optimum plant nutrition can increase the resistance of plants to nematodes. Increasing organic matter encourages beneficial nematodes in the soil.

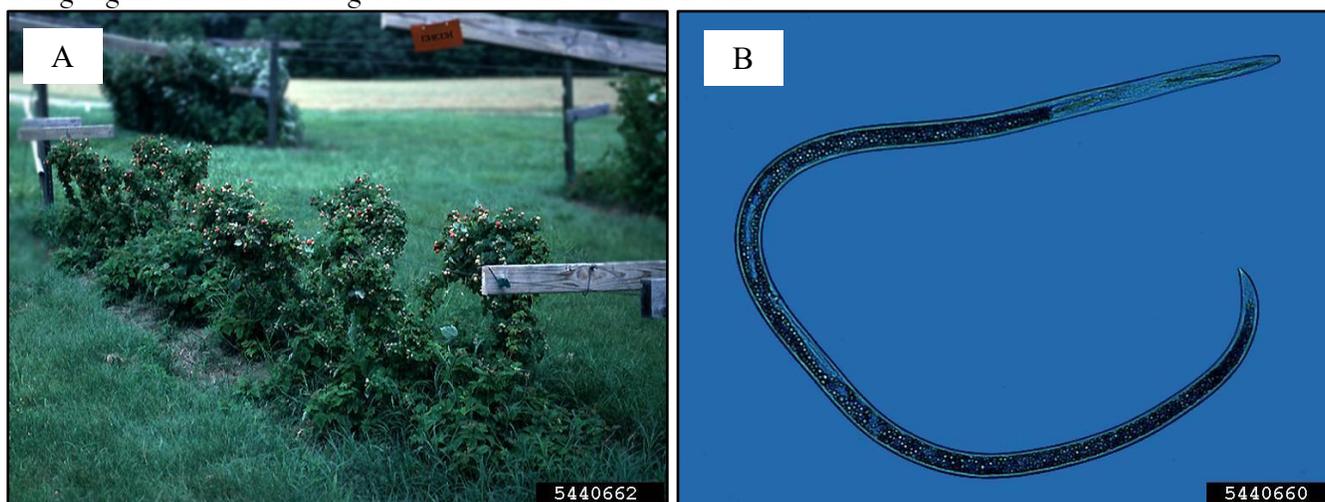


Figure 1: Raspberry plants with the nematode vectored ring spot virus (A) and dagger nematode the virus-vector (B). Photos by Jonathan D. Eisenback, Virginia Polytechnic Institute and State University, Bugwood.org.

### ***Nematodes on strawberry***

Root knot, dagger, and sting nematodes are occasionally problems in strawberry fields in Wisconsin. These nematodes cause damage by root feeding, and can contribute to the black root rot disease complex. Foliar nematodes (*Aphelenchoides* spp.) can damage strawberry leaves (Fig. 2). Foliar nematodes can spread by water splash during rain/irrigation and through infected planting material. Identification of nematode species and populations are key to management.



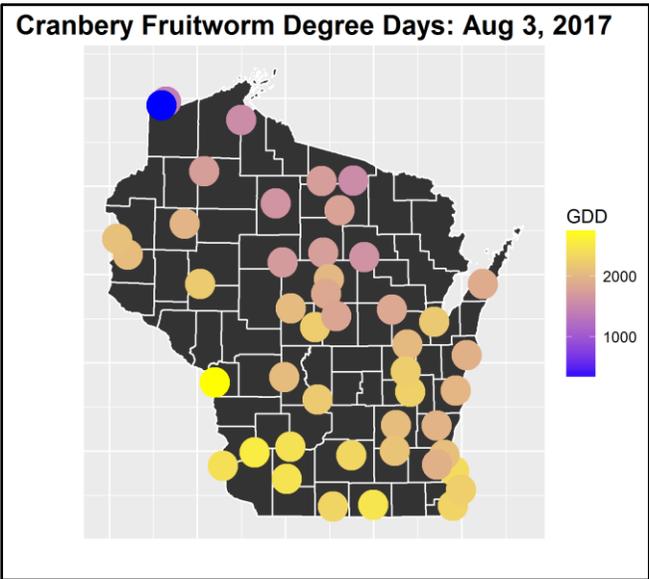
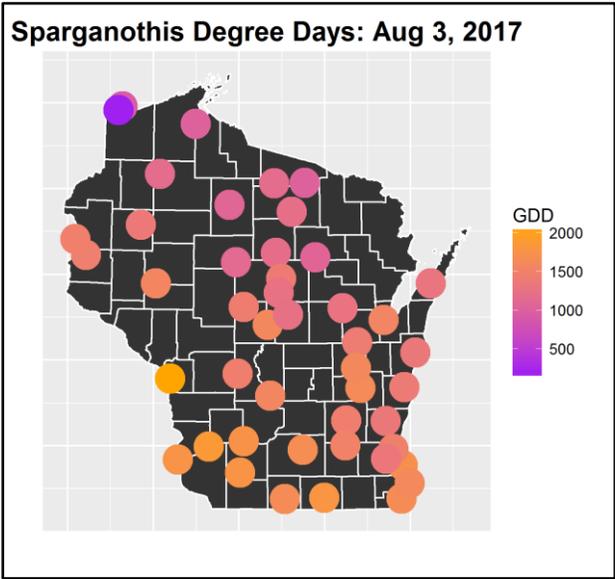
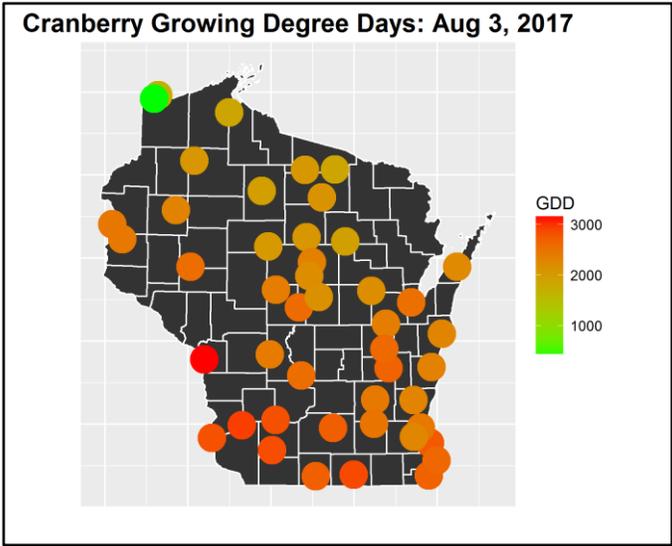
**Figure 2: symptoms of foliar nematode in strawberry.** Photo by Penn State Department of Plant Pathology & Environmental Microbiology Archives, Penn State University, Bugwood.org.

## **Cranberries**

### **Cranberry plant and pest degree-days: Aug 3, 2017**

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

See the maps below for the degree-days of the cranberry plant and associated pests. 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. 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.



August 3      Cranberry DDs      Sparg DDs      CFW DDs

|                               | 2015   | 2016   | 2017   | 2015   | 2016   | 2017   | 2015   | 2016   | 2017   |
|-------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Northern WI (Minocqua)        | 2154.1 | 2238.7 | 2063   | 1252.9 | 1345.2 | 1183.3 | 1832.4 | 1920.9 | 1748.1 |
| Central WI (Wisconsin Rapids) | 2665.8 | 2728.3 | 2587.6 | 1665.3 | 1739   | 1608.9 | 2314.6 | 2375.1 | 2241   |

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

The table at right 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

## Exploration into Canopy Management Practices to Improve Grape Qualities

By: Jacob Scharfetter, Jean Riesterer-Loper, & Amaya Atucha, Department of Horticulture, UW-Madison

Grape qualities, such as sugars, acids, and pigment compounds, are vital aspects that determine flavor and color of grapes. At the UW-Madison viticulture lab we have been exploring different canopy management practices with the intent to understand and improve grape fruit qualities (Fig 1 and 2). Specifically, we have been investigating the impact of shoot basal leaf removal on grape fruit quality. The practice of leaf removal opens the canopy increasing the exposure of the berry clusters to sunlight and airflow. There are many benefits of leaf removal around the cluster zone, such as reduced disease pressure (resulting from the increased airflow, which allows faster drying of clusters), increased spray coverage and efficacy, and improved fruit quality (i.e. increased sugars and lower acids).

### **Background to leaf removal**

Leaf removal can be conducted manually or mechanically. Not all leaves within the fruiting zone have to be removed. In fact, it is best to retain some of the leaves so that 60-80% of the fruit is visible. Roughly removing 1-3 leaves per shoot around the cluster zone can be enough to open the canopy and expose the fruit. The number of leaves removed per shoot will vary for each cultivar, and will depend on leaf size. For example, 'Brianna' may only need one leaf to open up the fruiting zone while the smaller leaved 'Marquette' may need 3 leaves removed to open up the fruiting zone.

Key to the practice of leaf removal is the temporal component. The practice of leaf removal can be conducted any time between fruit set and véraison. If leaf removal occurs too early in berry development, i.e. during bloom or earlier, it can cause a reduction in the carbohydrate levels and could potentially affect fruit set. These carbohydrates are vital to proper fruit set as well as initial berry growth. Thus, leaf removal too early fosters the greater risk for decreased berry yields. Additionally, leaf removal late in the season, past véraison, can cause detrimental effects. One detrimental effect is the increased susceptibility to berry sunburn, as grapes grown in shaded canopies tend to have thinner skins than those grown in the outside of the canopy. Secondly, leaf removal past véraison is not as effective in improving fruit quality when compared to leaf removal at berry set. Recent research conducted on northern *Vitis vinifera* grapes as well as cold-hardy grapes, suggests that the best time to leaf pull is after berry-set, close to the pea-sized stage in berry development.



Figure 1: Leaf removal cluster zone on 'Marquette' after fruit set at the WMARS research vineyard during the second week of July. Pictures were taken three weeks after leaf removal was performed. Picture on the left shows vine after leaf removal and picture on the right shows vines that did not have leaves removed.



Figure 2: Leaf removal cluster zone directly after fruit set at the WMARS research vineyard. Pictures were taken in late June. The dashed oval on the left indicates the shaded treatment and the un-dashed oval on the right.

### Effect of leaf pulling on grape qualities

Our research group has worked in the past 2 years on a research project evaluating the effect of basal leaf removal on fruit chemical composition of cold hardy hybrid grapes in Wisconsin. One of the most significant effects of leaf removal has been the reduction of titratable acidity (TA) levels of fruit in the leaf removal treatment. The graphs of ‘LaCrescent’ and ‘Frontenac’ grape acidity below both show a significant reduction in TA level in both years for berry clusters exposed to more sunlight, after leaf removal, compared to those that were in the treatment without leaf removal (Fig. 3 and 4). This trend in the reduction of acidity based upon leaf removal treatments is seen across all of the cold hardy grape cultivars and for both growing seasons.

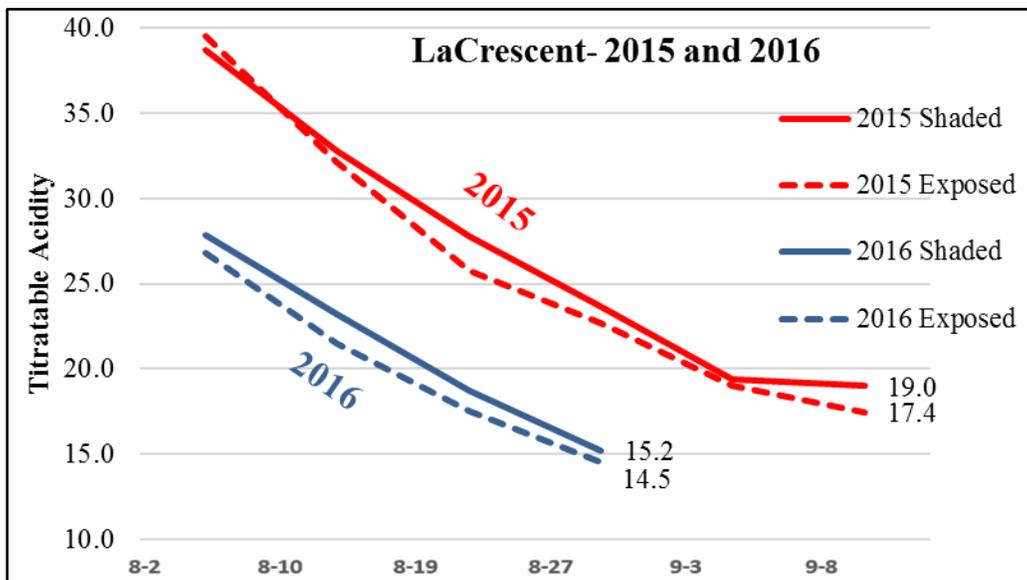
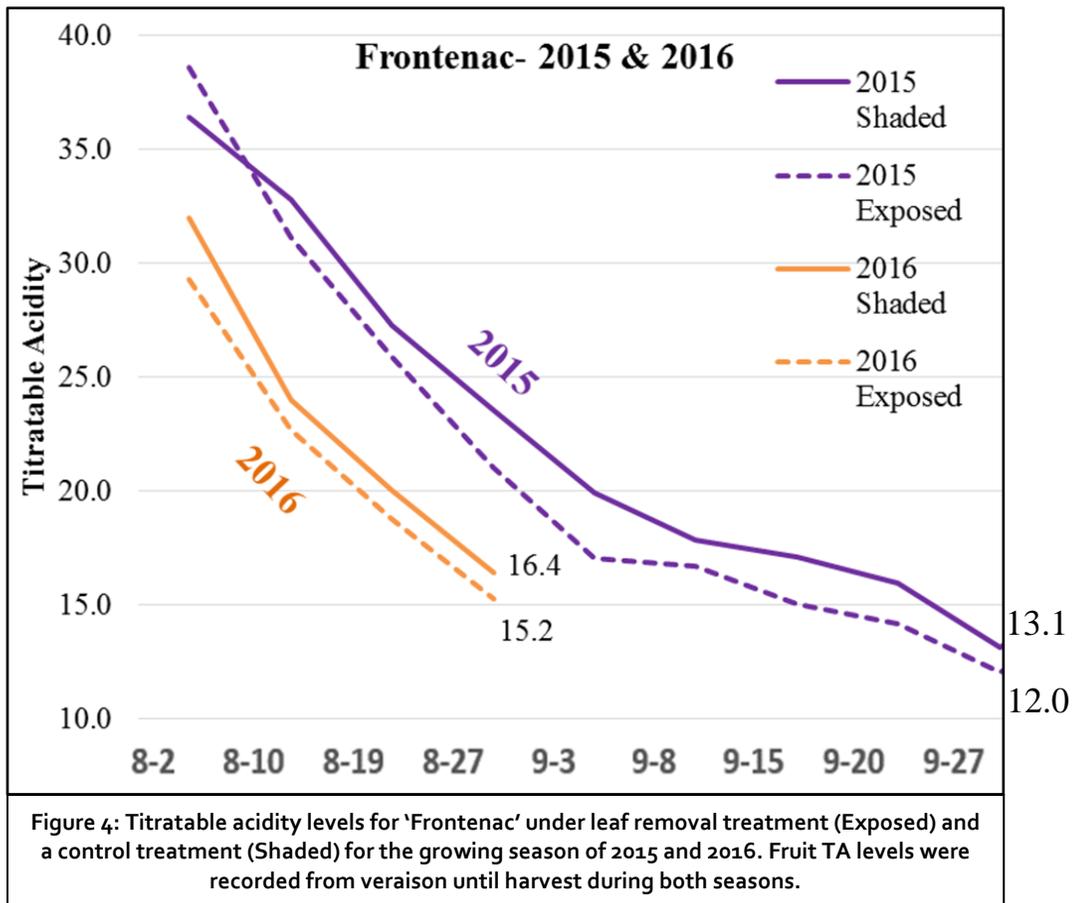


Figure 3: Titratable acidity levels for ‘LaCrescent’ under a leaf removal treatment (Exposed) and a control treatment (Shaded) for the growing season of 2015 and 2016. Fruit TA levels were recorded from véraison until harvest during both seasons.



The large difference between 2015 and 2016 titratable acidity comes from the two very different growing seasons the grapes experienced, with 2015 having a much slower/cooler growing season than 2016. However, despite the environmental factors, a reduction is seen in titratable acidity when comparing the control (shaded) and the leaf removal (exposed) treatments regardless of the year.

Interestingly, for most cultivars, Brix and pH did not differ between grape clusters that were shaded or exposed to more sunlight. Our lab will further explore the effect of leaf removal on other chemical compounds involved in fruit quality, such as sugars, color forming anthocyanins, and phenolic compounds that contribute to the astringency found in wines. Overall, our research has demonstrated positive effects from cluster zone leaf removal on fruit quality traits of cold hardy hybrid grapes.

### Wine and Table Grape Developmental Stages for Aug 4, 2017

By: Janet van Zoeren, Annie Deutsch, Jean Riesterer-Ioper, Jacob Scharfetter and Amaya Atucha

At the West Madison Agricultural Research Station (WMARS) development has really slowed down with the cooler, wet weather we've been having. Some cultivars are beginning to reach veraison, but overall little change in developmental stage has taken place over the past two weeks. Berries continue to vary by cultivar from stage E-L\* developmental number 32 ("berries touching") to 35 ("berries begin to color and enlarge (beginning of veraison)"). At the Peninsular Agricultural Research Station (PARS), the slower varieties have caught up, and all vines are at E-L\* developmental number 33 ("bunch closure, berries still hard and green").

\* Eichhorn-Lorenz Phenological stages to describe grapevine development

Following photos taken on July 31<sup>st</sup> at West Madison Agricultural Research Station.



Brianna at WMARS;  
"berries begin to color"  
E-L number = 35



La Crescent at WMARS;  
"bunch closure" E-L  
number = 33



La Crosse at WMARS;  
"bunch closure"  
E-L number = 33



Marquette at WMARS;  
"berries begin to color"  
E-L number = 35



Frontenac at WMARS;  
"berries begin to  
soften" E-L number = 34



St. Croix at WMARS;  
"bunch closure"  
E-L number = 33



Somerset at WMARS; "berries  
begin to color" E-L number = 35



Einset at WMARS; "bunch  
closure" E-L number = 33

Following photos taken on Aug 2<sup>nd</sup> at Peninsular Agricultural Research Station.



Brianna at WMARS;  
"bunch closure" E-L  
number = 33



La Crescent at WMARS;  
"bunch closure" E-L  
number = 33



La Crosse at WMARS;  
"bunch closure"  
E-L number = 33



Marquette at WMARS;  
"bunch closure" E-L  
number = 33



Frontenac at WMARS;  
"bunch closure" E-L  
number = 33



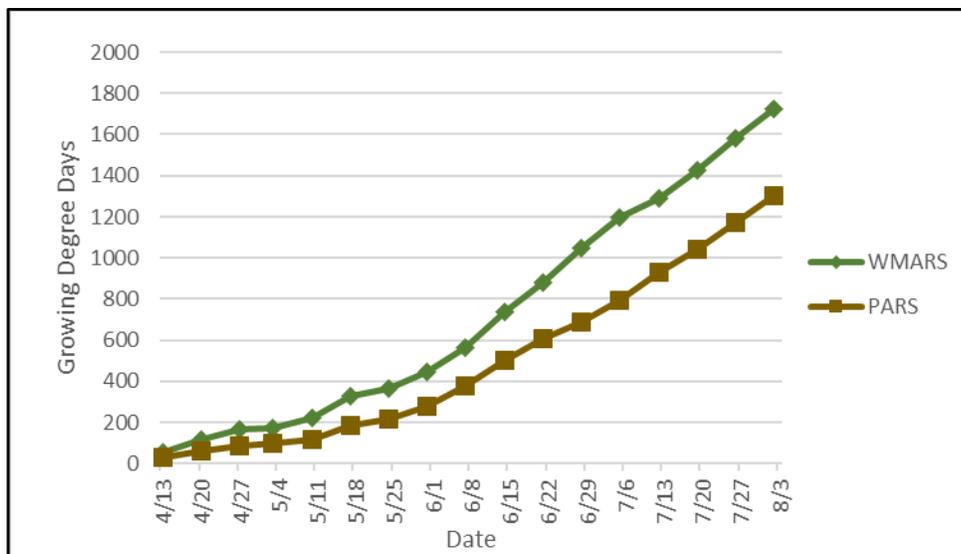
St. Croix at WMARS;  
"bunch closure" E-L  
number = 33

### Grape Growing Degree Days

April 1 - Aug 2, 2017

|              | 2107 | 2016 |
|--------------|------|------|
| <b>WMARS</b> | 1722 | 1838 |
| <b>PARS</b>  | 1304 | 1368 |

The growing degree-day accumulations as of August 2<sup>nd</sup> for this year are: 1,722 GDD at WMARS and 1,304 GDD at PARS. Door County continues to be around three weeks behind Dane County in terms of growing degree-days. At both locations, we continue to fall behind the degree-day accumulation from this date last year. Degree-days are calculated using a base of 50°F, starting on April 1<sup>st</sup> as a biofix.



## Tree Fruits

### Preharvest bitter pit prediction in Honeycrisp

Bitter Pit prevalence in Honeycrisp is a familiar concern in Wisconsin apple production. In fact, in the previous issue of this newsletter we published an article on a [“Comparison of Calcium products to control Bitter Pit in ‘Honeycrisp’ apples”](#). Of course, other states are having the same concerns as we are, and an excellent article was published in the Penn State University Extension tree fruit production newsletter on July 28<sup>th</sup>, entitled [“Preharvest Assessment of the Potential for Bitter Pit in Honeycrisp”](#).

In summary, the authors, Rich Marini and Tara Baugher, describe their recent finding that incidence of bitter pit can be related to a combination of terminal shoot length and the ratio of nitrogen to calcium in apple fruit peel. Specifically, they found that trees with longer shoot length and higher nitrogen to calcium ratio in fruit peel had greater incidence of bitter pit. This has implications both for predicting the extent of bitter pit in your orchard blocks before harvest, and proposes a multi-faceted approach for controlling bitter pit: by decreasing the ratio of N to Ca and limiting shoot growth.

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### Apple maturity index report – Aug 4<sup>th</sup> 2017

*By: Janet van Zoeren and Amaya Atucha*

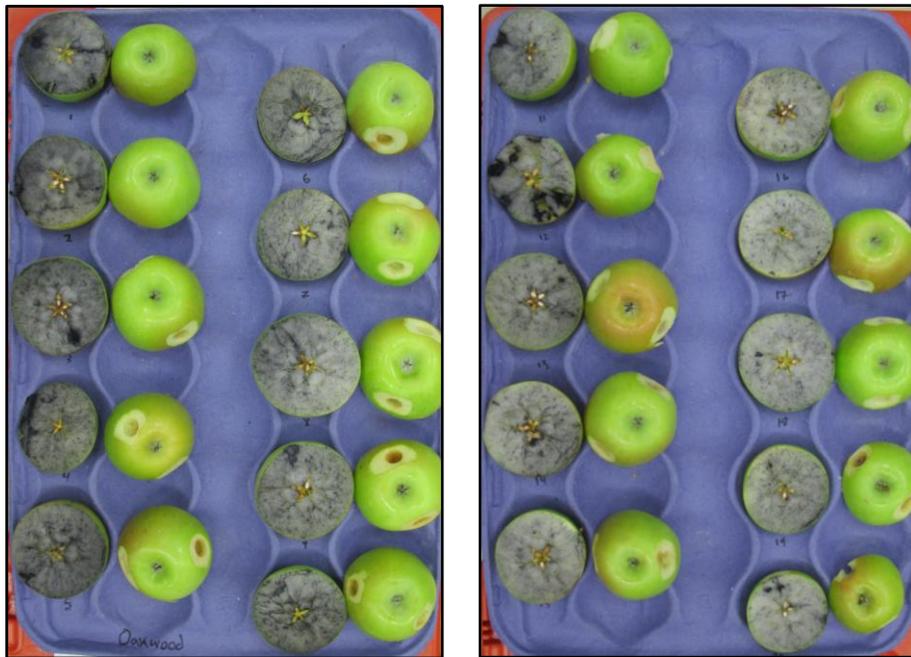
This week we collected our first samples to assess apple maturity in ‘Honeycrisp’, which we will be evaluating and reporting through apple harvest. The maturity indices we are evaluating to determine the optimal harvest period for this

cultivar include seed coloration, flesh firmness, soluble solids, and the starch pattern. In brief, as an apple matures, the seeds turn brown, flesh becomes softer, sugar content increases, and starch is converted to sugar in a predictable pattern; by measuring some or all of these traits you can quantify the optimal harvest date for your crop. To read more about apple maturity indices, please read the article we published about this subject last fall in this newsletter, [Volume 1, issue 12](#).

This week, we measured Honeycrisp variety apples at Oakwood Fruit Farm in Richland Center (Richland County), and at Eplegaarden in Fitchburg (Dane County).

In Richland County, flesh firmness ranged from 9.1 to 11.1 (lbs) and soluble solids ranged from 8.0 to 10.1. In Dane County, flesh firmness ranged from 9.4 to 12.4 and soluble solids ranged from 7.1 to 9.9. All apples have so far retained all their starch (giving them a rating of 1), and all their seeds are still entirely white. As expected, Honeycrisp have not yet begun to mature in Wisconsin. When we report next in two weeks we expect to begin to see some changes in these values. We will also add data from Door County when those apples begin to near maturity.

**Iodine starch staining pattern: Honeycrisp in Richland Center**

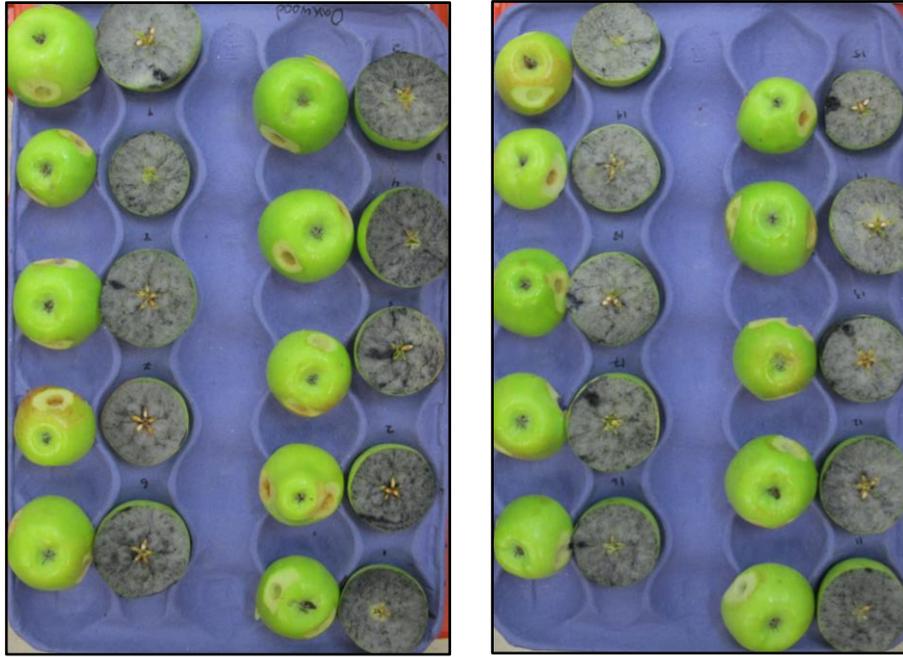


**Apple Maturity Indices for Richland Center**

Aug 3, 2017

|         | Weight (g) | Firmness (lbs) | Soluble solids (%) | Seed color | Starch Index |
|---------|------------|----------------|--------------------|------------|--------------|
| Average | 115        | 10.0           | 9.0                | 0          | 1            |
| Range   | 79 - 157   | 9.1 - 11.1     | 8.0 - 10.1         | 0          | 1            |

## Iodine starch staining pattern: Honeycrisp in Fitchburg



Aug 3, 2017

### Apple Maturity Indices for Fitchburg

|         | Weight (g) | Firmness (lbs) | Soluble solids (%) | Seed color | Starch Index |
|---------|------------|----------------|--------------------|------------|--------------|
| Average | 113        | 10.0           | 8.0                | 0          | 1            |
| Range   | 75 – 168   | 9.4 – 12.4     | 7.1 – 9.9          | 0          | 1            |

## Calendar of Events

**Aug 9, 2017** – Cranberry field day  
Cranberry Discovery Center, 204 Main Street, Warrens, WI

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If you have any questions or comments about the Wisconsin Fruit News issues, please contact Janet van Zoeren: vanzoeren@wisc.edu.