Wisconsin Fruit News

Volume 1 Issue 3– May 13, 2016

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General Information

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 April 30, 2016 through May 6, 2016.

PLANT/SAMPLE TYPE	DISEASE/ DISORDER	PATHOGEN	COUNTY
NEEDLED WOODY ORNAMENTALS			
Juniper	*"Cedar-Apple" Rust*	*Gymnosporangium sp.*	*Milwaukee*

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

Cedar-apple rust on an apple leaf.

Strawberry Angular Leaf Spot

By: Patricia McManus

Angular leaf spot is a sporadic but potentially serious disease of strawberry in Wisconsin. Our relatively cool climate, especially nighttime temperatures near freezing, is conducive to disease development. Angular leaf spot is caused by a bacterium (*Xanthomonas fragariae*), which distinguishes it from other strawberry diseases in Wisconsin, most of which are caused by fungi. As such, angular leaf spot cannot be controlled with the fungicides commonly used on other leaf diseases. Accurate identification of angular leaf spot is important so that appropriate control measures can be taken.

Identifying angular leaf spot

As the name implies, angular leaf spot affects leaves, which leads to decreased plant vigor. However, direct yield losses occur when the infected calyx (leafy fruit cap) becomes black and dry or when peduncles (fruit stems) are diseased. Symptoms vary depending on how long the disease has been developing and on weather conditions. Anecdotal evidence suggests that symptoms also vary among cultivars (e.g., certain cultivars may be more prone to calyx rather than leaf infection), but this has not been well documented.

Figure 1. Angular leaf spot symptoms on lower leaf surface viewed with incident light (left and center) and held up to light (right).

Figure 2. At late stages, angular leaf spot resembles other leaf diseases.

Leaf spots first appear on the lower surfaces of leaves as tiny, water-soaked lesions that are delimited by veins (Figure 1). The angular spots appear yellow to pale green and translucent when held up to light, but dark green and opaque when viewed from above. Under wet conditions, a slimy white film, which consists of masses of bacteria, oozes from the spots. Upon drying, this film becomes scaly and can easily be scraped from the leaves. As the disease progresses, spots become more numerous, merge, and become visible on the upper surfaces of leaves as reddish-brown dead areas (Figure 2). The edges of leaves may appear ragged as dead tissue breaks off. At such advanced stages, angular leaf spot is difficult to distinguish from fungal leaf-spotting diseases (e.g., leaf blight, leaf scorch, and common leaf spot). Therefore, it is important to scout for angular leaf spot when leaves still look healthy. Be sure to look at the undersides of leaves to detect symptoms at their earliest stages.

Figure 3. Symptoms on calyx tissue make berries unmarketable.

An infected calyx initially appears dark green, water-soaked, and limp, but then it quickly dries and turns black (Figure 3). Usually if the calyx is diseased, the peduncles will also be dark and wilted. Usually the berry flesh is not affected, but the blackened calyx makes the fruit unmarketable. *X. fragariae* can become systemic, affecting vascular tissue in all parts of the plant including the crown and roots. Severe infection of the crown can cause sudden wilting and collapse of the plant, although this is not a common occurrence in Wisconsin.

Disease origins and spread

X. fragariae is introduced into commercial plantings on infected but healthy-appearing plants. While most nurseries take measures to control angular leaf spot, they often cannot eliminate the pathogen. In established plantings where angular leaf spot has occurred, the pathogen can overwinter in infected leaf debris and persist in plant crowns. *X. fragariae* apparently does not survive on plants other than strawberry. Disease development is highly dependent on the environment, although the precise conditions required for angular leaf spot are not known. Angular leaf spot is favored by cool to moderate daytime temperatures (65-70 °F), cold nighttime temperatures (near freezing), high relative humidity, and wet conditions brought on by rain, irrigation, or heavy dew. In Wisconsin these conditions are very common during May, coinciding with the development of vigorously growing tissues that are highly susceptible to angular leaf spot. Nevertheless, this disease sometimes is absent or goes unnoticed early in the season but then quickly develops after rainy periods later in the summer, especially on new growth after renovation.

After symptoms develop, bacteria in a slimy white matrix ooze from stomata (breathing pores on leaves) onto the leaf surface. From there the bacteria are easily splashed about the planting by rain or irrigation water. The bacteria-laden slime can also get carried across a field on equipment or feet. *X. fragariae* infects strawberry tissues through stomata and perhaps hydathodes (small openings on the margins of leaves) and tiny wounds caused by abrasion from blowing sand.

Control

As with any disease of strawberry, control begins before you put the plants in the ground. Bacterial diseases, however, are notoriously difficult to control. Unlike fungal diseases for which there are many effective fungicides, angular leaf spot is difficult to control by spraying. Nevertheless, there are things you can do to minimize losses from angular leaf spot.

- **Site.** Choose well-drained sites with good air circulation and exposure to sunshine. This will minimize the time that plants are wet and should reduce the incidence and severity of all diseases.
- **Rotation.** Because *X. fragariae* survives in leaf debris, do not establish a new planting in soil containing old strawberry leaves, especially where there is a past history of angular leaf spot. If you are on a 3- to 4-year rotation with other crops, this should not be a problem because once leaf debris decomposes, the pathogen cannot survive in the soil.
- **Weed control.** Control weeds and maintain alleys between rows to improve air circulation.
- **Nitrogen.** Use nitrogen fertilizers sparingly. The soft, succulent tissues that result after heavy nitrogen application are especially susceptible to angular leaf spot.
- **Copper.** Copper-based fungicides (e.g., Champ, Kocide, COCS) and newer copper-based products (e.g., BadgeX2, Cueva, Magna-Bon) have shown various levels of control in trials. These may help prevent infection of new tissues when the pathogen is splashed about, but they will not control growth of bacteria that are already inside plants. To prevent new infection, copper-based products should be applied as early in the spring as permitted on product labels, when plants are rapidly growing. The main purpose of springtime sprays is to prevent infection of the calyx, which can make fruit unmarketable. When re-growth occurs after renovation, the benefits of copper are questionable. At this point the weather is usually not favorable for angular leaf spot, and it's not clear that leaf injury from angular leaf spot is economically important. Unfortunately, copper can be toxic to strawberry leaves after 4 to 5 applications. If this occurs, quit using it—the risks outweigh the benefits at this point.
- **"Soft" chemistries.** Copper-based products are the most-tested for angular leaf spot control. However, in trials in Florida, the plant resistance activator Actigard has shown some efficacy. In one report from Michigan where disease pressure was low, Regalia, Serenade Optimum, and Double Nickel controlled angular leaf spot. I am not comfortable recommending these products, however, because very little research data has been reported.
- **Cultivars.** Unfortunately, cultivars highly resistant to angular leaf spot are not commercially available. The most popular cultivars in Wisconsin, including Annapolis, Cavendish, Honeoye, Jewel, Kent, Sable, and Winona, are all highly susceptible. Tristar has shown tolerance (gets symptoms but without much impact on the plant) to angular leaf spot in Wisconsin.

Is aronia susceptible to spotted wing drosophila?

By: Katie Hietala-Henschell, Emma Pelton and Christelle Guédot – University of Wisconsin-Madison, Department of Entomology

Spotted wing drosophila (SWD) is a major invasive pest of soft skinned fruit worldwide. This pest has been reported to infest several cultivated fruit crops including blackberry, raspberry, blueberry, cherry, peach, grape, and strawberry and many native and non-native wild hosts including buckthorn, currant, elderberry, honeysuckle, mulberry, bittersweet nightshade, and autumn olive. Since SWD is a generalist of soft skinned fruits there is a need to identify all susceptible fruit species. The susceptibility of aronia (*Aronia melanocarpa*), a growing specialty crop, is unclear. Aronia is a woody shrub native to the U.S. that produces dark purple fruits (Figure 1). Aronia is expanding as a new specialty crop in the Midwest due to its potential as a high value crop, low pest pressure, cold hardiness and low cultivation requirements. It is currently marketed in specialty health food products and the health benefits are associated with prevention of hypertension and type 2 diabetes.

Figure 1: Ripening aronia berries in Wisconsin

Currently, little information is available on the susceptibility of aronia crops to SWD. Identifying all hosts that meet SWD requirements will provide information to better understand population dynamics (e.g. at risk crops, early/late season activity, population peaks) and improve management. In 2014 and 2015 we conducted a research study aimed at determining the susceptibility of aronia berries to SWD in the laboratory, to monitor adult SWD field populations using yeast-sugar traps (Figure 2), and to assess field larval infestation.

No-choice tests conducted in the lab suggest that SWD can utilize aronia as a host if the berry is damaged or destemmed but not if the berry is intact. In these tests, more SWD larvae were present and more adults emerged per fruit in raspberry than aronia. Aronia is a firm fruit which may provide a physical deterrent to SWD, making oviposition unlikely in healthy intact fruit. In several other crop hosts, lower SWD oviposition rates were observed on more firm fruits. However if fruit is damaged, physical characteristics such as firmness might not affect oviposition. Fruit damage from other pests and cracked berry skin are often present in the field which may in turn increase SWD infestations.

Our data suggests that aronia is a lesser quality host than raspberry. SWD completed its life cycle (from egg to adult) faster on raspberry, averaging around 13 days, than in aronia, which averaged around 18 days. No larvae were found in undamaged aronia, compared to almost 50 larvae per fruit in raspberry. Furthermore, SWD adults emerging from raspberry were larger than SWD adults that emerged from previously damaged aronia. The slower development of adults and the emergence of smaller adults suggest that aronia is a suboptimal host to SWD.

Figure 2. Yeast-sugar trap hanging in fruiting area of aronia shrub to monitor spotted wing drosophila populations.

During our adult field trapping, the first detection in aronia occurred the first week of July with a total of six flies. SWD was present at all three farms from July 6th through September 21st, 2015. Peak trap catch was the last week of trapping on September 21st (Figure 3) after aronia was machine harvested. The high trap catch numbers post-harvest are possibly due to the presence of damaged aronia which would increase access for oviposition. High trap catch, post-harvest, could also be due to the presence of ripening hosts nearby. Surrounding crops can influence trap catch as SWD is a mobile insect that utilizes different hosts based on availability. Alternative host use was further supported when we randomly collected aronia fruit to assess larval infestations over three separate weeks. A total of three drosophila larvae were collected. The drosophila larvae were detected from fruit collected on August 31st (Figure 3). The small numbers of spotted wing drosophila larvae found suggests that aronia serves as a low-risk susceptible crop and that the number of adults caught in traps is not a predictor of larval infestations.

Collectively our data suggests that intact unwounded aronia berries are unsuitable hosts for SWD; however, SWD can complete its life cycle within aronia berries. This successful use of aronia potentially provides a source for late season build up or serves as an in-between host until more preferable hosts are available, increasing their risk of infestation.

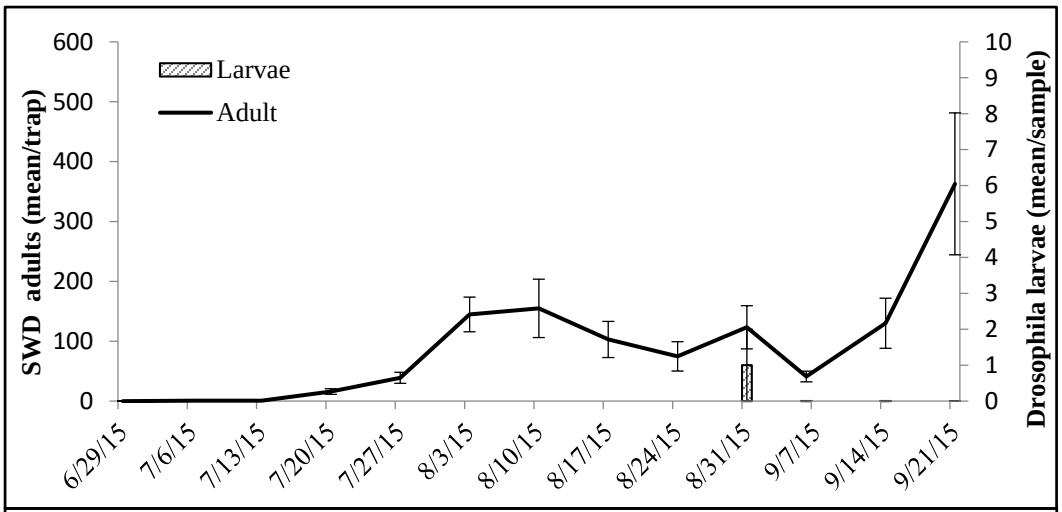


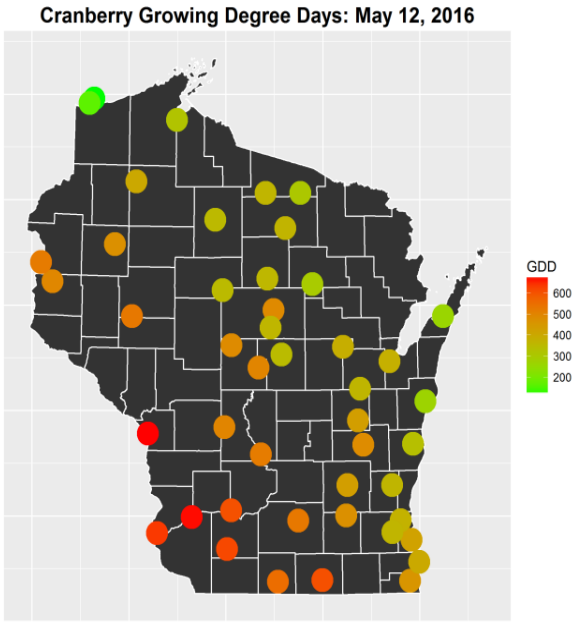
Figure 3. Mean number of SWD adults caught per trap and mean number of larvae/fruit sample from June-September 2015 in aronia crops in Southern Wisconsin.

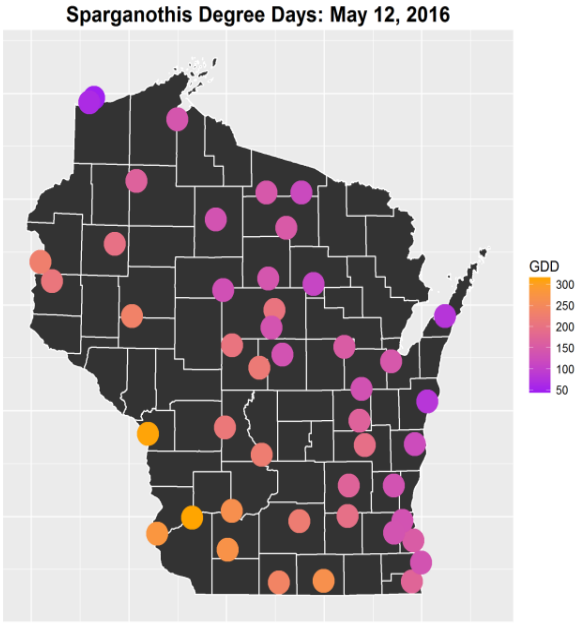
Cranberries

Cranberry Degree-Day Map and Update

Elissa Chasen and Shawn Steffan – USDA-ARS and UW Entomology

The maps below show degree day accumulations for cranberry plants and *Sparganothis* fruitworm across Wisconsin up through May 12, 2016. The weather data used for these degree day accumulations are retrieved from public weather stations and can vary from the degree-day accumulations specific to your marsh. Throughout WI, plant degree-days ranged from a low accumulation of 123 DD to a high of 666 DD, while Sparganothis degree-days ranged from a low of 50 DD to a high of 311 DD.





The table below allows for comparison of degree-days over the last three years. Plant stages at this level of DD accumulation are likely ranging from tight bud to cabbage head. Sparganothis flight does not begin until nearly 600 DD.

May 12	Cranberry Growing Degree Days			Sparganothis Degree Days		
	2014	2015	2016	2014	2015	2016
Central WI (Wisconsin Rapids)	320	566	498	128	278	219
Northern WI (Minocqua)	222	384	366	82	168	147

If you would like to read more articles and find more information specific to cranberry production in Wisconsin, be sure to read the most recent Cranberry Crop Management Journal, also published by the University of Wisconsin-Extension. In the April 25, 2016 issue of the Cranberry Crop Management Journal you will find information about: Blueberry Phytoplasma in Cranberry, Rose Chafer, 2016 Fungicide Update, Spring had Sprung, Bravo Status, TSV Bulletin, Observations from the Field, and Grower Updates.

Black Rot Management in the Early Growing Season

By: David S. Jones and Patty McManus

Disease scouting for the 2016 year is officially underway in the pathology research vineyards. WMARS was scouted for the first time on May 5th, and PARS will be scouted starting around the 15th. We are just past bud break at WMARS, and no disease symptoms have been observed. However, healthy buds and early shoots in the spring do not mean that disease-causing pathogens are not present. As weather warms and spring rains arrive, the overwintering bodies of various vineyard pathogens are also becoming active. One pathogen that is now active in most of Wisconsin that can cause serious loss if not controlled in the early season is the black rot fungus.

Black rot (*Guignardia bidwellii*) can infect all areas and stages of growth on grapes, but is particularly known for its ability to destroy clusters by infecting and later mummifying berries. This mummification process turns the berry into an overwintering structure used to house its sexual and asexual spores, which are released the following spring over the course of several weeks. While this disease is capable of causing foliar damage, it is most widely recognized for its ability to severely reduce fruit yield in vineyards, and control strategies revolve around protecting the clusters from damage. Black rot can be a challenging disease to manage, particularly to new growers, for a variety of reasons.

Firstly, black rot remains latent (inactive) after initially infecting fruit. This means that although infection can occur at bloom or any time during early fruit development, fruit symptoms do not show up until between bunch closure and veraison. An apparently promising fruit set early in the season can quickly turn into a significant loss when protectant fungicides are neglected and black rot is active. By the time symptoms appear in clusters, no control measures are possible.

Secondly, fruit have a long period of susceptibility, with peak susceptibility between bloom and about 4 weeks post-bloom. This means that the most crucial window for protecting grapes against black rot begins immediately pre-bloom and continues through early fruit development. A late start on the season can be costly when the black rot pathogen is present in a conducive environment.

Above: black rot mummy on LaCrosse at the West Madison Agricultural Research Station, 2016. Photo by D.S. Jones.

Finally, black rot has a cumulative effect in vineyards. This means that the disease builds in level over time, and that newer vineyards tend to have minimal levels of infection. This differs from other annual concerns such as downy mildew and powdery mildew, which can cause outbreaks in a single season and tend to be visible each year. New growers or owners of young vineyards may not see heavy black rot pressure in the early years of vineyard establishment. As a result, black rot may be forgotten or missed for several years, building up in the vineyard, and ultimately resulting in severe loss to fruit. Particular care should be taken to destroy the mummies of this pathogen. Research has shown that black rot mummies both on the ground and in the trellis release spores for several weeks in the spring and early summer, and mummies in the trellis experience a peak surge of spore release at fruit set, a very vulnerable period for a young crop.

Black rot infectivity can begin as soon as spring temperatures climb above 50 degrees F and moisture is present. As temperatures warm, the number of hours of leaf surface wetness required for an infection decreases. Infection can occur in as little as 6 hours under optimum temperatures (80 degrees F). Mancozeb provides excellent control for black rot, but its use is restricted by the 66-day pre-harvest interval (PHI). Sterol-inhibitor fungicides also provide control against black rot,

providing several days of post-infection activity. Several generic fungicides contain tebuconazole, a sterol-inhibitor chemistry. Strobilurin fungicides containing azoxystrobin are also effective, but should only be used as protectants, as the post-infection activity of these products is limited. It is also important to remember that several of these fungicides, such as Flint and Pristine, can cause severe injury to concord grapes. Many of the cold-climate wine grape varieties have concord grape (*Vitis labrusca*) or other American grape heritage, so great care should be used when selecting the appropriate product. Comments on phytotoxicity may be found in the 2016 Midwest Fruit Pest Management Guide.

Wine and Table Grape Developmental Stages

By: Annie Deutsch and Janet van Zoeren, UW-Extension

This week, and for the rest of the summer, we have pictures from the Peninsular Agricultural Research Station (PARS), as well as from West Madison Agricultural Research Station (WMARS). As you might expect, buds at PARS are behind (bud swell to late bud swell) the buds at WMARS (1- to 2- leaves completely separated from shoot tip). This difference in bud development is reflected by the growing degree day (GDD) accumulations in each location: 278 GDD at WMARS, 138 in Sturgeon Bay, near PARS. Degree days are calculated using a base of 50°F.

April 1 through May 11 2016	**Grape Growing Degree Days**
WMARS	**278**
PARS	**138**

Following photos taken on May 10th at West Madison Agricultural Research Station.

Frontenac at WMARS

Marquette at WMARS

St. Croix at WMARS

La Crescent at WMARS

La Crosse at WMARS

Brianna at WMARS

Somerset at WMARS

Einset at WMARS

Following photos taken on May 11th at the Peninsular Agricultural Research Station.

Frontenac at PARS

Marquette at PARS

St. Croix at PARS

La Crescent at PARS

La Crosse at PARS

Brianna at PARS

Establishing cold hardy grapevines on spur pruned High Cordon system

By: Madeline Kay Wimmer, MS student UW-Madison

Vine Establishment

There is more than one way to train a grapevine, but cold climate grape cultivars are usually characterized by having a downward growing habit and high vigor and are thus better suited to being established on a high cordon training system. This instruction will provide guidance through the first few years of vine establishment in Northern climates. Prior to planting, growers should already have selected the appropriate cultivars for their climate and market, made any necessary soil amendments, and determined aspects of trellis design like planting density and fruit zone height.

Year One

During the first year, there are two clear main goals:

1. Establish an extensive and healthy root system
2. Grow shoots out to become the vine's trunk.

Before planting

Grape cultivars ordered from plant nurseries are shipped as bare root cuttings, although some nurseries sell actively growing potted plants. If planting has to be delayed for a couple of days, make sure the roots stay moist, you can moisten the packing material around the roots or cover them with wet paper towels, place the vines in plastic bag, and keep in a cool storage area. Proper storage will prevent plants from molding and drying out so they are at prime health when planted.

Care for potted vines purchased before planting date to maintain plant health. Encourage shoot and root growth by removing all flowers/fruit.

Planting

During planting, vines that are not immediately planted should be kept moist. Double check the health of the vines before planting and only trim roots that are excessively longer than determined planting depth or are damaged. Dig a planting hole as deep and wide as the roots system of the vines. Plant vines deep enough so that the roots are below the surface of the soil. Cover the roots of the vines with the soil and tamp it gently to ensure good contact of the roots with the soil and to eliminate air pockets. Do not add any fertilizer, compost, or manure to the planting hole as it can burn new roots.

When planting potted vines, take caution to avoid knocking off any tender shoots. Untangle the root mass by teasing apart roots. If roots are not teased, the vine can become root bound, a state resulting from roots growing around each other, creating a knotted root mass rather than growing out into the soil. This often leads to weak plants with low structural integrity and eventual plant death.

Management

Thorough watering after planting is critical for the survival of the newly planted vines, as it will increase root contact with the soil. Weed control is a critical task during the first year of vine establishment; weeds are highly competitive for water and nutrients and will negatively affect growth and root development of newly planted vines. Monitor and control for insects and disease to protect vegetative growth and optimize the ability of the leaves to make carbohydrates for the plant.

Training

Allow for all of the shoots on the newly transplanted vine to grow out unless they appear to be suppressing the growth of lower buds near the base of the plant. This specific instruction contrasts other resources that recommend trimming the vine to 2-3 buds before planting. When more shoots are allowed to grow out it provides extra leaf area to produce more carbohydrates that will help develop a more extensive and healthy root system during the first year.

Training shoots upward to the first wire of the trellis is not always necessary during the first year. When shoots are trained upwards the overall leaf area of the newly established vines is less than when shoots are left to grow over the soil surface. However, weed and pest control are more difficult when shoots are growing over the surface area.

Fastening/training shoots along a vertical rebar will lead to straight shoots that can become the trunk. Options for fastening canes to rebar include using fasteners such as agriflex, hooked rubber bands, rubber string, or tapeners.

Note:

Vigor and Shoot Quality

Which shoots you select to become the trunk, cordon, spurs, etc. should be based on shoot quality. A "high quality shoot" is one that is fruitful and winter hardy. Overly vigorous shoots, often referred to as "bull canes," lack these traits and are characterized by rapid growth, long internodes (the space between each bud), thickness bigger than a sharpie marker, and extensive lateral shoot growth- all of which are signs of poor shoot quality. The ideal shoot has the diameter of a pencil and internodes lengths approximately the size of a fist. Varietal vine vigor, soil fertility, and climatic conditions all influence vine vegetative vigor. To decrease the chance of growing vigorous shoots, avoid growing practices (e.g. unnecessary use of grow tubes) that encourage rapid shoot growth.

Internode length comparison

Year Two

The second year is devoted to growing vegetation only, in particular training the cordons or the arms of the vine. Training the vines during year two will be easiest if the vine trellis is installed with a proper trellis wire and possibly a lower catch wire for the purpose of maintaining efficient shoot positions.

Diameter width comparison

During the dormant pruning period (usually late-February through mid-April), decide which vines grew healthy and tall enough to support the next training phase. Those vines that appear weak or are far shorter than the fruiting trellis wire can be cut back to a fewer number of buds and grown out again, repeating year one.

Creating a trunk

Choose two canes (one-year-old shoots) to become the trunk(s), but keep an extra shoot or two until bud break to assure that selected canes are free from frost damage. Clean up canes by removing last year's tendrils and lateral shoots. Retain buds that break close to the fruiting wire (approximately the top 8-12 inches).

Training shoots

If possible, allow shoots to grow and be trained out with enough space between shoots to avoid potential shading problems (refer to vine establishment info graphic figure on page 14). Further into the growing season, prior to shoots becoming woody, train one to two shoots in each direction down the training wire to become cordons. Training two shoots on each side as potential cordons will provide additional options if one shoot is subject to frost damage. Leave other shoots, laterals, etc. on the vine until it is time for dormant pruning the following season. Pruning during fall can stimulate vine growth, which takes energy away from the plant becoming winter hardy. Refer to above paragraph on how to select a high quality shoot and for further recommendations on shoot selection.

Note: When securing shoots, resist wrapping shoots around the wire. This could can lead to the wire cutting into the vine, lowering its overall ability to function.

Management

Continue irrigating vines and controlling for weeds on the planting row as needed. Insect and diseases monitoring and control is critical to the successful establishment of vines during this second year period.

Year Three

After the cordons have been established, year three aims to grow out shoots from cordons and establish spurs: pruned canes that provide the buds from which the fruit bearing shoots will grow each year.

Establishing cordons

Prune last year's tendrils and lateral shoots off chosen cordons similar to cleaning up the trunks in year two. Prune canes to a length that matches your planned vine spacing dimensions (i.e. if you plan to have six feet between vines, prune cordons to three feet or so on each side). If it is clear that only one of the cordons survived the winter, remove the other damaged cordon. If both are damaged, extra shoots that were kept on the vine the previous year can be carefully trained as a replacement. If there is any question about the quality of a chosen shoot, wait to choose the final cordon until bud break.

Management

Grow out shoots and follow canopy management tasks like combing (may choose to hoop under lower catch wire), leaf thinning, lateral shoot thinning, and skirting the vines as needed. Ripen no more than 1/3 of the vine's total clusters to prevent over-cropping. If canes from year two are too weak, remove all clusters to encourage vegetative growth. As with year two, continue to weed and irrigate vine rows, protect vines from insects and diseases, and avoid fall pruning.

Year Four

This is the first year that the canes from each point along the cordon are pruned back to become spurs. The concept of a spur can be a little difficult to imagine for beginning growers, but keep in mind that shoots mature into canes, which are then pruned down to spurs that have a specific bud count. To make the spur, prune back each cane to 3-4 buds (recommended for cold climate cultivars trained on high cordon). The goal will be to grow out 4-7 shoots per foot- shoot count being dependent on the cultivar's fruiting capacity and overall vigor. Always keep shoot density in mind when deciding how many spurs and buds to keep on each cordon.

Management

After bud break when shoots reach 5-12'', roughly reduce shoot count by removing shoots to the determined density. Allow the vine to mature a full crop, or thin fruit to two clusters per shoot for heavy bearing cultivars (e.g. 'Frontenac'). Keep up annual tasks of thinning lateral shoots and leaves around fruiting zone, combing, skirting, and monitor and control for pests and diseases.

Year Five and Beyond

At this point, the grapevines should be fairly established to produce good quality fruit for years down the road. Beyond summer canopy management tasks described for earlier years, other practices for monitoring and repairing the health of the grapevines and thus prolonging high quality fruit production include:

- Grape bud analysis- checking buds on the first 5 nodes from the base of the canes to assess cold damage during winter.
- Spur renewal- as vines and spurs get further away from the cordons, spurs need to be renewed to bring the centers of growth closer to the cordon. Always choose the canes on the lower portions of the spurs over those that are higher and further away from the cordon to become the current season's spur.
- Pruning weights- while this practice is tedious, obtaining a rough weight for pruned, one year-old shoots can indicate vine vigor and fruiting capacity. Vines that have been over-cropped will have low pruning weights, opposite to those that have been under-cropped, which will have high pruning weights.
- Cordon extension- it is common for shoots to not grow to their full trellis length by the second year. Cordons can easily be extended by training shoots that break near the end of the cordon horizontally along the wire.

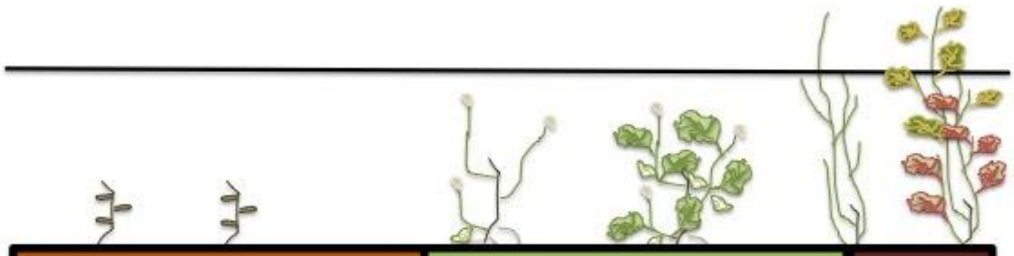
Establishing Cold Climate Grapevines Timeline

Modeled on Spur Pruned High Wire Cordon Training System

YEAR 1

1. Establish root system

2. Train shoots to become trunk



- **Check** bare root cuttings for quality
- **Trim** roots **only** if too long to fit planting hole
  Note: Trimming to 2-3 buds is **not** necessary

- **Plant** deep enough to encourage root establishment
- **Grow** out shoots and fasten to rebar (encourages a straight trunk)

Enter Dormancy

YEAR 2

1. Train shoots to trellis wire to become cordon

2. If vine is struggling, cut vine back to a lower number of buds and redo
YEAR 1

- **Choose** two good canes to become trunks
- **Prune** all lateral shoots and old tendrils from chosen canes

- **Allow** shoots to grow out and manage canopy to optimize sun-leaf contact
- **Eventually** choose 1-2 shoots to fasten along training wire

Enter Dormancy

water · weed · monitor for & manage insects & diseases · CM canopy management

YEAR 3

1. Establish spurs
2. Harvest a moderate crop

- **Prune** off old tendrils and lateral shoots from newly trained cordons
- **Remove** all other dormant shoots
- **May** leave pruned spur on trunk to become a cane renewal zone

- **Allow** shoots to grow out of single bud growing points from cordon, correcting to 4-7 shoots per foot
- **Fruit** thin to 1/3 of total crop load

CM

Enter Dormancy

YEAR 4+

1. Grow out 4-7 shoots per foot of cordon
2. Harvest full crop

- **Prune** canes along cordon to 3-4 buds (note: other training systems and cultivar types have different pruning requirements)

- **Thin** shoots to 4-7 shoots per foot
- **Allow** vines to bear full crop (thin overcropping cultivars like Frontenac to 2 clusters per shoot)
- **Monitor** fruit quality (i.e. sugar content, pH, & acid levels) until harvest

CM

Enter Dormancy

water · weed · monitor for & manage insects & diseases · CM canopy management

Wollersheim Winery and the University of Wisconsin-Madison collaborate to make Red Fusion

By: Madeline Kay Wimmer, MS student UW-Madison

On Thursday, April 27th, Wollersheim Winery of Prairie Du Sac, held an event to celebrate the release of the first wine from Campus Craft Winery, the label of the University of Wisconsin-Madison Fermentation Sciences program. Red Fusion, an all Wisconsin grape wine, has dry red wine like composition, similar to Cabernet, and is designed to pair with Babcock Dairy's Dutch Kase Cheese.

The wine is composed of Maréchal Foch (43%), Frontenac (29%), St. Croix (16%), and Marquette (12%). Grapes were donated from Wollersheim Winery and Danzinger Vineyard and produced at Wollersheim Winery. The UW-Madison students from Food Science and other departments participated and assisted throughout process, including wine production, assessing quality parameters, designing the label, and marketing the wine. Wollersheim, Danzinger and UW-Madison intend to use the profits to fund a program that provides outreach programs to enhance wine quality in the state, supports undergraduate education about wine, and conducts wine research to generate new knowledge to assist the Wisconsin wine industry.

Red Fusion is the first wine of its type, but the hope is to continue making different styles of wine and in a larger quantity. UW-Madison will further its attention on wine through offering a class titled, 'The Science of Wine,' taught by our newly hired enologist, Nick Smith, to teach students about enology and include their participation in making wine to be sold under the Campus Craft Winery label. For those who are interested in purchasing Red Fusion, it will be sold by the bottle at Wollersheim Winery and by the glass at the Wisconsin Memorial Union and Union South. In the spirit of Wisconsin, Red Fusion definitely makes a statement about science, education, and the Wisconsin wine industry!

This summer, the Fruit Crop Entomology lab will review selected insects and insecticides. We hope you enjoy them! Here's our first installment.

Reduced risk insecticide: Confirm

By: Christelle Guédot and Janet van Zoeren

Insecticide: Confirm

- 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 fruits: 14 days
- No more than 6 applications per season and no more than 20 fl. oz. per acre per application
- Do not exceed a total of 120 fl. oz. per acre per season
- Rate of use per acre: 10-20 fl. oz.
- Ground applications: Sprayers need to be calibrated to deliver 50-100 gallons per acre, depending on tree size

Confirm 2F, which is registered for Wisconsin tree fruits apple, crabapple, pear and quince, is not a new insecticide. It has been registered for these fruits since the late 1990's. It is marketed by Gowan Company under the formulation 2F (2 lbs of active ingredient per gallon, Flowable). Confirm is an Insect Growth Regulator (IGR) with the active ingredient tebufenozide. It mimics the action of a natural insect hormone (20-hydroxyecdysone) that induces molting and metamorphosis in insects. It is highly active against most lepidopterous larvae by inducing premature lethal molt after ingestion from treated crop surfaces. Larvae may take several days to die, but feeding generally ceases within 24 hrs. of ingestion.

Confirm 2F is registered for control of codling moth, obliquebanded and other leafrollers, lesser appleworm, green and laconobia fruitworms, tufted apple bud moth, and eyespotted bud moth. For codling moth, Confirm 2F can be applied at a rate of 20 fl. oz. per acre. Your first application should take place at egg hatch (150-250 degree days (base 50°F) accumulated following sustained adult trap catch), and a second application should be applied 10-15 days later.

Confirm 2F may be applied by ground equipment or by air (see label for specific application regulations). For ground applications, conventional ground sprayers need to be calibrated to deliver a minimum of 50 gallons per acre to trees that are less than 10-feet tall, or which are trellised, and calibrated to deliver a minimum 100 gallons per acre to trees that are greater than 10 feet tall. Aerial applications may be applied at a minimum of 20 gallons per acre, but only when trees are of a size and density at which aerial applications uniformly cover the entire tree canopy. Use of a spray adjuvant (spreader-sticker) to maximize coverage and distribution is recommended.

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. Confirm 2F has an LD50 of 234µg/bee, thus it is not considered toxic to bees. In addition, research reports no effect on adult bees and low to no effect on bee brood and queens (Thompson et al. 2005. Ecotoxicology 14: 757-769). While Confirm is safe to spray during bloom, as a general rule, avoid spraying when the bees are actively foraging and concentrate your spraying earlier or later in the day.

Confirm 2F is toxic to aquatic invertebrates and must be kept out of water.

As always, make sure to read the label before using any pesticide. You can find the label of Confirm 2F at the following link: *www.agrian.com/pdfs/**Confirm_2F**_Label4g.pdf*

Building a Hazelnut Industry Based on Wild-type American Hazelnut (*Corylus americana*)

Jason Fischbach – University of Wisconsin Extension, Washburn, WI

The Upper Midwest Hazelnut Development Initiative (UMHDI) is a research collaboration between the University of Wisconsin, the University of Minnesota, and early-adopter hazelnut growers. The goal of the UMHDI is to develop a commercial hazelnut industry in the Upper Midwest. Although there are currently at least 150 small-scale hazelnut growers in the Upper Midwest, their plantings are not yet commercially viable as they consist of primarily open-pollinated seedlings. In many ways, our work is not unlike the early breeding and industry development work that turned the wild blueberry and low-bush cranberry into the thriving industries we have today.

We are working to develop improved germplasm for the region using two source populations: 1) We are currently screening the on-farm seedling populations of hybrid hazelnuts originating from crosses between American hazelnut and European hazelnut, and anticipate moving select genotypes into farm trial in 2017. 2) We are also screening wild populations of American hazelnut for high-performing individuals for possible release, or more likely for use in controlled crosses.

Photo 1. High-yielding accessions of *Corylus americana* in wild populations in the Upper Midwest USA have potential as commercial germplasm and for contributing new and beneficial traits to breeding programs.

American hazelnut exists in large populations throughout the Upper Midwest, but particularly on public lands in northern Wisconsin and Minnesota. These populations have never been explored, and, thus, represent significant opportunity for finding new and beneficial traits for winter-hardiness, drought resistance, resistance to Eastern Filbert Blight, resistance to big bud mite and nut weevils, and for new and unique flavors. Since 2010 our team has been screening the wild populations for high performing plants and have selected 50 accessions for propagation and further evaluation. Many of these accessions have demonstrated significant yield potential in the wild (Fischbach et al, 2010). (Photo 1) We have also conducted baseline genetic diversity analysis showing significant within-population diversity (Demchik et al, 2014). Although kernel size is small, some accessions have little to no pellicle, very round kernels, and aroma and flavor profiles that can exceed industry standards such as Tonda di Giffoni (Demchick et al, 2016) (Photo 1). Oleic acid content of American hazelnut is consistently above 75% with some accessions exceeding 80%.

Photo 2. Kernels of Corylus americana accessions from wild populations in northern Wisconsin compared to Tonda di Giffoni (upper left).

We anticipate the Upper Midwest hazelnut industry to be based on the shrub-type American hazelnut with over-the-row harvesting as is done with blueberries. Initial cultivars of hybrid hazelnuts selected from the on-farm populations will be followed in the years to come by clonal material of pure American hazelnut or backcross offspring from crosses between European hazelnut and

our American hazelnut selections. More about the UMHDI and our work with American hazelnut can be found at www.midwesthazelnuts.org or by emailing jason.fischbach@ces.uwex.edu or michael.demchik@uwsp.edu

References:

Demchik MD, J. Fischbach, A. Kern, J. Lane, B. McCown, E. Zeldin, and K. Turnquist. 2014. Selection of American hazelnut as a potential oilseed crop. Agrofor. Syst. 88:449-459.

Demchik, M.D., J. Fischbach, and M.D. Yates. 2016 (in press). Physical characteristics and sensory analysis of American hazelnuts in comparison to Tonda di Giffoni. Agrofor. Syst.

Fischbach J, M. Demchik, and K. Brasseur. 2010. Screening wild populations of American hazelnut in NW Wisconsin for high yielding plants. Bayfield County UW-Extension Research Bulletin #16, Washburn, WI http://midwesthazelnuts.org/assets/files/Research%20Bulletin%2016_American%20hazelnut%20yields.pdf

Apricot blossoms are in full bloom.

Calendar of Events

May 26, 2016 – WGBA Berry Field Day
White Pine Berry Farm, River Falls, WI

June 14, 2016 – Monroe and Richland County Fruit Field Day
Location TBD

June 15, 2016 – Advanced Organic Orchard Management Field Day
9:00-4:30, Atoms to Apples, Mount Horeb, WI and Two Onions Farm, Belmont, WI

June 16-19, 2016 – Cranberry Blossom Festival
Wisconsin Rapids, WI

July 14, 2016 – PARS Vineyard Walk
Peninsular Agricultural Research Station, 4312 Hwy 42 North, Sturgeon Bay, WI

July 27, 2016 – WAGA Apple Field Day
Location TBD

August 10, 2016 – Cranberry Growers Summer Field Day
Brockway Cranberry, Black River Falls, WI

Useful Links:

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

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

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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