Wisconsin Fruit News

Volume 1 Issue 2– May 2, 2016

In This Issue:

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General Information

Degree Days: What they are, how to calculate them, and why they matter to you

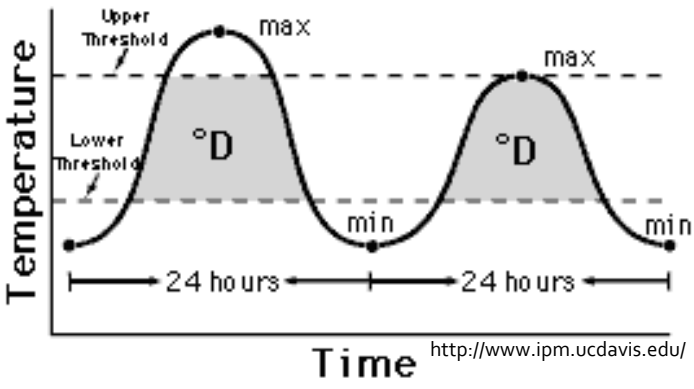
By: Janet van Zoeren, Elissa Chasen, and Amaya Atucha

Degree days (DD) are a tool with which we can estimate the most abundant life stage present of a certain pest species at each point in time. This is extremely important for growing fruit crops, because it increases the efficiency of your pest monitoring and pesticide applications, by timing them accurately to when pests are most likely to be present, and thereby saving the cost and time of excessive applications while ensuring adequate pest control. In some cases, DDs are also used to track plant development, allowing growers to predict how plant developmental stages will align with calendar dates and with pest pressures. When being used to calculate plant development, they are often called "Growing Degree Days".

How to calculate Degree Days:

Degree Days take advantage of the fact that plants and insects are ectotherms, meaning they require a certain amount of heat energy to develop. Unlike you and I, plants and insects cannot create their own metabolic heat, and so they rely on external heat to allow them to grow and mature. Below a certain temperature, called the "lower developmental threshold", the plant or insect is not developing, and above a certain temperature, the "upper developmental threshold" development slows as temperatures increase. These developmental thresholds are different for each plant or insect species, meaning that each species matures within a different optimal temperature range. The first job of a researcher is to determine the thresholds for the crop or pest of interest – this has already been done for many of the key pests affecting Wisconsin Fruit production.

Once the thresholds have been determined, DDs can be calculated a number of different ways. The most precise calculations approximate temperature fluctuations over the course of a day with a sine wave, and calculate the area underneath the sine wave within the bounds of the organism's temperature thresholds (see the shaded area of figure 1). An easier calculation of the number of DDs accrued by a plant or insect on a particular day is represented in the equation in figure 1. The only information necessary for this calculation is the daily high and low temperatures and the species' thresholds. The DD accumulation for a given day is calculated by adding the daily high to the daily low, dividing by 2, and subtracting the lower developmental threshold. If the daily high is warmer than the upper developmental threshold, you will replace daily high in the equation with the threshold. Similarly, if the daily low is colder than the lower developmental threshold, you replace daily low with that threshold.



$$DD = \frac{Daily\ High + Daily\ Low}{2} - Lower\ Threshold$$

Figure 1: Two ways to estimate Degree Days: the shaded area in the graph above represents the degree day accumulations for a species on a given day; a simple equation used to calculate DDs is below.

Once you have calculated the day's accumulated DDs, you can just keep a running tally, adding each new day to the previously accumulated total. However, you do need to know when to begin tabulating DDs. For many species, there is a certain date, often March 1st, when accumulation begins for the year. For other species, DDs begin to be tabulated following a certain event, such as the first trap catch of an adult moth to calculate larval infestation.

Using Degree Days to estimate Development:

Now you know how to calculate your accumulated degree days, by finding the upper and lower developmental thresholds for the insect or plant of interest, along with the daily high and low temperatures, plugging them into the equation above, and adding each new day's DDs to the previous total. But then what does it mean? The final piece of information is to know the "degree day benchmarks", or the number of degree days necessary for an individual to complete a life stage. This is different for each plant or insect species.

For example, for sparganothis fruitworm, overwintering larvae require around 600 DDs to develop into moths, and the moths require an additional 85 DDs to begin to lay eggs. Similar information is available for some of the most problematic pests in Wisconsin, and is in the process of being developed for others. So, as seen in the previous example, the Steffan Lab has calculated degree day benchmarks for sparganothis fruitworm (which will be reported on weekly in the Cranberry section of this newsletter), and this summer they are working on calculating benchmarks for cranberry fruitworm.

When looking at plant development, DD are often used to predict phenological stages in the plants, such as bud break or bloom, as well as harvest. Multiples models have been developed based on growing DD and other plant and environmental factors to predict when these events will happen. Michigan State University has developed and apple maturity prediction model based on growing DD that helps predict when fruit should be harvest to achieve the maximum quality during post-harvest. Likewise, peach harvest date has been shown to correlate to the growing DDs accumulated during the first 30 days following bloom.

Why Degree Days are important to you:

Insecticides are often limited by the fact that not all insect life stages are equally susceptible. For example, eggs, larvae, adults and pupae of a beetle (red flour beetle) were exposed to four different insecticides (spinetoram, imidacloprid, thiamethoxam, and chlorantraniliprole). None of these insecticides were effective against pupae and efficacy of chlorantraniliprole (Altacor), for example, was greatest for young larvae (nearly 100%). Mortality was much less for other life stages (i.e. 66% for adults, 64% for old larvae, and 40% in eggs, Saglam et al. 2013). So if an insecticide application missed the time window when larvae are young, effectiveness would decrease sharply.

Precise and accurately timed insecticide applications can save fruit growers hundreds of dollars per acre. For example, in a study completed in apples, applications made three days early led to 1.4% greater yield damage, and applications made three days late led to 2.0% greater yield damage, than applications made at optimal timing. Optimal treatments were achieved by timing the insecticide applications for adult trap catches of the insect pest, along with the use of a degree-day model (Sjöberg et al. 2015).

What's the difference between Growing Degree Days and Chill Units in plant development?

The term "*chill unit*" was developed to quantify how long plants need to be exposed to chilling temperatures to break endodormancy or "complete rest". A "chill unit" is defined as one hour at 45°F. However, partial chill units can be gained or lost based on a broader range of temperature. Chill units are calculated beginning late summer. Once the temperature starts dropping in October or November, chill units will start to accumulate and from that point on a running total is calculated. Chill unit requirements to complete rest vary among fruit crops and varieties, apple trees ranges from 800 to 1700 chill units while almond range between 50 and 700 units to complete rest. After the rest has been completed buds need to be expose to a period of warm temperatures (over 40°F) to resume growth, referred to as "*growing degree day*" accumulation. This prevents buds from breaking too soon, when there is still a likelihood for frost damage. They have to wait until March or April to accumulate the required growing degree days (which vary depending on species). So once the plant has received both the required chill units, followed by appropriate growing degree day accumulation, buds will begin to break and flowers will begin to open up! Happy spring!

Accurately timing insecticide applications is always important, but has been especially crucial in recent years given the widely variable spring temperatures seen lately. For example, if you always spray an insecticide on May 7th, to target adult emergence of some pest, in a warm year you may have already lost much of your crop because adults emerged in late April, while on a cold year you may have no insecticide efficacy because the pest remained hidden underground as pupa until mid-May! By using DDs, you can more accurately predict adult emergence, and time the insecticide application to prevent most pest damage.

How to use Degree Days this summer:

If you would like to use degree days this summer, but have not done so before, the easiest way to calculate your degree day accumulation is to find your closest weather station (go to www.wunderground.com), take the daily highs and lows, and plug them into a degree day calculator (i.e. http://agwx.soils.wisc.edu/uwex_agwx/thermal_models/degree_days). For cranberry growers, information regarding plant and pest degree days will be available on the Steffan Lab website and in this newsletter. For other fruit growers, we hope to include this information soon, but for now you should look at our website for more information on degree days.

Pest Alert: Spotted Lanternfly

By: Christelle Guédot – UW Madison Fruit Crop Entomology and Extension

Common Name: Spotted Lanternfly
Order: Hemiptera
Family: Fulgoridae
Scientific Name: *Lycorma delicatula* (White)

Adult spotted lanternfly on *Vitis* sp. *Photo credit:* Sven-Erik Spichiger, Pennsylvania Department of Agriculture.

Spotted lanternfly (SLF) is an invasive plant hopper native to China, India, and Vietnam. It has been introduced in Japan, South Korea, and, closer to home, Pennsylvania. In Korea, where it was first detected in 2004, it is known to feed on over 70 plant species and is a pest of both grapes and peaches. The first detection for the U.S. was confirmed in Pennsylvania in September 2014. SLF most likely arrived as egg masses on an imported product or shipping material from China up to two years earlier. As of February 2016, SLF has been detected in 6 counties, with its range steadily expanding. SLF is a highly invasive insect that can spread rapidly when introduced to new areas. Insects seem to spread by hitchhiking. This pest has the potential to greatly impact the grape, tree fruit, plant nursery and timber industries in the U.S.

Adult spotted lanternfly. *Photo credit:* Lawrence Barringer, BugGuide Copyright © 2014.

Appearance: Adult SLF are ~1" long and ½" wide when resting. The forewings are light brown to grey with black spots and the wing tips are reticulated black blocks outlined in grey. The hindwings are red with black spots with a white band separating the tips of reticulated black blocks. The head and legs are black, while the abdomen is yellow with broad black bands. When resting, adults fold their wings in a tent-like position over the body and appear light brown to grey with black spots. Adult females can be distinguished by the presence of a red spot at the tip of the abdomen. SLF eggs are laid in masses containing 30-50 eggs. Egg masses are 1-1.5" long and ½ - ¾" wide, greyish-brown, and covered with a grey, waxy coating. First stage immatures are wingless and black with white spots. As the nymphs grow to the last instar, they will develop red patches while keeping the white spot pattern.

Spotted lanternfly nymph. *Photo credit:* Pennsylvania Dpt. of Aq., BugGuide

Host Range: As they emerge, nymphs will disperse from the egg mass site by crawling or jumping, and appear to feed on a wide range of plant species, feeding on almost every plant they encounter on the ground. The new hosts will include several kinds of agricultural crops such as grape and fruit trees. Nymphs are most often observed on leaves and branches of plants. Nymphs and adults tend to aggregate in large numbers on host plants. In the fall, adult SLF will aggregate in groups on tree of heaven (*Ailanthus altissima*) (F.), willows (*Salix* spp.), and other trees. Tree of Heaven, also known as Paradise tree, is a preferred host for adults in the fall as a food source, mating and egg laying site. Tree of Heaven is an invasive species native to China and is a fast growing deciduous tree often found in disturbed sites or along roadways. Other hosts include maples (*Acer* spp.), birch (*Betula* spp.), poplars (*Populus* spp.), tulip trees (*Liriodendron* spp.), ash (*Fraxinus* spp.), oak (*Quercus* spp.), grape (*Vitis* spp.), and tree fruits, such as apple and stone fruits.

Symptoms and Effects: SLF adults and nymphs feed on the plant's phloem, sucking the sap from young stems and leaves. Affected trees will show weeping or oozing wounds of sap on the trunks, leaving greyish-black trails along the trunk. Damage can result in the withering of whole trees; as photosynthesis is reduced, the trees will weaken and may eventually die. In addition, SLF excrete large amounts of honeydew, a sugar-rich liquid as they feed on large amounts of plant sap. In heavy SLF infestations, the honeydew secretions will cover the stems and leaves of trees, and will build up on the ground at the base of the plant. The secretions will in turn get colonized by sooty mold fungal growth which can also reduce photosynthesis and eventually lead to plant death. Honeydew secretions and sap-oozing plant wounds will attract other insects such as wasps, hornets, bees, and ants. When larger populations of SLF are found nearby, fruit trees and grapes may be more susceptible to damage and mortality.

Egg masses of spotted lanternfly covered by waxy deposits. *Photo credit:* Lawrence Barringer, Pennsylvania Department of Agriculture.

Aggregation of adult spotted lanternfly on tree of heaven. *Photo credit:* Lawrence Barringer, Pennsylvania Department of Agriculture.

Life Cycle: SLF is univoltine, meaning that it has only one generation per year, and overwinters as eggs. In the spring and early summer, the eggs will hatch and undergo four nymphal instars. Adults will begin to appear in July with abundant populations in August. Males and females mate multiple times and female may lay eggs twice before dying (based on observations in South Korea). Egg laying begins in September and continues through November, until all adults die with the onset of winter. Egg masses are laid on smooth bark of medium to large trees, on trunk, branches, and limb bases, but also on stone or other vertical surfaces.

Monitoring and Control: SLF adults are poor fliers but very strong jumpers and thus prefer to walk. Nymphs and adults congregate in large number on host plants and are easy to see at dusk or night when they migrate up and down tree trunks. They are harder to see during the day as they tend to stay near the base of the host plant. Beginning in late April to mid-May, nymphs may be seen on smaller plants and vines, and any new growth on trees and shrubs. Adults should be monitored in late August-September. Mating and oviposition will occur from evening to night from mid-September to November. Look for egg masses from October into spring predominantly on tree of heaven, but not exclusively. Egg masses are often inconspicuous and may be found on outdoors manmade items such as vehicles, yard furniture, and farm equipment. Thus, egg masses may pose the greatest risk for hitchhiking to new areas. Immature stages are easily caught on sticky tree bands as they actively crawl up and down trees and plants. Adult and late instars are not often caught on these bands.

Quarantine and Status: An active monitoring and eradication program is underway in Pennsylvania to prevent the spread of this new invasive pest. For more information about this insect, visit www.agriculture.pa.gov/Protect/PlantIndustry/spotted_lanternfly/. To this date, SLF has only been confirmed in eastern Pennsylvania in six counties, which are under quarantine. Because SLF is spreading steadily and has the potential to affect the grape, tree fruit, tree and wood-product, and green industries, it is important to be on the lookout for possible detections and infestations in Wisconsin. If you suspect insects you see might be SLF, please contact the Insect Diagnostic Lab in the Entomology Department at UW-Madison (http://labs.russell.wisc.edu/insectlab/contact-us/).

Strawberry Cultivars and Your Farm Profitability: Results of Midwest Strawberry Performance Trials

Brian R. Smith – State Extension Commercial Fruit Specialist, University of Wisconsin-River Falls

Some of you reading this had the opportunity to attend presentations that I have given at conferences, workshops and field days. Most of you have either already planted your new strawberry fields or are nearly ready to. This article outlines some of the results that I have generated over the last several years that will hopefully give some more insight in to the realm of choosing the correct cultivar for your farm. While it cannot be denied that our Wisconsin/Midwest macroclimate is of the fast-changing continental type, individual characteristics of your own farm mesoclimate and business/marketing practices can change grower priorities as to cultivar selection. Some questions to ask yourself with regards to choice of cultivar can range from "What soil type do I have?" to "What avenues do I use to market my strawberries?" The wide choice of cultivars available today is both an advantage and a disadvantage, depending on how you make your decision to plant a certain amount of acreage.

Let's take a look at grower options. One of the best starting points is to find out what cultivars have worked for the greater population of growers in an area. Cultivars such as 'Annapolis', 'Honeoye', 'Cavendish' and 'Jewel' are the "bread and butter" cultivars of the Midwest industry. They all have specific faults but when observed over a wide range of mesoclimates, they perform exceedingly well in terms of yield, general winter hardiness and adaptability. If we throw in variables to eliminate cultivars even from this generalized list, your options are limited. What if you have a heavier soil like a clay loam? Root disease resistance is of paramount importance, such as for red stele disease and black root rot complex. 'Honeoye' and 'Jewel' might not look so good as candidates in this situation. What if firmness, flavor and appearance are required for farmers' markets or pre-picked-on- farm sales marketing? 'Jewel' is your top pick but 'Annapolis' and 'Cavendish' not the best of choices from lack of firmness, light coloration (Annapolis) to uneven coloring (Cavendish). If your top criteria includes winter hardiness and you live in places like Spooner or Tomahawk, Jewel is borderline to unacceptable. So where does this leave you? You need to dip in to the "second and third tier" cultivars.

The second and third tier cultivars are a diverse group in terms of winter hardiness, flavor, general adaptability, yield and disease resistance. The second tier is typified by older cultivars like 'Darselect' and 'Cabot' that have found their niche with a few growers but do not have the enough of what it takes to make it as a recommendation for all to plant. They may have more reliability than the third tier but have some major faults. Let's use 'Darselect' as an example. Many growers have tried it and for the first year or two after planting, there have been heavy yields and good flavor. Unfortunately, winter hardiness is usually an issue and fruit size in the 3rd year and beyond is subpar. Special nutritional regimes are also required. 'Cabot' is very large and has great appearance but typically lacks winter hardiness, flavor and yield. Third tier cultivars are a real mixed bag. Most are newly-released and only minimally tested by both growers and universities. There may be some winners in them that jump to first tier status within a few years but most will be losers; primarily because they have been bred for performance outside the parameters of our climate.

So, what are the options for making informed decisions on which 2nd and 3rd tier cultivars to plant? The grower can grow a whole host of new cultivars and conduct test plots on their farms. This usually works with limited success, primarily because there are limited hours in a day. I know, I have grown strawberries commercially myself! Are you going to spend the time and money it takes to fully evaluate a new cultivar? At the same time as you should be weeding your new strawberry planting and directing traffic and sales of your bearing acreage, you should be out evaluating your test plots. Are you really going to take good data to prove to yourself that a new cultivar is worthy of planting on your farm? What if you decide to plant a larger acreage of a new cultivar that you think looks promising and you let your customers decide? Well, let's look at it peering through an economics window. If you plant a new, untested cultivar on ½ acre, what will it cost you? The chances are, you will decide not to plant it in the end on more acreage in the future. It is like the lottery; the chances are there but not very good to win and you have to spend money to get that chance. Plants, labor, pesticides, fuel, straw,

irrigation could easily add up to $3,000.00. To get any return on that money, you are going to need customers to pick that test plot. If they are in there picking, will you get a good look at it before they have harvested most of the evidence? Will you be able to keep track of amount picked and whether the customers were happy? What if you get severe winter injury on the test cultivar? Then you are out the $3,000 + the potential $9,000.00 of income off that ½ acre.

Don't get me wrong; I am not shunning on-farm trials but there is a time and a place. That is where universities come in to the picture. Our plots are small but set up to provide realistic results to growers with very little, if any cost to the growers. This is why grower-funded cultivar trials are a cheap method for commercial growers to narrow the field of potential cultivars. Extension specialists like myself can help you decide on whether a 2nd tier cultivar is right for you to trial on your farm based on past information that we have. Tier 3 cultivars are prime for testing at universities so that you, as a grower, do not have to waste your hard-earned money testing something that probably will be a bigger risk than you want to take. Some nurseries test new cultivars and then, based on their trials, suggest certain cultivars to growers. However, results from trials on the east coast or anywhere other than the Midwest are notoriously unreliable.

So, here we are, the results of Midwest trials, with University of Wisconsin-River Falls and University of Minnesota data included:

Junebearing Strawberry Performance Trials

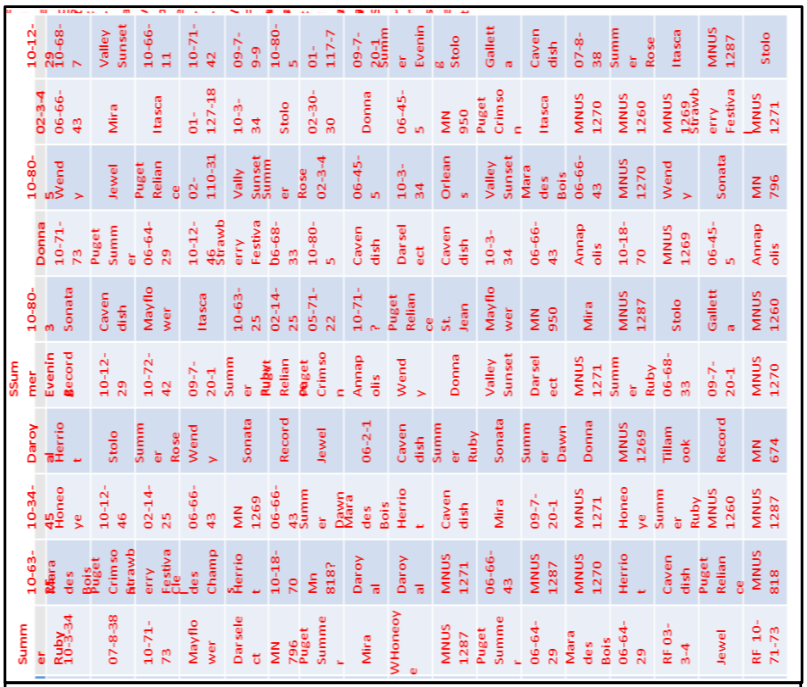
Standards
Annapolis, Wendy, Brunswick, Honeoye, Cavendish, Jewel, Valley Sunset

New/Miscellaneous Cultivars
Galletta (E), Summer Dawn(E), Summer Ruby (E) Daroyal (EM), Mara des Bois (EM), Herriot (EM), Puget Reliance (EM), Donna (M), Mayflower (M), Sonata (M), Summer Rose (M), Tillamook (LM), Stolo (L), Puget Summer (L), Puget Crimson (L), Strawberry Festival (L), Record (L)

Specifics and Methods

- 2012-planted large trial has 60 genotypes (26 cultivars; 34 advanced breeding selections – 29 and 5 respectively from UW-River Falls and University of MN)
- 4 replications, plot size= 20' (many trials at other universities going to 10')
- Commercial production culture, except for limited pest control (no disease sprays, 1-2 insecticide apps. for TPB and clipper)
- Harvest season (very late)6/26/14 (1 day late for this area, starting) – 7/22/14; (15 days later than average of last 24 years)
- Very cold winter (worst tree fruit damage since 1983-84); good snow-cover for strawberries

To the right is a partial map of the large replicated trial at the UW-River Falls Fruit Research Facility.



Partial Map of 2014 UW-RF Replicated Performance Trial

2014 Data: UW-River Falls

Early season cultivar	Total yield	Rank[z]	1st Harvest Fruit Size (g)	Rank	All Harvest Fruit Size	Rank
Galletta	13,156	4	14.5	26	11.7	15
Itasca	11,164	11	12.7	35	9.3	37
Daroyal	10,955	13	12.6	36	11.3	21
Summer Ruby	9,668	21	14.0	29	12.5	4
09-7-9-9	9,323	22	14.5	25	11.6	18
Wendy	7,844	25	18.1	7	12.2	6
Annapolis	5,137	34	12.0	39	8.5	41
Summer Dawn	3,685	37	15.8	16	11.4	20
LSD .05	3,397		3.2		2.3	

[z] 43 genotypes ranked in data set

67

2014 Data: UW-River Falls

Early midseason cultivar	Total yield	Rank[z]	1st Harvest Fruit Size (g)	Rank	All Harvest Fruit Size	Rank
MNUS 1269	17,321	1	21.6	1	12.2	7
Honeoye	11,158	12	12.0	38	9.1	39
02-3-4	10,364	17	16.2	12	11.8	13
Herriot	7,686	26	13.1	31	8.5	42
06-45-5	7,398	27	20.5	2	11.6	17
MNUS 1271	7,273	28	14.8	20	10.0	29
Puget Reliance	6,770	30	14.0	28	9.8	33
Mara des Bois	2,432	41	7.7	43	6.8	43
LSD .05	3,397		3.2		2.3	

[z] 43 genotypes ranked in data set

68

2014 Data: UW-River Falls

Midseason cultivar	Total yield	Rank[z]	1st Harvest Fruit Size (g)	Rank	All Harvest Fruit Size	Rank
10-3-34	12,359	6	14.7	23	11.0	24
MNUS 691	11,567	10	14.5	24	13.9	1
10-12-29	10,750	14	18.2	5	12	9
MNUS 1287	10,615	15	15.2	19	9.8	23
Sonata	10,411	16	16.4	11	11.0	25
Jewel	8,851	23	15.7	17	12.0	11
Cavendish	5,724	31	14.8	21	10.8	27
Donna	5,190	33	13.9	30	10.0	30
Mayflower	5,051	35	16.2	13	11.6	19
Mira	4,831	36	16.1	14	9.4	34
Summer Rose	3,606	38	16.8	9	12.1	8
LSD .05	3,397		3.2		2.3	

[z] 43 genotypes ranked in data set

69

2014 Data: UW-River Falls

Late Midseason cultivar	Total yield	Rank[z]	1st Harvest Fruit Size (g)	Rank	All Harvest Fruit Size	Rank
10-80-5	14,635	2	15.5	18	9.9	31
Darselect	13,234	3	14.8	22	11.7	16
10-68-7	12,145	7	15.8	15	12.3	5
06-66-43	10,314	18	18.6	4	11.3	22
10-18-70	10,045	19	16.7	10	13.0	2
02-14-25	9,866	20	12.2	37	9.8	38
Tillamook	7,093	29	17.5	8	12.6	3
Stolo	5,285	32	13.1	32	9.5	35
MNUS 1260	2,081	42	13.0	34	9.4	36
LSD .05	3,397		3.2		2.3	

[z] 43 genotypes ranked in data set

70

2014 Data: UW-River Falls

Late season cultivar	Total yield	Rank[z]	1st Harvest Fruit Size (g)	Rank	All Harvest Fruit Size	Rank
Valley Sunset	12,418	5	18.7	3	11.9	12
Record	12,112	8	18.1	6	11.0	26
09-7-20-1	11,902	9	13.1	33	10.2	28
10-80-3	8,029	24	14.0	27	11.8	14
Puget Summer	3,530	39	11.3	40	8.9	40
Puget Crimson	3,154	40	10.6	41	8.0	42
Strawberry Festival	1,973	43	10.2	42	8.1	41
LSD .05	3,397		3.2		2.3	

[z] 43 genotypes ranked in data set

A summary of the top performers is a "snapshot" in time and is only for 2014:

More recently, I have added 'Malwina', 'Flavorfest', 'Lila', 'Laurel', 'Rutgers Scarlet' and 'Verity' to a new trial. Good luck with your season!

Top Performers-2014 UWRF

Yield	All Harvest	Vigor	Flavor	Leaf scorch	Leaf spot	Leaf blight
Darselect	Darselect	Tillamook	Darselect	Puget Sum	Puget Sum	Darselect
Galletta	Galletta	Galletta	Pug. Rel.	Galletta	Pug. Rel.	Pug. Rel.
Valley Sun.	Valley Sunset	Valley Sun	Pug. Crim.	Pug. Rel.	Valley Sun	Pug. Crim.
Record	Darselect	Record	Itasca	Pug. Crim.	Itasca	Itasca
Itasca	Tillamook	Cavendish	Cavendish	Cavendish	Cavendish	Cavendish
Honeoye	Summer Rose	Donna	Sum Rose	Honeoye	Sum. Rose	Honeoye
Daroyal	Daroyal	Daroyal	Daroyal	Daroyal	Daroyal	Daroyal
Sonata	Sonata	Sonata	Sonata	Sonata	Orleans	Puget Sum
Sum. Ruby	Sum. Ruby	Herriot	Mara d.Bois	Herriot	Herriot	Sum. Ruby
Jewel	Jewel	Jewel	Jewel	Jewel	Darselect	Orleans
Wendy	Wendy	Wendy	Wendy	Wendy	Pug. Crim.	Mayflower
Annapolis	Mayflower	Stolo	Stolo	Mayflower	Stolo	Stolo

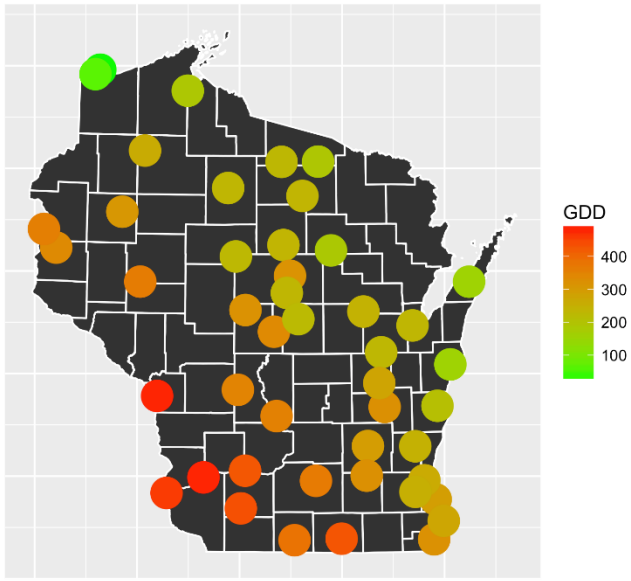
Cranberries

Cranberry Degree Day Map and Update

By: Elissa Chasen - Steffan Lab, UW-Entomology

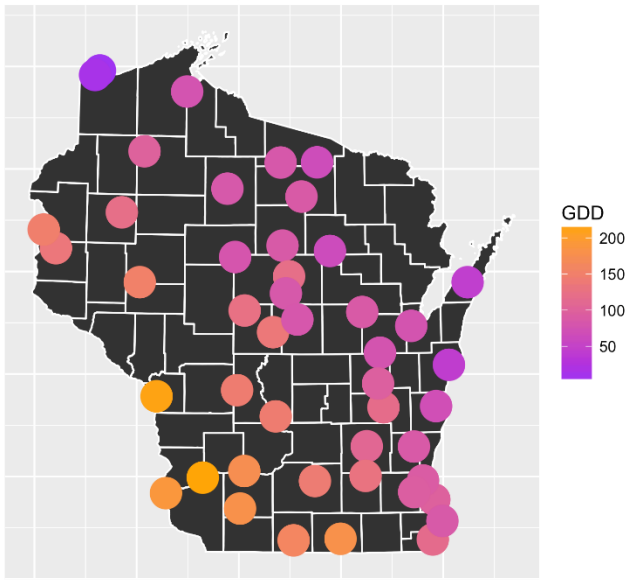
In general, it's been fairly cool over the past two weeks, so we have not accumulated many more degree days than when we last reported on April 18th. However, cranberry plants in the central growing region of the state are now mostly in cabbage head, although those in the northern part of the state are predominantly still dormant. Even in the southernmost part of Wisconsin, Sparganothis fruitworm has not yet begun adult flight.

Cranberry Growing Degree Days: May 1, 2016



Cranberry Growing Degree Days are calculated using a base temperature of 41° F.

Sparganothis Degree Days: May 1, 2016



Sparganothis Degree Days are calculated using a base temperature of 50° F.

May 1	Cranberry Growing Degree Days			Sparganothis Degree Days		
	2014	2015	2016	2014	2015	2016
Central WI (Wisconsin Rapids)	169	355	337	55	157	136
Northern WI (Minocqua)	95	222	226	25	82	83

Summer plans in the Steffan Lab

By: Elissa Chasen and Shawn Steffan – UW Entomology

We have a lot of exciting research ongoing and planned for the upcoming field season in the Steffan Lab. There are five primary research priorities:

Octocopter drone
Photo from http://www.fastcoexist.com/

1. <u>Ongoing work with mating disruption/SPLAT trials</u> - You have likely heard about the work we have been doing over the last 4 years developing a mating disruption program from the ground up. We have been targeting the three major cranberry moth pests: cranberry fruitworm, sparganothis fruitworm and blackheaded fireworm. This year, the research continues and will be improved in two ways: 1) SPLAT will be deployed by drones; and 2) the pheromone load for sparganothis fruitworm is being increased. Our past trials have been successful at disrupting cranberry fruitworm and blackheaded fireworm, but not sparganothis fruitworm. By increasing the pheromone load of sparganothis, we hope to see more successful results for this pest as well. Also, an exciting part of this summer's research is that we will be working with cranberry growers in the northern part of the state! We are excited to broaden our network of cranberry grower collaborators!

2. <u>Development of the cranberry fruitworm degree-day model</u> – Last year, we determined the temperature thresholds for cranberry fruitworm development so that we could begin the creation of a degree-day model for cranberry fruitworm. When this model is completed, it will help growers predict the presence of different cranberry fruitworm life stages so that treatment can be timed more effectively. In this first year of model development, we will be correlating cranberry fruitworm specific degree-day accruals with first flight, peak-flight, and end of flight by trapping the moth at several different central WI marshes. Future laboratory work will also correlate degree-day accruals with egg-laying and egg-hatch.

Artistic rendering of a cranberry fruitworm.
Drawing by Elissa Chasen.

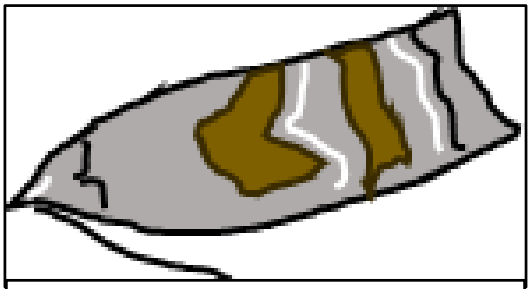
3. <u>Examining the potential for dragonflies and damselflies as biological control agents</u> – Dragonfly and damselfly communities are abundant in wild and cultivated marshlands and seem to benefit from the land stewardship practices of cranberry growers. This is important because these insects are generalist predators and therefore possible biocontrol agents of cranberry insect pests. Steffan lab graduate student, Maria Chavez, will be sampling dragonflies and damselflies on northern WI cranberry marshes. Back at the laboratory, gut-content analysis will help us determine what these insects are eating and how they might be beneficial to cranberry growers!

4. <u>Native nematodes for biological control</u> – Shane Foye, a Ph.D. student in the Steffan Lab, will be continuing his work searching wild cranberry marshes for native nematodes that attack and kill cranberry insect pests. Already, he has discovered three promising nematode species in central

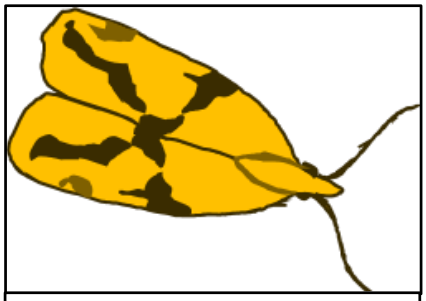
Wisconsin, and trials are currently being conducted to determine which of these nematodes is best for controlling cranberry fruitworm, sparganothis fruitworm, and the redheaded flea beetle. Efforts are also underway to identify the bacteria that live within these nematodes, because the bacteria within the nematodes are actually the killing agents, and may possess novel insecticidal properties.

5. Bee-microbe symbiosis study – Most growers pay significant amounts of money to bring honey bee hives to their marsh for pollination services. But in addition to these honey bees, there exists a diverse and abundant community of native bees around the marsh that contributes to pollination. In the laboratory, we are looking at the effects of fungicides on the microbial symbionts of native bee species (*Osmia lignaria* and *Bombus impatiens*).

Bumblebee pollinating a cranberry flower
Photo from http://www.beeccdcap.uga.edu/



Artistic rendering of a black-headed fireworm. *Drawing by Elissa Chasen.*



Artistic rendering of a sparganothis fruitworm. *Drawing by Elissa Chasen.*

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
- Grower Updates

Reducing Disease Pressure through Vineyard Sanitation

By: David S. Jones and Patty McManus, UW-Madison Dept. of Plant Pathology

As we approach the beginning of another growing season, a yearly concern to growers is the challenge of controlling disease. While there are elements of disease development each year that growers cannot control, we can reliably get a start on minimizing disease pressure during the off-season by implementing vineyard sanitation practices.

What is vineyard sanitation?

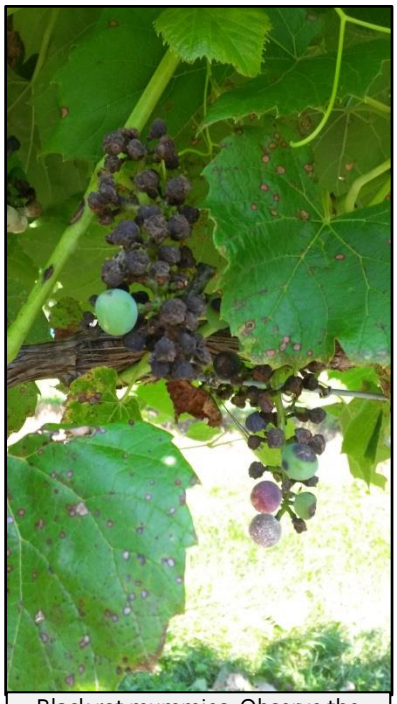
Vineyard sanitation is the practice of removing and destroying prunings, diseased wood, and diseased berries from a vineyard each year. Mulching or cultivating can also be employed to encourage decomposition and avoidance of overwintering fungal structures.

Why is vineyard sanitation so important?

There are several damaging grape diseases that rely heavily on infected tissues from the previous year to initiate new infections each spring. Leaving infected prunings or berries in a vineyard serves as a source of inoculum (spores), leading to heightened problems throughout the season. These fungi produce special overwintering structures that house their sexual or asexual spores, and if left in the vineyard these structures will release spores for several weeks during the growing season. By removing these structures during the offseason, we prevent this steady release of spores onto the developing crop each year.

What are some of the diseases that can be reduced by practicing good vineyard sanitation?

Black Rot (Guignardia bidwellii) overwinters in desiccated grape berries, called "mummies" which remain on the rachis attached to the previous year's growth through the winter months, as well as in infected canes. Infected tissues are filled with flask shaped structures containing either asexual or sexual spores. Spores are discharged when warm spring weather arrives, and are splashed onto young growth during rain events. Young stems, leaves, and flowers are highly susceptible to infection.



Black rot mummies. Observe the damage to fruit, foliage, and shoots surrounding the mummified cluster. *Photo by D.S. Jones.*

Phomopsis Cane and Leaf Spot (Phomopsis viticola) overwinters in a similar fashion to black rot. Like black rot, phomopsis turns infected fruits into mummies filled with sexual and asexual spores during the growing season, and can also infect canes. Mummies may hang on the rachis of infected clusters throughout the winter or fall to the ground. In the spring of each year, spores are splashed onto susceptible young foliage, flowers, and fruit during rain events.

Anthracnose (Elsinoë ampelina) overwinters primarily in infected canes. Mummified berries that fall to the vineyard floor and overwinter have also been documented, and may contribute to disease outbreaks. Sexual and asexual spore structures are found on both infected fruit and cane tissue. Like black rot and phomopsis, spores are splashed onto new tissues in the spring during rain events.

Additional points on vineyard sanitation:

Diseases such as black rot, phomopsis, and anthracnose are reduced through vineyard sanitation because they rely heavily on splashing rain to distribute spores from overwintering structures that are already present within the vineyard. Diseases such as powdery mildew and downy mildew are not as effectively controlled by vineyard sanitation in the same way because of their windblown spores, which are able to travel long distances in large numbers and cause severe outbreaks. While spores of black rot, phomopsis, and anthracnose

are capable of travelling short distances, they do not have the same capacity to move in wind currents, accumulate, and cause outbreaks in a single season. For this reason, diseases such as black rot, phomopsis, and anthracnose are said to have a cumulative effect. This means neglecting control of these pathogens will result in significant increases in disease pressure in each successive year. This contrasts with diseases such as powdery mildew and downy mildew, which can cause devastating outbreaks in a single season if not properly managed.

This is an excellent time of year to walk through your vineyard and remove withered clusters still hanging on cordons and make sure that prunings have been destroyed. A layer of mulch or investment in cultivation will further reduce inoculum. Make sure to pair good vineyard sanitation practices with well-timed sprays early in the season. Good vineyard sanitation and well-timed product application provide an excellent start to a productive year.

Wine and Table Grape Developmental Stages

By: Janet van Zoeren

Over the past two weeks we have had a couple really warm days, when the plants accumulated a lot of degree days, followed by a number of cooler days. Overall, since the last time I was out at West Madison Agricultural Research Station on April 11th, buds have gone from dormant to bud break. Some varieties are much further along than others; for example, La Crosse, Brianna and St. Croix are just beginning to break, while Frontenac in particular has begun to unfold the first leaves. Of the table grapes that I looked at, Einset is still tightly curled up while Somerset is beginning to unfurl.

The following photos were all taken on April 29th or 30th at West Madison Agricultural Research Station.

Frontenac

Marquette

St. Croix

La Crescent

La Crosse

Brianna

Somerset

Einset

Cambridge Beginning Vineyard School

By: Janet van Zoeren

Last Thursday April 21st was the Cambridge Beginning Vineyard School, sponsored by the Wisconsin Grape Growers Association and located at Cambridge Winery. The talks, from six invited speakers as well as a grower panel, covered a lot of ground, exploring pretty much everything you need to know in order to start a vineyard, all the way from site and variety selection through vine training and pruning, and finally disease and insect management! Coming in to the program, I knew very little about vineyard management, and here are a few things I learned on Thursday.

1. There is a difference between "frost damage", which happens in the spring or fall when freezing temperatures damage the green plant tissue after it has started budding out, compared to "winter damage", which is when extremely cold temperatures, especially early in the winter, cause damage to dormant buds or xylem/phloem tissues. In some regions, vineyards will be more prone to frost damage, especially if vines have an early bud break. The northwest parts of Wisconsin have a continental climate, characterized by rapidly fluctuating air temperature on a daily basis, while areas close to Lake Michigan will have more moderated changes in temperature due to the buffer effect of the lake.

2. Itasca is a new white wine grape cultivar which will be released out of the University of Minnesota breeding program in 2017. Some advantages of Itasca are that it is highly cold tolerant and shows resistance to downy and powdery mildew. We recently posted a little information about the Itasca grape on the Wisconsin Fruit website – you can read more about Itasca grapes here.

3. It is recommended to not trim or prune dormant grape vine at planting. In fact, the objective during the first year of planting is to establish a strong root system and let the vines grow as much foliage as possible to provide carbohydrates to the new roots. Grape vine's first pruning should take place the following spring when it's starting its second year. There was a lot of interesting information regarding grape trellising and pruning by presenter Madeline Wimmer. She will be providing an infographic about her work in the next edition of our newsletter, so I will let the expert tell her story then!

4. The most important times for spraying fungicides are just before, during and after bloom. However, no matter what your fungicide program, the most important disease management strategies include sanitation, good airflow and soil drainage, and where practical, using varieties that are relatively resistant to disease.

5. The insect pests you are most likely to see right now are grape flea beetle and climbing cutworms. Flea beetle adults, which emerge in April-May, feed directly on the grape buds, potentially damaging both primary and secondary buds. By feeding on both those buds, flea beetles can, despite their tiny size, reduce yield by up to 100%. Cutworms similarly feed on swelling buds in the spring. The best way to determine if damage is being done by flea beetles or by cutworms is to see when the damage happens – flea beetles are active and feed during the day, while cutworms feed at night.

Special Indar 2F Fungicide Label Approved on Certain Stone Fruits

By: Patty McManus, UW-Madison, Department of Plant Pathology

We recently received word that a 24 (c) Special Local Needs label for Indar 2F (fenbuconazole) was approved by EPA for use on cherries, peaches, and nectarines (although I realize we don't have much peach or nectarine in WI). This label will permit growers to apply Indar 2F at a rate of 6-12 fluid ounces per acre (maximum of 48 fluid ounces per acre per season), compared to the regular labeled rate of 6 fluid ounces per acre (maximum of 24 fluid ounces per acre per season). The target disease is brown rot blossom blight and fruit rot of cherries, peaches, and nectarines. While apricot, plum and prune also get brown rot and are listed on the regular Indar 2F label, these crops are not listed on the special label. To use Indar 2F at the higher rates, you must have a copy of the 24 (c) SLN label in your possession at the time of application. Using Indar 2F according to the special label is subject to all use precautions and limitations imposed by the regular label affixed to the product container.

What are the benefits of Indar and why would you consider using the higher rate permitted on the special label? Fenbuconazole, the active ingredient in Indar, is a sterol demethylation inhibitor (DMI, group 3) fungicide that is *usually* effective in controlling both the blossom blight and fruit rot stages of brown rot, caused by species of the fungus *Monilinia*, and cherry leaf spot, caused by *Blumeriella jaapii*. I say "*usually* highly effective" because where strains of the brown rot or leaf spot pathogens resistant to DMI fungicides are present, the efficacy of Indar decreases as the level of resistance in the fungus increases and as the number of resistant individuals in the fungal population increases. With DMI fungicides, resistance is not "all or nothing," but rather it is "quantitative." This means that rather than having an all-out disease control failure, you get some control, but not as good as you would if strains were fully sensitive to the DMI. It also means that if a DMI provides "some" control at a lower rate, it will generally provide "more" control when applied at a higher rate.

We have strong circumstantial evidence that the leaf spot and brown rot pathogens have developed some level of resistance to the DMI group of fungicides in Door county, where most of the state's cherries are grown. In particular, in orchards where brown rot disease pressure is high (lots of overwintered brown rot mummies and mild, wet weather during bloom and again as fruit ripen), it is difficult to control this disease with the 6 fluid ounce rate of Indar 2F. In such orchards, a higher rate (i.e., up to 12 fl oz per acre), applied at key times, would provide better control of brown rot and also slow down the rate at which further DMI resistance develops. For further information on chemical control of brown rot on stone fruits, refer to the 2016 Midwest Fruit Pest Management Guide, bulletin A4104 available from the UW-Extension online Learning Store (http://learningstore.uwex.edu/Midwest-Fruit-Pest-Management-Guide-2016-P1785.aspx).

Brown rot on cherry fruit

Calendar of Events

May 10, 2016 – Apple Cider Field Day
9:00am-5:00pm at Kickapoo Orchard, 46490 State Highway 171, Gays Mills, WI

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 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

Edited by: Christelle Guédot, Entomology Specialist, UW-Madison and Amaya Atucha, Horticulture Specialist, UW-Madison. *Formatting by:* Janet van Zoeren, Fruit Crops Extension Intern, UW-Extension. Articles provided by other sources as attributed. Funding provided by the University of Wisconsin-Extension. *Email Questions to:* vanzoeren@wisc.edu.