Wisconsin Fruit News

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General Information

What's going on with worker protection?

By: Jane Larson, Worker Protection Specialist, Wisconsin Department of Agriculture, Trade and Consumer Protection

Some of you may be wondering if the federal rule to protect your farm workers from pesticide exposure is still in effect, or if it was delayed.

The simplest, but still confusing answer is, "Yes it is and yes it was." And we can also tell you that, if you already have a worker protection program, keep doing what you're doing. The Worker Protection Standard is not going away.

Some background, if you're not familiar with the story: The Worker Protection Standard, or WPS, was developed by the Environmental Protection Agency to protect agricultural workers and pesticide handlers from pesticide exposure on farms, forests, greenhouses and nurseries. In January, a major revision to the federal rule took effect. The American Farm Bureau Federation and the National Association of State Departments of Agriculture, or NASDA, had asked EPA to postpone the rule revisions, but EPA denied their requests. In February, NASDA again petitioned EPA to postpone the revisions. This time EPA agreed and said that the federal agency would "extend the implementation of all worker protection provisions."

This means there will be changes to WPS, but we don't yet know what those changes will be, nor do we know when those changes will take place. Even though EPA agreed with the petition, the agency must go through a formal process of posting information in the Federal Register. It's likely that EPA will take public comments. This could be a lengthy process, lasting a few months or longer. It's unknown if the entire revised rule will be suspended, or just some portions. It's safe to say that worker protection is not going away; it's a question of which version of the rule to follow. When we have more information, we will notify you through this newsletter, the agricultural media and various commodity groups.

So what is a Wisconsin fruit grower to do? Keep in mind that the revised rule that took effect in January is still in place. Our 14 environmental enforcement staff are visiting agricultural establishments in Wisconsin, including orchards, vineyard and other fruit and vegetable growing operations, to share information on the revised rule and to do inspections.

Our department has taken a "compliance assistance" approach to the new portions of WPS. This means that growers have time to learn the new requirements

and incorporate them into their operations without penalty. This includes requirements such as:

- Providing safety data sheets for all applied pesticides
- Putting a system in place to capture pesticide application information for at least two years
- Medical evaluations, annual fit testing and training for pesticide applicators and handlers when the product label requires the use of a respirator
- No pesticide applicators or handlers under age 18 (family members are exempt)

Other requirements have always been part of the rule, such as providing decontamination supplies, training workers and handlers in pesticide safety and warning workers about pesticide applications. We will continue to enforce those provisions. Again, if you have an existing worker protection program, just keep doing what you're doing. If you aren't sure what is required, contact Jane Larson, DATCP worker protection program specialist, (608) 224-4545, jane.larson@wisconsin.gov. You can also find information online at datcp.wi.gov. Search for "worker protection". You can find resources such as the new WPS How to Comply manual and a self-review checklist at pesticideresources.org.

Biological control Part I: Integrating biological control into an IPM program

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

Biological control involves the reduction of pest populations by natural enemies (including predators, parasitoids, pathogens and nematodes) due to human intervention. In this article (Biological control Part I), we will consider different types of biocontrol strategies and discuss the advantages and difficulties of integrating biocontrol into an IPM plan. In the next issue (Biological control Part II) we will introduce the many effective natural enemies that are found in Wisconsin.

Biological control can be divided into three different strategies: importation, augmentation, and conservation biocontrol. Each can be useful in certain situations. **Importation biocontrol, also known as classical biocontrol,** is used when trying to control an invasive pest. The idea behind importation biocontrol is that invasive pests are often only prolific and problematic because they are outside of their native range, and therefore do not have natural enemies in this new range to control their populations. Therefore, by importing biocontrol agents from the pest's native range, the invasive pest's outbreak sometimes can be kept in check. A concern with this strategy is that the imported biocontrol agent, if it is a generalist feeder, may also feed on our native insects or become a pest itself. For that reason, importation biocontrol requires a great deal of research and time, to determine which potential importation biocontrol agents will be most effective at controlling the pest species, without causing any adverse effects.

Lacewing larva eating aphids. These natural enemies are commercially available for augmentation biocontrol. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org.

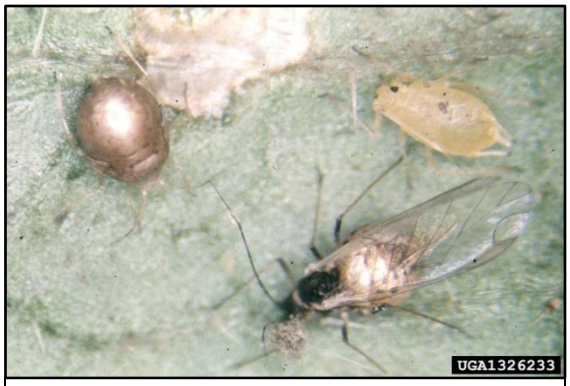
Augmentation biocontrol involves rearing and releasing a biocontrol agent to increase (augment) the existing natural enemy populations. In general, these releases need to be made regularly, like a pesticide application, to continue to maintain control year after year. Some natural enemies commonly used in augmentation biocontrol include ladybeetles, parasitoid wasps, and predatory mites. Augmentation biocontrol is most often used in a greenhouse or other controlled environment, and, in those situations, can be a very effective way to limit pest populations. However, for augmentation biocontrol to be effective, you need to be sure to correctly identify your pest of concern, release a biocontrol agent known to work against the pest present, ensure the timing is right for them to be most useful (at the optimal life stage and density of the pest), and provide the conditions (habitat, shelter, food availability, environmental

conditions) necessary for these biocontrol agents to survive.

Providing the best conditions for natural enemies to thrive is also the key ingredient in **conservation biocontrol**, which involves altering the agro-environment to provide the best conditions for naturally occurring, native biocontrol agents to thrive and be most effective. Some common tactics in conservation biocontrol include providing floral resources for nectar-drinking biocontrol agents, providing hiding and nesting spaces along field borders, and minimizing pesticide application that may have a non-target effect on biocontrol agents. Conservation biocontrol has its own set of challenges, including that it can be more complex or time-consuming to implement, recommendations may be somewhat general, and some research in this field has focused on academic questions rather than practical recommendations. However, many of the tactics for conservation biological control also benefit pollinators, and the cost and time to implement them can often be offset by government or private grants.

How to incorporate biocontrol with other IPM practices

Biological control can be one of the most cost and time efficient pest control strategies. However, it does require an understanding of the pest/predator interactions and of the unintended effects of your other farm management practices.



Green peach aphid "mummies" have been parasitized. Finding abundant aphid mummies indicates a spray may not be beneficial. Photo by Whitney Cranshaw, Colorado State University, Bugwood.org.

The first cornerstone of most IPM programs is monitoring of pest populations (as was discussed in the first installment of this series). When incorporating biocontrol with monitoring, it can be helpful to monitor also for natural enemies, and to adjust the economic threshold for when to spray according to not only the prevalence of the pest, but also the abundance of natural enemies. For example, when scouting for aphids, calculating not only the number of aphids but also the number of parasitized aphid "mummies" can give an idea if natural enemies are likely to control this pest on their own in the near future, which may mean that spraying is not only unnecessary, and thus a waste of money, but could also do more harm than good by decreasing natural enemy populations.

Fruit crop production has an inherent advantage in terms of maintenance of biocontrol agents, since the typically perennial nature of these crops promotes habitat stability, which generally also supports natural enemy populations. Some cultural control methods, such as the use of mulch, have been shown to further encourage natural enemy abundance and diversity. Unfortunately, other control methods can have a negative effect on natural enemies. Sticky traps and insecticide applications may have non-target effects of removing natural enemies alongside pests. However, it certainly can be possible to overcome these difficulties, and to incorporate biocontrol with chemical and other controls. One important strategy to minimize these non-target effects on natural enemies is the development of more selective products, which remove pests but do not target beneficials. Additional strategies to protect natural enemies (as well as pollinators) when using pesticides include spraying at a time and location when beneficials are least likely to come into contact with the pesticides, spraying only when necessary, and, when possible, and focusing spray applications on limited areas where the pest is most likely to be most prevalent (i.e. field edges).

By using these strategies, biological control can be successfully incorporated into an IPM program to help provide effective and cost-efficient pest control, even in places and at times when other control methods cannot be used. In the next issue, we will discuss the different species of natural enemies present in our orchards, marshes, farms, and vineyards.

Much of the information for this article came from the following resources:

Orr, D. (2009). Biological control and integrated pest management. In *Integrated Pest Management: Innovation-Development Process* (pp. 207-239). Springer Netherlands.

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

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

By: Brian Hudelson, Sean Toporek, and Ann Joy

The PDDC receives samples of many plant and soil samples from around the state. The following diseases/disorders have been identified at the PDDC from July 1, 2017 through July 14, 2017.

PLANT/ SAMPLE TYPE	DISEASE/ DISORDER	PATHOGEN	COUNTY
FRUIT CROPS			
Blueberry	*Phomopsis Canker*	*Phomopsis sp.*	*Kewaunee*
Grape	*Anthracnose* *Phomopsis Cane and Leaf Spot*	*Sphaceloma ampelinum* *Phomopsis viticola*	*Dane* *Dane*

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

UW Insect Diagnostic Lab—Fruit Insect Report: July 20th, 2017

By: PJ Liesch

Japanese beetles have perhaps been the biggest insect story in the past few weeks. Japanese Beetles can feed on over 300 different types of plants including many fruit crops: fruit trees, grapes, and cane berries. Adult emergence began in early July and high beetle pressure will likely continue for another 5-6 weeks. While the far northern parts of Wisconsin haven't had to deal with this insect yet, reports coming into the UW Insect Diagnostic Lab indicate that beetle numbers are high most other places in the state. Reports from nearby states have been similar, indicating that Japanese beetles are thriving in the Midwest this year. See page 9 for more information about Japanese beetles in grapes.

Aphids continue to be reported around the state in both fruit and landscape/ornamental plants. Significant biological control by predators (lady beetles and lacewings) and parasitoids (parasitoid wasps and their "mummies") has also been noted. Growers should check for and consider the activity of these beneficial insects before spraying for aphids. In some cases, fungal diseases can also cause aphid populations to crash.

Skeletonizing damage from the **pearslug sawfly** has been noted in a handful of locations scattered around the state (as far north as Douglas County). These slug-like insects typically feed just on the upper surface of leaves, leaving a lace-like pattern behind. A factsheet with basic information about the life cycle and biology of the pearslug sawfly can be found here: hort.uwex.edu/articles/pear-slug-pear-sawfly/

Several cases of **plum curculio** damage have been diagnosed at the UW Insect Diagnostic Lab lately. These are mostly from backyard fruit trees where insecticide sprays may not have been timed correctly or applied at all.

A few reports of **spotted wing drosophila** have come in to the diagnostic lab recently from raspberries and blackberries from the southern part of Wisconsin.

More of a curiosity than a pest, caterpillars of certain **giant silk moths** (such as Polyphemus and Cecropia moths) can feed on fruit trees on occasion. Mature caterpillars can get to be 3-4 inches long. These creatures are most frequently spotted in July and August and are usually found alone or in small numbers, so there's little concern for fruit trees.

Some reflections on weed control in strawberries (Part I)

By: Brian R. Smith, Extension Commercial Fruit Specialist, UW-River Falls

Weeds are more challenging than many of the other pests we have to deal with in strawberry production. Virtually no other pest besides weeds is present at all times of the growing season (and after) and if left unchecked, populations will almost always continue to grow, whether it is a perennial, annual, broadleaf, grass or sedge. Weeds serve as alternate hosts for strawberry insects and disease pests and are unsightly in PYO operations. They outcompete strawberries for light, water and nutrients and have allelopathic (suppressive) effects on strawberries. Weeds are just as migratory as insects and diseases in their own way, as their seeds can be dispersed by wind and water, come attached to strawberry plants, in mulch and travel short distance on your clothing, animals, tractors and implements. Weeds develop resistance to herbicides just like insects and diseases to their respective pesticide controls. Weeds are literally the biggest challenge for many growers. This means that the battle against weeds must take place on multiple fronts and with varying strategies in order to control them adequately. That concept, of course, is known as Integrated Weed Management (IWM).

Effective weed control starts pre-plant. Make sure your rotation schedule fits in well with when you will need to plant more strawberries. Growing agronomic crops pre-strawberries can help immensely with planting year weed pressure; just make sure the herbicides being used are not going to carry over and cause problems in the planting year. Smother crops like sudan, sorghum-sudan hybrids, or grain rye can dramatically lower weed numbers for the next year. The old "flush and burn" also works well, which involves pushing multiple flushes of weed germination and then destroying those weeds early on in their cycle. Two flushes in each of spring, summer and fall can reduce the weed seed bank significantly and target multiple species of weeds that favor certain times of year for germination.

It's always good to take stock of your surroundings and assess and prioritize your weed control program. IWM starts with scouting and making maps of "hot" areas that can easily become unmanageable in a short time if nothing is done. So, just like a grower searches for clipper weevil or botrytis and maps the location, so must the weeds be accurately identified as to location. However, to be able to effectively control those weeds, they must also be accurately identified as to the species. There are many excellent guides out there that will have pictures of the seed, seedling, mature plant, flowers and growth habit. Many of the better guides will indicate the typical area of the U.S. that particular weed is usually found and under what types of conditions.

Many of the worst weeds move in from field edges like chickweed, groundsel and dandelions, so don't discount the importance of identifying potential problem areas in the borders of your fields. You may even have to have a talk with your neighbors and their weed problems bordering your fields! Remember, the nice thing about the border is that you have much more flexibility with herbicides (such as Roundup or Gramoxone), mowing, or establishing a much more competitive cover than within the field. I can remember two years ago, driving on a nine-mile stretch of State Highway 35 between River Falls and Hudson, where there was almost solid Canadian thistle blooming in the median and in the ditches. I thought, "Oh, those poor farmers nearby!" Since this is known as one of the most noxious weeds in Wisconsin, I called up DOT, and within 2 days they had those Canadian thistle mowed. So, you can do your part to help others and you do not always have to be the one totally responsible for weeds along your border! There are many Cooperative Weed Management Areas (CWMAs) in which landowners, local citizens, businesses, non-profit groups, county, state and federal agencies all get together to manage high-risk weed areas, especially after 2009, when the state's invasive species rule (NR 40) went into effect.

Once certain weed species get started, they generally do not blanket an area, but start in small patches and expand. This is the time to hit hard and consider your options with spot treatment. Maybe you can use equipment and/or methods that will not hurt the strawberries, such as wick wiping for taller weeds. On occasion, flaming and more non-selective

approaches are needed that will also kill the strawberries but sometimes a few plants lost are a far superior trade-off than a highly invasive weed that gets out of control. In my home yard, I have had to maintain a lawn-free buffer zone and spray Roundup 2X/summer to keep my neighbor's creeping Charlie from gaining a foothold. It would be beneficial to make sure you have some high quality spot-treatment devices on hand, like a hockey stick rope wick applicator, good hand sprayer (now even many good battery-operated ones) or a slightly larger capacity sprayer with a diaphragm pump for mounting on your ATV and running off of its 12-volt system.

Another mode by which problem weeds can get established can be sourced to field applications of improperly-finished compost or manure. Weed species with small seeds and hard seed coats like pigweed, velvetleaf and smartweed can easily survive livestock digestive systems and germinate in immense numbers in the field. Proper composting is a must, so make sure you trust the sources of your compost. Unfortunately, there are a few weed species that can even survive the typical 125-160^{0}F common in most composting situations. In any case, if new weeds appear in your field after applications of manure or compost, make sure your total weed control strategy will address this, including the use of appropriate herbicides.

Herbicides are just one of many strategies used to control weeds, but they are one of the easiest and cheapest routes; that is why so many growers use them. Unfortunately, ease of use can lead to complacency and just because you get good results a couple of times with a particular herbicide does not mean that it is working to its full potential or will continue to kill weeds as it has in the past. First of all, it is good to rotate between different herbicides, especially with different chemistries, just like fungicides and insecticides. This helps prevent particular weeds like white cockle from becoming a dominant species in your fields and minimizes the chances of a species developing resistance to the herbicide.

Herbicide rotation works well but many other variables should be investigated, including the spray nozzles you are using and your spray tank water carrier amount and chemistry. For most herbicide applications, off-set flat-fan nozzles are most common and work well. A traditional 8002-8004 Teejet, for example, running at 20-30 psi, will have sufficiently large droplets to reduce drift but small enough to provide good post-emergent coverage with little runoff. Smaller nozzles tend to clog easily and will produce a finer spray that is more likely to drift under even 2-4 mph winds. Some of the newer low-drift nozzles such as the Turbo TeeJet or TurboDrop are also becoming more available and eliminate the occurrence of smaller droplets that can easily drift.

Water chemistry can also play a big role in herbicide effectiveness. A condition known as alkaline hydrolysis happens when high-pH tank water causes some herbicides to lose 50% or more of their effectiveness in a matter of minutes or hours as they are hydrolyzed to less active compounds. Much of our well water and pond water tends to be alkaline, so the use of buffering agents like Buffericide or LI 700 Acidiphactant can reduce tank water pH. One can even use food grade citric acid; as an example, 2 oz. /100 gal would lower the pH from 8.3 to 5.4. Adjusting the pH to neutral would be acceptable in most cases. When your water chemistry pH has been adjusted, remember that there is also a recommended total amount of water carrier to use per acre, just like the amount of active ingredient, in order achieve best results. In strawberries, that amount ranges from 10-40 gpa, depending on the particular herbicide. Details are very important!

Most growers are more familiar with the fact that there is also a range of rates recommended for a particular herbicide. Be aware of how your decision should be made regarding this aspect. Many pre-emergent herbicide rate ranges are based on soil type; soils with more sand in composition would be at the low-end of the rate range and the highest rates would be for the clay soils. With post-emergent herbicides, rates tend to be based more on the weed species and the weed stage of development.

The nozzle orientation, spacing and height above the target will play a large role regarding the evenness and amount of the herbicide applied to the target. Traditional flat-fans are offset by about 5^0 on the boom in order to prevent the spray

patterns from colliding because you need to achieve 40-50% overlap in the adjacent spray patterns in order to obtain even concentration on the target (higher concentration in the middle of the spray pattern and lesser concentrations on either side of the pattern). The nozzle spray pattern angle and boom height must also be considered, because the higher the boom, the more overlap there is. A 65^0 spray angle nozzle set-up at 20" spacing on the boom should be 22-24" above the target and an 80^0 spray angle nozzle set-up at the same spacing on the boom should be at 17-19" above the target. Just make sure you are not using even-flat-fan nozzles with this set-up because they have uniform concentration of spray across the entire width of the spray pattern! Even-flat-fans are typically reserved for banding chemicals over the row.

The last subject for this particular article on weed control is spray additives. Each herbicide is different as far as the recommended additive, if any, so make sure you check the label. Here is a summary of the common spray additives and function from one of my ppt. presentations:

- Spray additives (adjuvants)
  - Activators – ↑ penetration through leaf hairs or cuticle
  - Acidifiers – prevent alkaline hydrolysis
  - Buffers – change spray H_2O pH and hold at desired
  - De-foamers
  - Elasticizers/drift control agents – maintain droplet size to ↓ drift
  - Surfactants,spreaders, wetting agents – ↓ surface tension, allowing better spread, some surfactants with some pesticides will act as activators
  - Stickers – herbicide sticks to surface after spray dries (↓'s loss from rain/irrigation)
  - Spreader-stickers – combines characteristics of surfactant and a sticker

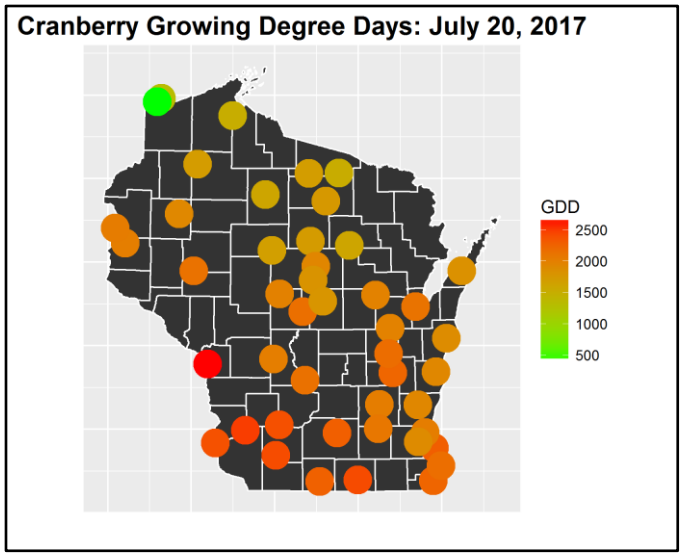
If one looks at the spray guide, fully 1/3 of all the herbicides registered for use in strawberries requires some type of spray additive to be fully effective. Even the RoundUp WeatherMax 5.5EC label suggests adding ammonium sulfate if spraying under drought conditions… Choosing a high quality and appropriate spray additive in itself can make the difference between an effective or completely ineffective herbicide application. Get those hoes ready to go!

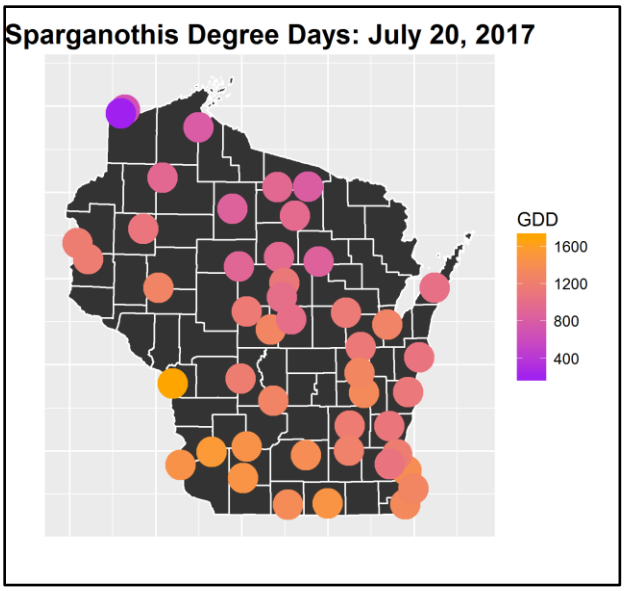
Cranberries

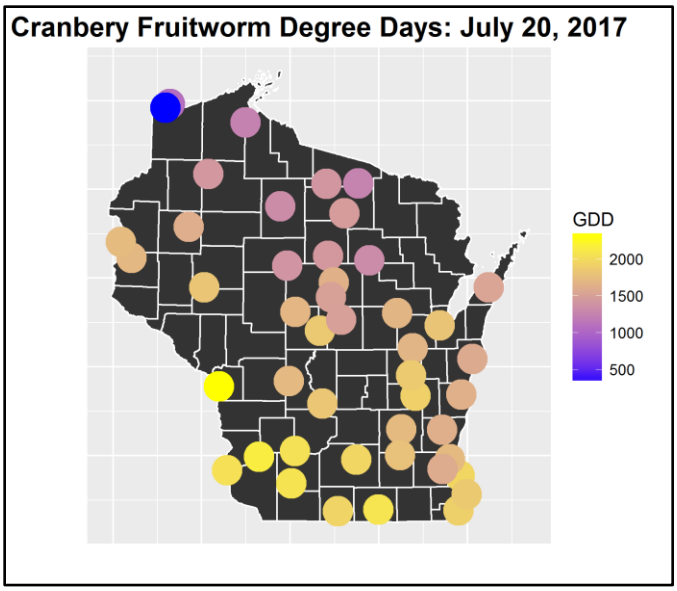
Cranberry plant and pest degree-days: July 20, 2017

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

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







July 20	Cranberry DDs			Sparg DDs			CFW DDs		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Northern WI (Minocqua)	1765.6	1830.2	1700	990.4	1062.3	946.3	1485.9	1554.4	1427.1
Central WI (Wisconsin Rapids)	2228.8	2269.8	2163.1	1354.3	1406.5	1310.4	1919.6	1958.6	1858.5

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

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

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

* Egg hatch window: 895 – 1,890 DDs

Grape insect scouting report – Japanese beetle

By: Christelle Guédot, UW-Madison Department of Entomology

The populations of JB (Japanese beetles, not Justin Bieber!) have been really ramping up in the last week in the Southern part of the state. Last Friday, large aggregations were observed at WMARS on the grapes (see photos), completely defoliating the canopy of plants. Grape is a preferred host plant for JB and overall, the susceptibility of cultivars increases from juice grapes being the least preferred, followed by hybrids, with Vinifera being the most susceptible. For more detail on varietal preference, see the table below with percent of leaf damage from a cage study for different cultivars tested (Gu and Pomper, 2008). JB females lay eggs in grass so that larvae can feed on grass and plant roots. As a result, JB adults tend to be more abundant in grass around fields and plants near grassy areas will see higher populations.

There is no known threshold for JB, but a Michigan study found that caging up to 40 beetles on a grape plant at veraison for two weeks led to less than 7% defoliation and this had no effect on growth parameters, such as cane diameter, cane length, numbers of nodes, pruning weights, and next year's growth (Mercader and Isaacs, 2003). Manually applying 30% leaf area loss had an impact on vine growth when incurred at bloom but not at veraison. In this study, researchers also found a combined effect in that damage at bloom made the vines less tolerant of damage at veraison. This suggests that grape plants can tolerate damage (withstand a certain level of injury without reduction in fruit quality and vine productivity) up to 30% leaf area loss, at which point, the plants start showing a decrease in plant productivity.

Japanese beetle aggregations on grape plants and skeletonized leaves at WMARS. Photo credit: Amaya Atucha, UW-Madison

Management practices

Biological control. There are several biological control agents that attack JB larvae, including bacterial pathogens (milky spores), fungal pathogens (*Metarrhizium* and *Beauvaria*), insect parasitic nematodes, parasitoid wasps, and predator. However, none of these have proven to be very effective in research studies.

Cultural control. Withholding irrigation during adult activity and raising the cutting height of grass to above 3 inches will deter females from laying eggs in nearby turf grass. Irrigating turf in Mid-August and September will help the turf recover from the lack of irrigation.

Different mulch treatments (bark, hardwood chips, and rubber mulch) applied to row middles were shown to all decrease JB larval populations in vineyards with rubber mulch resulting in zero JB larvae (Maier, 2016).

Tilling row middles in blueberry reduced larval populations of JB by 72% compared to grassy row middles and JB adults were less abundant in tilled fields. The timing of tillage (Spring vs. Fall) was not consistent in providing reductions of JB larval populations over the two-year study but overall reduced populations by 50-70% in blueberry fields (Szendrei and Isaacs, 2005).

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

Table 1. Foliage feeding incidence and severity[z] of Japanese beetles to grapes in cages.

Cultivar	Vitis[y] group	Incidence (% leaves damaged)	Leaf area loss[x] (1–10)
Mars	AL	42 d[w]	0.5
Marquis	HL	61 cd	1.1
Reliance	AL	64 bcd	1.1
Catawba (At[v])	AL	64 bcd	1.1
Concord Seedless	AL	64 bcd	1.2
Concord	AL	66 bcd	1.2
Edelweiss	A	66 bcd	1.6
3309 Couderc	A	67 bcd	1.7
Einset	HL	69 bcd	1.6
Cabernet Sauvignon (Pr)	E	72 bc	1.6
Cabernet Franc	E	72 bc	1.8
Vanessa	A	74 bc	1.7
Jupiter	H	74 bc	2.0
Rougeon	AM	75 abc	1.7
St. Croix	H	77 abc	1.5
St. Vincent	H	78 abc	2.5
Vignoles	H	79 abc	1.5
Lemberger	E	79 abc	2.0
Chambourcin	H	80 abc	2.3
Glenora	HL	81 abc	2.6
DeChaunac	H	84 abc	1.9
Marshal Foch	H	84 abc	2.0
Himrod	AL	84 abc	2.7
Chardonel	H	84 abc	3.0
Delaware (Pr)	H	85 abc	2.3
Cayuga White	H	87 abc	2.4
Chardonnay (Pr)	E	87 abc	2.9
Chancellor	H	87 abc	2.9
Frantenac	H	87 abc	2.5
Lacrosse	H	89 abc	2.9
Seyval	H	91 ab	2.5
Vidal Blanc	H	94 a	3.4

[z]Incidence data are reported as percent leaves damaged; however, mean separation was performed on data that was subjected to arcsine square root transformation. Severity of leaf damage was rated as 0 pt, 0%; 1 pt, 1% to 10%; 2 pt, 11% to 20%; 3 pt, 21% to 30%; 4 pt, 31% to 40%; 5 pt , 41% to 50%; 6 pt, 51% to 60%; and 7 pt, more than 60% of estimated leaf area loss (Boucher and Pfeiffer, 1989).
[y]A, American cultivar; AL, American cultivar with *Vitus labrusca* background; AM, American cultivar with Muscadine background; E, European cultivar; H, French hybrid cultivar; HL; French hybrid with *V. labrusca* background.
[x]Denotation of 1 to 10 refers to the leaf number on a shoot, with 1 being the youngest and 10 being the oldest.
[w]Any two means of incidence not followed by a same letter are significantly different at $P \leq 0.05$.
[v]Pr, classified as preferred by Langford and Cory (1948); At, classified as attractive by Langford and Cory (1948).

Cultivar susceptibility to Japanese beetle adult feeding (Gu and Pomper, 2008 HortScience 43: 196-199).

Class (IRAC code)	Trade name	Active ingredient	PHI (days)	Efficacy
Organophosphates (1B)	Imidan 70WP	Phosmet	7-14	Good
Carbamates (1A)	Sevin XLR (4EC)	Carbaryl	7	Excellent
Pyrethroids (3A)	Danitol 2.4EC	Fenpropathrin	21	Excellent
	Baythroid	cyfluthrin	3	Excellent
	Mustang Max 0.8EC	Zeta-cypermethrin	14	Excellent
Neonicotinoids (4A)	Assail 30SG	Acetamiprid	7	Good
Sodium channel blockers (22A)	Avaunt **(Reduced Risk)**	Indoxacarb	7	Good
Diamides (28)	Altacor	Chlorantraniliprole	14	Good
Insect Growth Regulators (n/a)	Neemix 4.5	Azadirachtin	0	Fair
Physical deterrents (n/a)	Surround **(Reduced Risk, OMRI)**	Kaolin clay	0	Good

IRAC Code: Insecticide Resistance Action Committee Mode of Action group code

Erratum: in the previous issue of this newsletter, we discussed Japanese beetle and classified Altacor as a Butenolide (IRAC 4D). This was a typo and was corrected here to reflect its actual class of Diamides (IRAC 28). Human error happens (and we apologize!) and reinforces the fact that you should always fully read and follow the label before spraying any pesticide.

Observations from the vineyard- Berry splitting after heavy rains

By: Amaya Atucha- UW Extension Fruit Crop Specialist

Last week we started seeing some berry splitting in our research vineyard at WMARS in Verona. Our weather station recorded a 5.45 mm rain event in July 10, and a couple of days after berries started showing splitting in almost all varieties (Figure 1). Research done by Dr. Markus Keller at Washington State University has shown that water diffusion across the berry skin is a major pathway of water uptake in berries. During heavy rains, berries uptake large amount of water resulting in a rapid berry enlargement that can induce splitting, and high temperature following the heavy rain events may increase the incidence of berry splitting. In general, berry splitting most often occurs early in the ripening process, at the onset of veraison when berries start accumulating sugar; skin pigments develop, and water content of berries increase. Berry splitting can promote infection by Botrytis, the cause of bunch rot. A fungicide application can help prevent infection.

Figure 1. Berry splitting in Frontenac and La Crescent after 5-inch rain in July 10 at West Madison Ag Research Station in Verona WI.

Wine and Table Grape Developmental Stages for July 21, 2017

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

At the West Madison Agricultural Research Station (WMARS) berries are filling out, and vary from stage E-L* developmental number 32 ("berries touching") to 35 ("berries begin to color and enlarge (beginning of veraison)") depending on the cultivarsAt the Peninsular Agricultural Research Station (PARS), inflorescences are just beginning to open. The vines at PARS are between E-L* developmental number 29 ("berries peppercorn-size, bunches tending downward") to 32 ("berries touching").

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

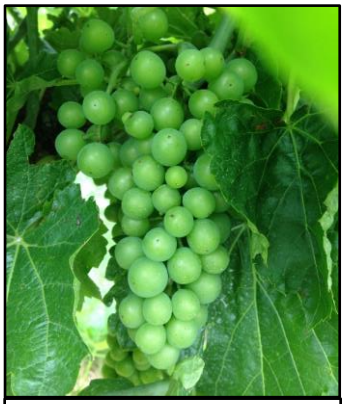
In southern Wisconsin, we've had over 8 inches of rain in the past week, and some of the berries (especially those on the west side of the vines receiving afternoon sun) have some splitting. Luckily, the damage was relatively minor. See

the previous article for information on how to prevent berry loss during periods of heavy rain.

Following photos taken on July 18th at West Madison Agricultural Research Station.

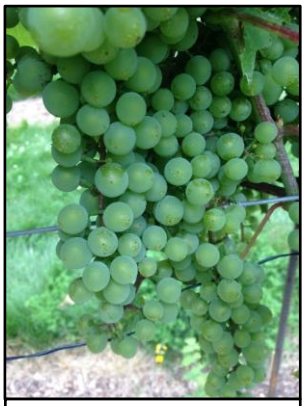
Brianna at WMARS; "berries begin to color" E-L number = 35

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



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

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



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

St. Croix at WMARS; "berries touching" E-L number = 32

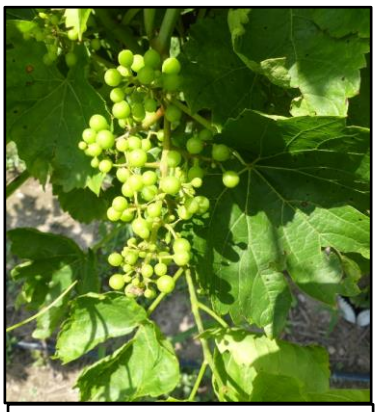
Somerset at WMARS; "berries begin to color" E-L number = 35

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

Following photos taken on July 18th at the Peninsular Agricultural Research Station.

Brianna at PARS; "berries touching"
E-L number = 32

La Crescent at PARS; "pea sized berries" E-L number = 31



La Crosse at PARS; "bunches tending downward"
E-L number = 29

Marquette at PARS; "pea sized berries" E-L number = 31

Frontenac at PARS; "pea sized berries" E-L number = 31

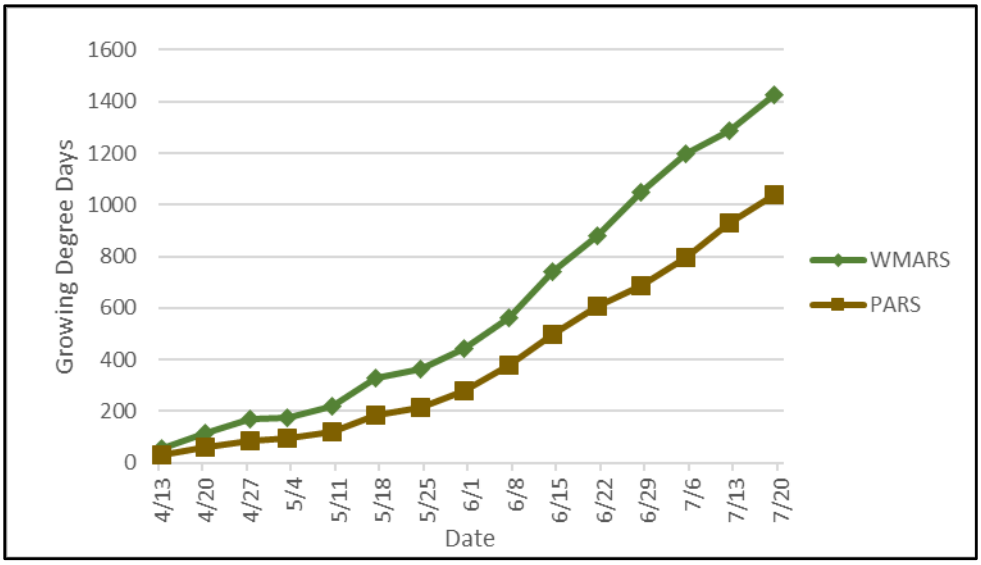
St Croix at PARS;
"pea sized berries"
E-L number = 31

Grape Growing Degree Days

April 1 - July 20, 2017

	2107	2016
WMARS	1426	1487
PARS	1040	1075

The growing degree-day accumulations as of July 20th for this year are: 1,426 GDD at WMARS and 1,040 GDD at PARS. PARS is now about three weeks behind WMARS in terms of growing degree-days, although beginning to catch up developmentally at stages begin to last longer. At both locations, we are just a little bit behind the degree-day accumulation from last year. Degree-days are calculated using a base of 50°F, starting on April 1st as a biofix.



Tree Fruits

Apple Summer Diseases

By: Patty McManus

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

The summer of 2017 has brought more than enough rain to make conditions favorable for the development of the so-called "summer diseases," a complex that includes sooty blotch, flyspeck, and fruit rots such as black rot, white rot, and bitter rot. The fungi that cause black rot and white rot can also infect branches and trunks and cause cankers. This article will provide a quick refresher on these diseases and the use of fungicides to manage them.

Sooty blotch and flyspeck are caused by several different fungi that feed on waxy cuticles of apple and some other fruit and the waxy stems of wild grapevines and brambles that are common in woodlots and hedgerows. Sooty blotch and flyspeck usually are considered together as a disease complex (SBFS), because they show up on apple fruit at about the same time and cause similar types of black specks and smudges on fruit (Figure 1). The SBFS fungi start infecting apple fruit and plants in woodlots in late May and early June. With enough moisture (and we have had more than enough this year in most parts of the state), those early infections produce large spore loads by mid July. Many growers back off on fungicide sprays by mid July, because the threat of scab is less than earlier in the season, but this leaves fruit vulnerable to infection by SBFS pathogens. About a year go I wrote an article on using wetness hour accumulation to guide sprays for SBFS (check the WFN archives for Volume 1, Issue 8, July 22, 2016). Disease prediction models are more valuable in drier or normal seasons when it's not clear whether conditions have been met for disease. In wet years (this year for most of us) you can assume that conditions have been met and SBFS spores are out and about. That said, if SBFS infections are being controlled now and into August, and then we get drier weather, the model might guide you in backing off sprays as you approach harvest.

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

Figure 2. Black rot (left) and white rot (right). Photos from APSnet.

Figure 3. Bitter rot lesion with orange/salmon colored spores on the surface. Photo by P. McManus.

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

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

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

Apple borers: dogwood, American plum, flat-headed and black stem

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

***Dogwood borer*: (Order** Lepidoptera, **Family** Sesiidae, **Scientific Name** *Synanthedon scitula* (Harris))

Dogwood borer eggs are laid under the bark at burr knots or damaged areas on apple or other host trees. The larvae crawl under the bark and feed on the living tissue of the tree, causing a loss of vigor and eventual death. Burr knots are often found on trees with dwarfing rootstocks, including Malling and Malling-Merton. Damaged areas can be caused by pruning, hitting the trunk with a mower or other farm equipment, or places where branches are rubbing against each other.

Identification and Damage Symptoms

The adult dogwood borer flies during the day and looks similar to a wasp at first glanse, although it is in fact a moth. Larvae are light pink maggot-looking caterpillars with a dark brown head, developing entirely within the tree. There is only one generation of dogwood borer per year, but larval development spans from late June through the following spring, overwintering as a larva inside the tree. Damage generally includes a loss of tree vigor, occassionally culminating in death. Dogwood borer feeding sites often have reddish frass on the burr knot or other damage point, which is simialr to that of the American plum borer. These can be distinguished by cutting into the tree to find the larva, which look different (see below for description of plum borer larvae).

Dogwood borer adult. Photo by J.A. Davidson, Univ. Md, College Pk, Bugwood.org.

Monitoring and Control

Monitoring can be done using pheromone-baited traps at approximately head-height in the trees. ***Cultural control*** can include painting a white latex on the trunk of the tree, which discourages dogwood borer females from ovipositing. Additionally, it will help to be aware of which rootstocks are most likely to cause burr knots. Whether using a susceptible rootstock or not, allowing sunlight and air-circulation on the graft union can help minimize the risk of burr knot development. ***Mating Disruption*** (Isomate®) is not currently registered for use in Wisconsin. However, Isomate® has been shown in other states to be an effective product, which, unlike traditional mating disruption pheromones, is a repellant to males seeking out females, pushing them out of the orchard. Should the need arise, we will make an effort to get a mating disruption product registered for your use against dogwood borer. ***Chemical control*** options are detailed in the table below. There are many other tradenames available, and we do not recommend these that are listed above other options. All product recommendations can be found in the 2017 Midwest Fruit Pest Management Guide. You should always fully read and follow the label before spraying any pesticide.

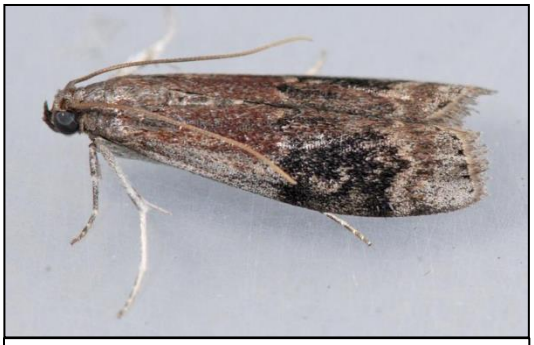
Class (IRAC code)	Trade name	Active ingredient	PHI (days)	Effectiveness
Organophosphates (1B)	Lorsban (Trunk spray)	chlorpyrifos	28	Excellent
Pyrethroids (3A)	Warrior II	Lambda-cyhalothrin	21	Good
	Declare	Gamma-cyhalothrin	21	Good
Neonicotinoids (4A)	Assail	Acetamiprid	7	Good

***American plum borer*: (Order** Lepidoptera, **Family** Pyralidae, **Scientific Name** *Euzophera semifuneralis* (Walker))

American plum borer is a pest of cherry, peach and apple in Wisconsin. Similarly to dogwood borer, the American plum borer enters the tree through burr knots or where the bark has been damaged.

Identification and Damage Symptoms

The adult plum borer is a small brown and white moth, similar to many other pest moths in Wisconsin. Larvae are dark brown to purplish in color. Damage to the tree begins with a loss of tree vigor, and girdling may cause death. Similarly to the dogwood borer, a reddish frass may be seen outside the site of American plum borer feeding; the best way to distinguish between these two pests is by cutting into the burr knot to find the larva inside, as the larvae are very different in coloration.



American plum borer adult. Photo by Mark Dreiling, Bugwood.org.

Monitoring and Control

Monitoring can be done using pheromone-baited traps at approximately head-height in the trees. ***Cultural control*** can include painting a white latex coat on the trunk of the tree, which discourages American plum borer females from ovipositing. Again, you will be least likely to have problems with this pest by avoiding damage to the bark, using rootstocks that are less likely to cause burr knots, and by allowing sunlight and air-circulation on the graft union. ***Chemical control*** is generally not necessary for this pest in apples. However, if necessary, Lorsban has been shown to be the most effective chemical control. You should always fully read and follow the label before spraying any pesticide.

***Flat-headed apple borer*: (Order** Coleoptera, **Family** Buprestidae, **Scientific Name** *Chrysobothris femorata* (Olivier))

The flat-headed apple tree borer is a sporadic pest in Wisconsin, usually affecting only weakened, diseased or damaged trees. However, it can have the potential to cause significant damage if an outbreak does occur, as the larvae move throughout the apple tree, and a single larva can girdle and kill a tree.

Flat-headed apple borer adult. Photo by Joseph Berger, Bugwood.org.

Identification and Damage Symptoms

The adult flat-headed apple borer is a metalic brown beetle, which can be found in Wisconsin during the summer months. Larvae are flat and pink-colored with a wide head. They overwinter as larvae inside the tree, and there is only one generation per year. Damage symptoms include a loss of tree vigor, evenutally causing death.

Monitoring and Control

Monitoring for flat-headed apple borer includes being on the lookout for wilting or unhealthy trees, then looking for areas of depressed and discolored bark and oozing sap. ***Cultural controls*** include being sure to promptly remove wrapping from the trunk of the trees after one season, and keeping the trees well-watered and healthy, as these both decrease the attractiveness of the tree to flat-headed apple borer. Additionally, if a problem does arise in your orchard, you can use trap logs, by lying freshly cut logs of any species, covered in a sticky substance, in the orchard. This will trap and kill ovipositing females. If damage is not yet extensive on an apple tree, it may be possible to save the tree by cutting away the damaged bark and finding and killing the larva. ***Chemical control*** options are listed in the table below. Other product recommendations can be found in the 2017 Midwest Fruit Pest Management Guide. As always, read and follow the label before spraying any pesticide.

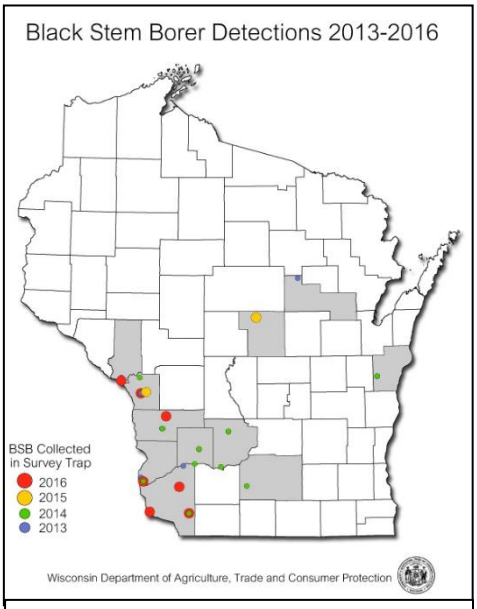
Class (IRAC code)	Trade name	Active ingredient	PHI (days)	Effectiveness
Oxadiazines (22A)	Avaunt **(Reduced Risk)**	Indoxacarb	14	Excellent
Organophosphates (1B)	Lorsban	chlorpyrifos	28	Excellent
	Imidan	Phosmet	7	Excellent
Neonicotinoids (4A)	Assail	Acetamiprid	7	Good

***Black stem borer*: (Order** Lepidoptera, **Family** Curculionidae, **Scientific Name** *Xylosandrus germanus* (Blandford))

Black stem borer beetles were introduced in the United States in the 1930s, and have been an occasional pest on ornamental trees since that time. In the past seven years, black stem borer has become a pest of tree fruit in Michigan and New York State. The reason for this movement from ornamentals into orchards is unclear, as is the level of potential damage from this pest in the future.

Black stem borer adult. Photo by Maja Jurc, University of Ljubljana, Bugwood.org.

In Wisconsin, black stem borer has not yet been found in an agricultural crop, but only in lumberyards and wood waste disposal sites. However, to be on the safe side, it would be good to learn to recognize this beetle and their damage symptoms, and to make sure you get in contact with one of us, or your local extension agent, if you suspect damage from the black stem borer in your fruit trees.



Distribution map of where black stem borer has been found in Wisconsin. Courtesy of WI Department of Agriculture and Consumer Trade Protection and Department of Natural Resources.

Identification and Damage Symptoms

Black stem borer beeltes are rarely seen outside of the tree; in fact, the males generally does not leave the galleries of tunnels within the tree, and only the female will fly to another location to mate and lay eggs. They are thought to have two generations per year in Michigan. Unlike our typical apple tree borers, black stem borer does not feed on the tree itself, but instead cultivates a fungus on the tree, and then feeds in turn on the fungus. Damage symptoms of the black stem borer include vertical lines of circular holes on the tree trunk, possibly with oozing sap or with sawdust and frass 'toothpicks' coming out of the holes.

Monitoring and Control

Monitoring is probably not necessary at this time, as there is no evidence to date of black stem borer in Wisconsin orchards. If you suspect damage, and would like to trap for the adult females, you can make your own trap by cutting a few windows into a 1- to 2-liter plastic container, then baiting it with vodka or antifreeze. The beetles are tiny (2 mm long), and require a microscope for positive identification. ***Cultural control***, removing and burning any affected trees, is currently the recommended strategy for this pest. ***Chemical control*** options can be found in the 2017 Midwest Fruit Pest Management Guide. You should always fully read and follow the label before spraying any pesticide. Please note that systemic insecticides have no effect on black stem borers, as they do not feed directly on the tree, but only on the associated fungus.

Comparison of Calcium products to control Bitter Pit in 'Honeycrisp' Apples

By: Amaya Atucha, UW-Extension Fruit Crop Specialist

This week at the Apple Field day, hosted at Green's Pleasant Spring Orchards near Stoughton WI, we reviewed factors affecting bitter pit incidence in 'Honeycrisp'. During the mini sessions there was some discussion regarding different products available in the market, including some calcium formulation derived from Calcium Carbonate, and their effectiveness compared to Calcium Chloride, which can be corrosive and phytotoxic. I have attached here the summary of a study conducted by Dr. Alan Biggs and Dr. Gregory Peck in which they compared several formulations of foliar Ca products for managing bitter pit. They concluded that high concentrations of foliar Calcium Chloride applications throughout the growing season were the best treatment to control bitter pit in Honeycrisp.

The article was published in HortTechnology June 2015 vol. 25 (3): 385-391. *"Managing Bitter Pit in 'Honeycrisp' Apples Grown in the Mid-Atlantic United States with Foliar-applied Calcium Chloride and Some Alternatives"* by Alan R. Biggs and Gregory M. Peck.

Three separate experiments were conducted to test standard calcium chloride salt (CaCl2) rates and several new formulations of calcium (Ca) for amelioration of bitter pit, a Ca-related physiological disorder that affects fruit of many apple (*Malus domestica*) cultivars, including the popular cultivar Honeycrisp. Even small amounts of bitter pit damage make apples unmarketable. We evaluated various formulations of Ca to compare their effectiveness in controlling bitter pit, including proprietary Ca products (InCa™, Sysstem-Cal™, Vigor-Cal™, XD10, and XD505) with and without antitranspirant. Calcium chloride is the most common Ca product used to reduce bitter pit incidence, but it has negative impacts, such as phytotoxicity and corrosiveness. Of the products that were tested in 2011, XD10 at the high rate and XD505 are candidates for future study. In 2012, both the CaCl2 and XD10 treatments had lower bitter pit severity than the nontreated control, but only the CaCl2 treatments had a lower total percentage of fruit with bitter pit compared with the control. The antitranspirant reduced bitter pit incidence in one of three treatments. Full season Ca treatments and higher rates (up to 23.5 lb/acre per season of elemental Ca) are needed to significantly reduce bitter pit incidence in 'Honeycrisp' apples in the mid-Atlantic United States.

InCa™ contains 5% Calcium derived from Calcium Nitrate (4% Nitrogen) plus Zinc Nitrate (1% Zinc).
Sysstem-Cal™ contains 4% Calcium derived from Calcium Carbonate plus Copper Carbonate (0.24% Cu).
Vigor-Cal™ contains 5% Calcium derived from Calcium Carbonate.
XD10 and XD505 were experimental formulations not commercially available.

Calendar of Events

Aug 3, 2017 – PARS Vineyard Walk

Peninsular Agricultural Research Station, 4312 Hwy 42 North, Sturgeon Bay, WI

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.

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