



In This Issue

- Crop Conditions
- Cold Injury to Fruit Crops
- Determining Winter Injury in Grape Vines
- Pruning to Adjust for Winter Injury and Avoid Spring Frost Damage to Grapes
- Pruning Brambles
- Anthracnose on Blackberries and Black Raspberries
- Straw Removal on Strawberries
- Strawberry Winter Protection: Straw Mulch vs. Row Covers
- Update your FieldWatch/DriftWatch Information
- Census of Agriculture
- Midwest Fruit Pest Management Guide (ID-465) available
- Woolly Apple Aphid
- Oil Sprays
- Pheromones and Pheromone Traps
- Spring Temperatures
- Increasing Apple Fruit Set in Cold Springs
- The First Fruit Made with a Blockbuster Gene-editing Tool
- China Proposes 15% Tariff on Fresh Fruit, Wine
- Forewarned is Forearmed
- EBDC Timing for Bitter and Summer Rot Control
- Fire Blight
- Powdery Mildew
- Peach Scab
- Gene Stuckey Obituary
- Upcoming Events



Grape dormant



Blackberry dormant



Apple dormant



Peach dormant

Crop Conditions

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323) & (Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

It has been a cool spring so far and most fruit crops are still relatively dormant in the Lafayette area. Early grapes are just at bud swell, red raspberries are also showing signs of growth, sweet cherry buds are swelling, and early apples are at silver tip.

Fruit trees in Lafayette remain dormant, however are pushing forward in more southern areas of the state. In southern Indiana apples are at or past full bloom and peaches are in shuck split. Blackberries are at half-inch green.

Cold Injury to Fruit Crops

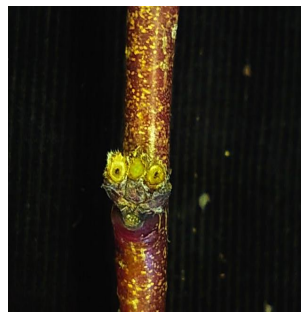
(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

This winter was significantly colder than normal in the northern half of Indiana. Many areas north of "I-70" experienced temperatures between -15 and -20°F in early January. That is cold enough to cause considerable cold injury to grapes, peaches, and blackberries. Ten below zero is a commonly accepted threshold for seeing damage to cold sensitive crops. In Lafayette, we had a minimum winter temperature of -19°F on Jan. 2, but also had three other mornings when temperature reached -17°F.

We have evaluated fruit crops at the Meigs Horticulture Research Farm in Lafayette and found considerable injury. Peach flower buds appear to be 100% dead. Most blackberry cultivars appear to be severely injured, but raspberries appear to be fine. With brambles, damage occurs to the cambium in the canes rather than the buds. Sweet cherries have some minor damage, but should have plenty of live flowers for a full crop. Apples are cold hardy and seldom damaged. I only checked Golden Delicious and the flower buds appear to be fine. I also found some injury to paw paw flower buds as well. I did not check strawberries, but any that were not covered by straw are sure to have some crown damage.

Injury in grapes depends largely on cultivar. Cold hardiness varies greatly among commonly grown cultivars. In our trials, several cultivars have more than 50% primary bud injury. These include Chambourcin (45% live), Noiret (32% live), Cayuga white (23% live), Traminette (21% live), and Vidal (18% live). Super cold hardy cultivars like Brianna, Frontenac, Marquette and LaCrescent are 80-95% live. Concord has 73% live buds. Fortunately, grape growers can adjust pruning severity to make up for damaged primary buds. Once the extent of cold injury is determined, a grower can decide if they need to adjust pruning severity. By leaving extra buds to account for those damaged, a full crop can be produced. I posted an article earlier with a short video to explain how to check grape buds and adjust for injury. It is included again in this issue.

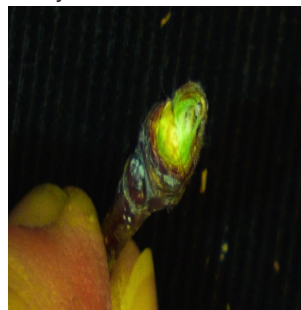
Even though we have seen significant damage in our area, that doesn't mean there won't be a crop of fruit across the state. For instance, I checked peaches in the Goshen area recently and they looked fine. Peaches are seldom grown in regions where cold injury is likely. That's why most of the commercial peach orchards in Indiana are in the far southern counties along the Ohio River, or near Lake Michigan in the northern part of the state. Even if there is considerable injury, it only takes about 10% of the flowers to produce a full crop of peaches. Many blackberry growers are using a rotating cross arm trellis and cover the plants over winter. This year will be a test of that system. Hopefully there will be a good crop of all fruits this year. Let's hope we get past spring frost damage.



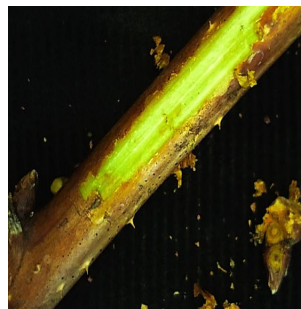
Peach with dead flower buds and live vegetative bud



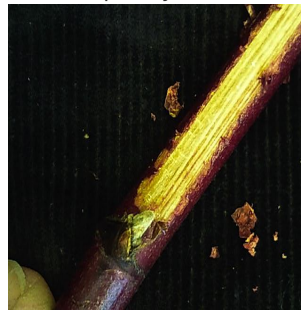
Sweetcherry flower buds about 50% dead



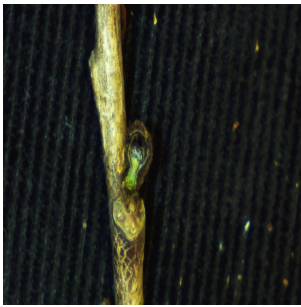
Apple bud - alive



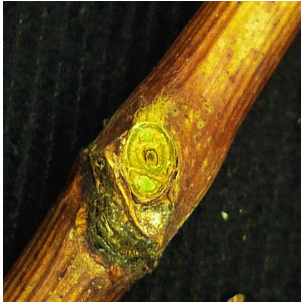
Red raspberry cane - live



Blackberry cane - dead



Paw paw flower bud – dead



Concord grape with dead primary bud

Determining Winter Injury in Grape Vines

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

This winter was significantly colder than normal in the northern half of Indiana. Many areas north of "I-70" experienced temperatures between -15 and -20°F in early January. That is cold enough to cause considerable cold injury to grapes, peaches, and blackberries. See the map below for minimum winter temperatures.

We have evaluated crops at the Meigs Horticulture Research Farm in Lafayette and found considerable injury. Peaches are 100% dead. Most blackberry cultivars appear to be severely injured. Injury in grapes depends largely on genotype (cultivar). Cold hardiness varies greatly among commonly grown cultivars. Cold tender cultivars such as Chambourcin and Vidal have significant damage. In our trials, several cultivars have more than 50% primary bud injury. These include Chambourcin (45% live), Noiret (32% live), Cayuga white (23% alive), Traminette (21% live), and Vidal (18% live). Super cold hardy cultivars like Marquette and LaCrescent are 85-95% live.

Growers need to know how much injury has occurred before they prune so that they can adjust pruning severity. It is important to check buds from your plantings. Our results may differ considerably from yours. Many factors affect relative cold hardiness including vine vigor, crop load last season, late season leaf disease incidence, etc. as well as the temperature that occurred at your location. I recommend growers do a thorough evaluation of their most tender cultivars first, then moderately hardy and finally hardy cultivars. Our general recommendation is to collect a sample of at least 100 buds. I generally take ten 10-node cuttings of each cultivar. Choose canes that are

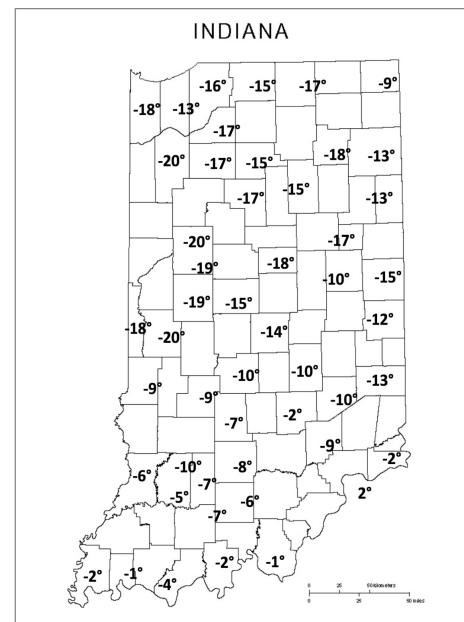
representative of those you will save for fruiting wood this year. Avoid shaded or excessively vigorous canes. Since the cold damage occurred in early January there has been plenty of time for the damage to show up. If samples are taken immediately after a cold event, it is recommended that they be brought indoors and allowed to warm up for 24-48 hours to allow browning of damaged tissues. Check bud survival by slicing through the buds with a sharp razor blade. Start about 1/3 of the way from the tip and slice progressively deeper until you can see the main, primary growing point. With some practice it is easy to also check the secondary growing point as well. The video clip mentioned below shows how to properly dissect buds.

Once you've determined if you have cold injury, you can decide if you need to adjust your pruning severity. By leaving extra buds to account for those damaged, you can produce a full crop and maintain vine balance. For instance if 40% of the primary buds are dead, then only 60% of the buds are alive. To assure that we have the desired 50 shoots per vine (on an 8 foot vine spacing), we will need to leave extra buds. To determine how many to leave, divide 100 by the percent live buds. For example, $100/60 = 167\%$. So we need to leave $50 \times 167\% = 84$ buds to end up with the appropriate number of live primary shoots and fruit clusters. If more than 50% damage occurred, we recommend pruning lightly and adjusting shoot counts after bud break.

If you have questions about winter injury and pruning adjustment, don't hesitate to contact me at bordelon@purdue.edu.

The attached video clip (about 3 min) shows how to dissect grape buds to determine injury.

https://mediaspace.itap.purdue.edu/media/Winter+injury+in+grapes/0_vus5dd3n



2018 Minimum winter temperatures

Pruning to Adjust for Winter Injury and Avoid Spring Frost Damage to Grapes

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

Spring freeze damage can be a significant economic problem for Midwest grape growers. Widespread damage occurred in 2007, 2012 and 2017 when warm temperatures in February and March were followed by freezing temperatures. Obviously this year has been very cool so far so there is hopefully less risk of early budbreak and frost damage. But, considering that we had fairly significant winter injury in the northern half of the state, we need to do all we can to avoid further damage.

So far it looks like bud swell is on track for a normal year. Most growers are reporting that their grapes are still dormant, or mostly so. Grapes pruned recently are bleeding, meaning that activity is beginning and bud break will not be far behind. There is still the potential for frost and freeze damage. The average date of last spring frost for central Indiana is about May 1. At early stages of swell, buds can tolerate temperatures in the single digits or low teens, but as they progress they rapidly lose hardiness. A bud at full swell can be damaged by temperatures about 20°F. Once bud break occurs, damage happens at 28°F.

Varieties differ considerably in the amount of heat units (growing degree days -base 50°F) needed to cause bud break. Exact figures are not well established, but for early grapes such as Foch, Marquette and Brianna, I think 120-150 GDDs is sufficient to lead to bud break. For late varieties such as Vidal and Chambourcin, it is likely 150-180 or more. We normally start counting seasonal GDDs on April 1, but by then, we are already at bud break in the south. So it makes sense to consider those that occur earlier when determining date of bud break. We also have to take into account the accumulation of chilling hours. Plants require a certain amount of chilling (temperatures between 32 and 45°F) to satisfy their “rest” period, or dormancy, before they will respond to warm temperatures. So warm temperatures in January or February don’t necessarily mean cause for alarm as chilling requirement may not have been satisfied. Grapes don’t need as many chilling hours as some fruit crops, but probably at least 1,000. We accumulated over 1,000 chilling hours by late February this year, so vines are ready to respond to the warmer temperatures. If we look at GDDs since Jan 1, it gives us a good idea of where we are in terms of heat units needed to cause bud break. I checked this week and we have accumulated about 100-130 in southern Indiana, about 50-60 in central Indiana, and 20-40 in northern Indiana. Some of these GDDs may have occurred before chilling was satisfied.

Fortunately growers have some options to manage freeze risk and adjust for winter injury. A technique called long pruning or double pruning helps avoid spring frost and freeze damage, especially on varieties that tend to bud out early. The procedure utilizes the apical dominance of buds on a cane. The first buds to begin growing are those on the tip of a cane, while buds closer to the cordon begin growth later. Additionally, if more buds are left on a vine, the rate of bud development for all buds will be delayed. Since many northern growers have 50% or more winter injury this

year, they may already be pruning minimally (see related article). But for others, this technique may offer a method or risk management.

To perform long pruning, select canes to be used for fruiting spurs during the normal pruning practice, but leave those canes long, with 10-15 more buds than desired. Spurs are normally pruned to 3 to 4 nodes for fruiting, but if they are not cut back, then the extra buds will help delay the development of the desired basal 3 to 4 buds, which helps avoid frost injury. After the date of the last probable spring freeze has passed, the canes are shortened to the desired length to properly adjust the shoot number for the vine. Growth of the basal buds can be delayed as much as two weeks if weather conditions are favorable. For vines with winter injury, final decision on pruning can be done once fruitfulness of shoots can be determined.

Another advantage of double pruning is that if frost damage occurs to primary shoots, the large number of buds retained will result in many secondary shoots. Even though secondary shoots are not as fruitful as primaries, the large number can result in near normal yields. While this procedure requires more labor, it can mean the difference between a full crop and little or no crop.

Pruning Brambles

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

It’s been a cool spring this year and brambles are still mostly dormant in the Lafayette area. This is a good time to finish pruning chores. In summer fruiting types, this past year’s fruited canes should be removed if they were not removed last summer or fall. Remove weak or spindly floricanes and thin to 4-6 canes per foot of row depending on vigor and type. Laterals on blackberries and black raspberries should be shortened to about pencil diameter on thornless blackberries (these could be 3 to 4 feet long), or to 6 to 12 inches on black raspberries to promote flowering on strong wood. Strong wood produces the largest fruit. Red raspberry canes can be tipped if desired, but no more than about 1/4 of the total cane length. If the planting is trellised, the canes should be tied to the wires now before growth starts.

Fall bearing types can be handled in two ways: either mowed to the ground for a fall-only harvest on primocanes; or if a summer and fall crop is desired, retain the floricanes but remove the fruited tips and thin out weak floricanes.

Remove and/or destroy the prunings to help prevent diseases. It is better to remove and burn the prunings than mow or flail chop in the planting.

There may be some winter injury this year in blackberries, depending on location in the state. See the related article on winter injury in this issue.

Anthracnose on Blackberries and Black

Raspberries

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

Anthrachnose, caused by *Elsinoe veneta*, is a common fungal disease on black raspberries and some blackberries. It is much less common on red raspberries. Most modern thornless blackberries (Apache, Triple Crown, Osage, Ouachita, etc) are resistant to anthracnose. Most black raspberry cultivars are highly susceptible. If you grow a susceptible variety, it is important to control this disease early. Damage to canes and leaves can reduce vigor and fruit size, and fruit infections are possible. A single application of fungicide is effective at controlling anthracnose, but timing is critical. It must be applied just as the shoots are beginning to grow. Normally we recommend applications at 1/2 to 3/4 inch shoots.

The time for applications is upon us! Brambles should be at the appropriate stage for treatment soon. Apply liquid lime sulfur, Sulfurix, or copper hydroxide according to label recommendations. Lime sulfur or Sulfurix may burn the leaves if they are beyond 1 inch long, especially on hot, sunny days. If your crop has advanced too far, you may want to apply the lowest recommended rate, or apply on a cool, cloudy day or late in the evening. Copper hydroxide is less likely to cause leaf burning.

Straw Removal on Strawberries

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

The proper time to remove straw from matted row strawberries is when the bare-soil temperature at 4 inches averages about 40-43°F. This usually coincides with mid to late March in central Indiana. This year is later than average with soil temperatures still in the 40s. Plants will begin pushing new leaves as the soil temperatures rise steadily so the straw should be raked off the tops of the beds and into the row middles. Leaving some straw on top of the beds for plants to grow up through provides a clean surface for fruit. Straw should be removed from beds before the plants grow enough to cause yellowing of foliage. Allowing the leaves to become etiolated (yellowed with long petioles) due to late straw removal can reduce yields by as much as 25%. However, uncovering the plants early may promote early growth and increase chances of frost or freeze injury. The difference between early removal and late removal may increase first harvest by about three days, so there is no real advantage. After the straw is removed the frost protection irrigation equipment should be set up and tested and made ready for frost during bloom.

Strawberry Winter Protection: Straw Mulch vs. Row Covers

(Wenjing Guan, guan40@purdue.edu)

Although strawberry plants can be quite cold hardy, they need protection to survive the winter. In North Carolina, growers use

floating row covers to protect strawberries in the winter. In Indiana, straw mulch is a more traditional way of winter protection for strawberries grown in a matted row system.

After two relatively mild winters in 2015 and 2016, I heard successful stories about growing strawberries with the plasticulture system and using row covers for winter protection in Southern Indiana. Can the system also be successful in a colder winter, like the one that just passed? Our ongoing strawberry study will provide the answer. This article provides an update from this project comparing strawberries covered with straw mulch (about 4-inch thick) and row covers (two layers of 1.5-oz/yard² row cover laid on wire hoops) this past winter (Figure 1).



Fig. 1 Strawberries were covered with straw mulch and row cover. Picture taken January 9 2018

Temperature

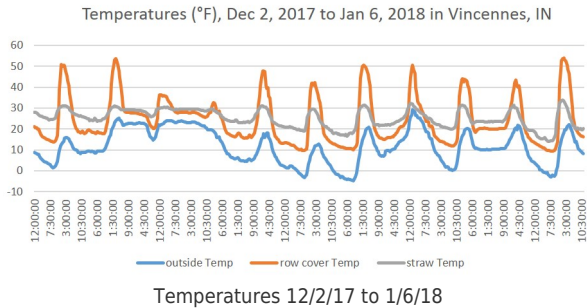
Between Dec. 27 to Jan 6, we had the coldest nights of the season in Vincennes, IN. The recorded lowest temperature was around -5°F. The lowest temperatures under row covers were 10°F, while under straw mulch, it was about 15°F. At the dormant stage, strawberries are hardy to 10°F. The plants under row covers encountered the threshold temperature thus we lost 3 out of 192 plants and a few plants were injured. Note the difference of plant growth of the same variety (Figure 2).



Fig. 2 Different sizes of Chandler plants. Picture was taken March 27 2018

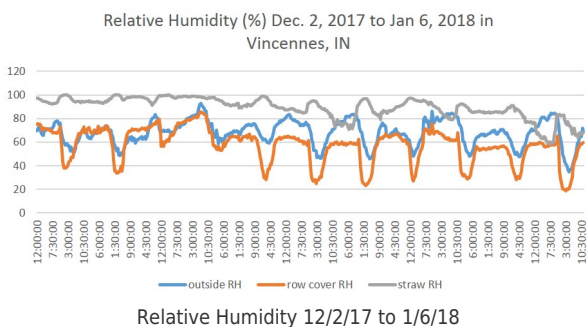
Temperature fluctuations were the greatest under row covers. Temperatures under the row covers reached 50°F on sunny days,

even when the air temperature was quite cold. Temperature fluctuations were the smallest under straw mulch, and ranged from 15°F to 32°F. The accumulated heat under row covers suggests the plants could potentially come out of dormancy early and be subject to cold damage.



Relative Humidity

Relative humidity was the highest under straw mulch, while lowest under row covers. The high relative humidity explained why the majority of the leaves were rotted when we removed the straw in the spring. The rotted leaves and the remaining straw provide the perfect condition for the development of Botrytis fruit rot. Compared with the strawberry plants covered with straw, plants under row covers were much cleaner. We removed the dead leaves on these plants, which is a strategy effective in controlling Botrytis.



We will have more updates on the project as the season progresses. Watch for opportunities to see our research at upcoming SWPAC field days.

Update your FieldWatch/DriftWatch Information

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

FieldWatch is an easy-to-use, reliable, accurate and secure on-line mapping tool intended to enhance communications that promote awareness and stewardship activities between producers of specialty crops, beekeepers, and pesticide applicators. Originally developed at Purdue University, FieldWatch is now a non-profit company with support from producers, applicators, agricultural chemical companies and other organizations.

The program allows specialty crop producers and beekeepers to enter their locations on a secure on-line map. The map is viewed

by pesticide applicators so they know what crops are in the area they intend to treat. All you need to do to sign up is visit <http://www.fieldwatch.com/> and follow the easy tutorials under the resources tab. Once you have an account, you should be asked to update your FieldWatch (DriftWatch) information each year. If you have not heard from FieldWatch recently, log on to to update your account information. The service is free. You can purchase signs at reasonable prices to post at your location as a visible notification to applicators. See signs below.



Specialty Crop sign



Beehive sign

As most of you know, 2018 will likely be one of the most challenging years ever for drift and off-target damage. This past year, 2017, saw a record number of drift complaints in Indiana and across the Midwest, mostly due to dicamba. A very large increase in the acreage of Monsanto's Dicamba-Tolerant "Xtendimax" soybeans is expected in the state this year. Millions of acres of DT beans could be sprayed with dicamba in May and June so the potential for off-target damage is enormous. Special

training programs have been held for applicators this year by Purdue Extension. All dicamba applicators are required attend the training. A requirement of the dicamba product labels is to check FieldWatch to determine where sensitive crops exist. Your orchard, vineyard, blueberry farm, high tunnel, etc is protected by product labels that restrict making an application if the wind is blowing toward your crop. But if the applicator doesn't know you are there, they can't make the right decision. So be sure to sign up on FieldWatch today or update your account information. The spray season for row crops is coming up soon.

Census of Agriculture

(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

If you sold, or normally do you sell, more than \$1000 worth of agricultural products in a year then it is your responsibility to fill out the 2017 USDA Census of Agriculture. USDA's National Agricultural Statistics Service (NASS) needs a Census of Agriculture response from ALL the nation's producers. In order to get an accurate representation of American agriculture – of all farmers and ranchers across the country – NASS will continue to accept completed census questionnaires through spring. NASS has heard that some producers need extra time due to planting, bad weather, or gathering documents for taxes and the census. All operations are important and every response matters. NASS is committed to giving producers every opportunity to be represented in these widely-used data. We must communicate and paint an accurate picture of our agricultural industry in order to garner support from the public and legislature.

Federal law mandates that everyone who received the 2017 Census of Agriculture questionnaire complete it and return it even if not currently farming. NASS will follow-up via mailings, phone calls, and farm visits with producers who have not yet responded. To avoid these additional contacts, farmers and ranchers are encouraged to complete their census either online at www.agcounts.usda.gov or by mail as soon as possible. For more information about the 2017 Census of Agriculture, visit www.agcensus.usda.gov. For questions about or assistance filling out the census, producers can call toll-free (888) 424-7828.

Midwest Fruit Pest Management Guide (ID-465) available

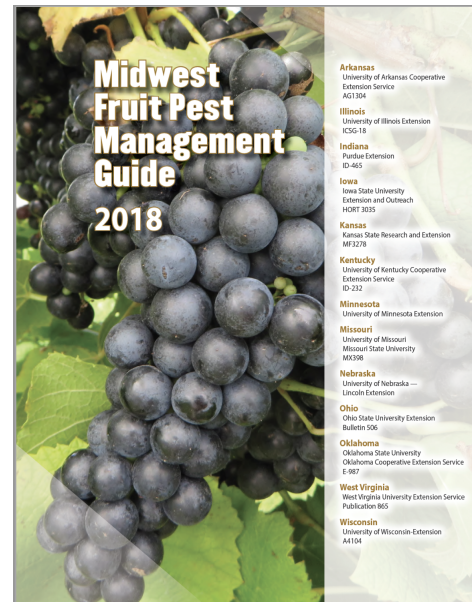
(Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

The Midwest Fruit Pest Management Guide is updated each year by the Midwest Fruit Workers group to provide the most complete information and recommendations for controlling weeds, diseases and insect pests of all major fruit crops grown in the Midwest. For the past three years, the guide has combined information on tree fruit, small fruit and grapes. There are many revisions in this year's version as there have been a number of label changes by manufacturers and several new products registered. The guide is valuable resource for all fruit growers as it keeps them up to date on the latest products, registrations and recommendations. Be

sure to get a new copy before the spray season starts.

The guide is available from the Purdue Education Store in print format for \$15 plus shipping and handling at: https://edustore.purdue.edu/item.asp?Item_Number=ID-465. Copies will also be available at some of our workshops and summer meetings. It is also available as a free download at our website at:

https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx. The on-line version includes updates and corrects any mistakes found after printing.



Cover of the 2018 ID-465

Woolly Apple Aphid

(Ricky E Foster, fosterre@purdue.edu)

Woolly apple aphids seems to be an increasing problem with a growing number of fruit growers. One of the difficulties with this pest is that it has both an aboveground form that feeds like most other aphids and a subterranean form that feeds on the roots. Both need to be controlled. After consulting with a number of colleagues, I suggest growers consider some or all of these suggestions if woolly apple aphids are an ongoing problem.

1. Make a pre-bloom application of Lorban.
2. Make an application of Movento at petal fall/first cover. Movento will move down to the roots and help control that form of the pest. You may not see immediate results from this application. You may need to do this for several years before the results are obvious.
3. Substitute diazinon for a cover spray at some point in the summer, probably when codling moth pressure is relatively low.
4. Add 1% Saf-T-Side oil to some cover sprays if you are not using captan or Sevin.

Oil Sprays

(Ricky E Foster, fosterre@purdue.edu)

One of the first and most important parts of a good insect and mite management program is the application of an early season oil spray to control European red mites, San Jose scale, and several species of aphids. Scales overwinter on the tree as nymphs and European red mites and aphids overwinter as eggs. Because two-spotted spider mites do not overwinter on the tree, oil sprays are not an effective control measure for that species. Although scales, European red mite eggs, and aphid eggs may appear to be inactive, they are living organisms and, therefore, must respire, or breathe. The application of the oil creates an impervious layer over the pests that will not allow the exchange of gases, causing the pest to die of suffocation. We have seen a resurgence of San Jose scale in recent years in some orchards. If you had scales on your fruit last fall, then a well-timed oil spray is highly recommended. Earlier oil sprays are more effective than late sprays for San Jose scale control. For growers who may need to use pyrethroid insecticides to control brown marmorated stink bugs, I think the oil sprays become even more important.

Oil sprays should be applied between 1/2-inch green and tight cluster. Apply a 2% rate at the 1/2 inch green stage or a 1% rate at tight cluster. Oil sprays should not be applied during, immediately before, or immediately after freezing weather. For best results, apply when temperatures are 45oF or above, and not just before rain showers. Remember that oils are not directly toxic to the pests. They only work by suffocation. Therefore, the better the coverage, the better control you will receive. Our data have shown that mite control is improved if oil is applied at tight cluster rather than at 1/2 inch green.

One note of caution: If you are using captan as a part of your early season fungicide program, you should skip the oil spray. Spraying oil and captan within about 2 weeks of each other can result in serious phytotoxicity.

Pheromones and Pheromone Traps

(Ricky E Foster, fosterre@purdue.edu)

One way insects communicate with individuals of the same species is with pheromones. Pheromones are volatile chemicals released by an insect that usually can be detected only by individuals of the same species. There are a number of different types of pheromones, but the most common type is the sex pheromone. Usually the females will emit a tiny amount of a chemical that attracts the male to her and increases the likelihood of mating. Because the chemical is volatile, air currents carry it. The male detects the pheromone in the air with receptors on his antennae. He then flies upwind to find the source of the pheromone, a prospective mate. The chemical compositions of pheromones for a number of pest species have been identified and synthetic copies can be produced in the laboratory. Synthetic pheromones can be used in conjunction with traps to catch male insects.

There are a number of fruit pests that can be monitored with pheromone traps. For growers who have not used traps before, I suggest starting out by trapping for codling moth, spotted tentiform leafminer, or peachtree borers. As you gain experience with the traps and learn how they can improve your pest management practices, you may want to begin trapping for additional pests.

The proper timing for setting out pheromone traps for fruit pests are:

[Edit](#)

Pest	Start Trapping
Redbanded leafroller	Green tip
Spotted tentiform leafminer	Green tip
Oriental fruit moth	Pink (in peaches)
Codling moth	Pink
Fruit tree leafroller	Pink
Lesser peachtree borer	Late April
Obliquebanded leafroller	Mid-May
Peachtree borer	Late May

Monitoring with pheromone traps lets you know when the insect is active. This allows you to better time control practices or, in some cases, to determine if control is even necessary. If you choose to control spotted tentiform leafminers with sprays targeted at the adults, having pheromone traps will help you know when the moths are flying in large numbers. For codling moth control, we can use a combination of pheromone trap catches and degree day accumulations to better time sprays. This will be covered in more detail in the next issue of Facts for Fancy Fruit.

Listed below are some, but certainly not all, of the suppliers of pheromones and traps.

Gempler's; P. O. Box 270; 100 Countryside Dr.; Belleville, WI 53508; 800-382-8473; www.gemplers.com

Great Lakes IPM; 10220 Church Rd., NE; Vestaburg, MI 48891-9746; 989-268-5693; www.greatlakesipm.com

Scentry Biologicals Inc.; 610 Central Ave.; Billings MT 59102; 800-735-5323; www.scentry.com

Trece Incorporated; P.O. Box 129. 1031 Industrial St.; Adair, OK; 866-785-1313; www.trece.com

Just a few notes about using pheromones. 1. It is preferable to use more than one trap for each insect pest for which you are trapping. Sometimes, for reasons we don't entirely understand, a trap placed at a particular location may not catch many moths, which could give you misleading information. If you have two or three traps, you can be a lot more confident in the results. 2. Pay attention to how frequently the lures need to be replaced. When you replace a lure, don't throw the old lure on the ground. If you do, it may compete with the lure in the trap and lower your trap catch. 3. If you are trapping for more than one insect, don't handle more than one type of lure with your bare hands. You can contaminate the lure with the other pheromone and it will lose effectiveness.

Spring Temperatures

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323)

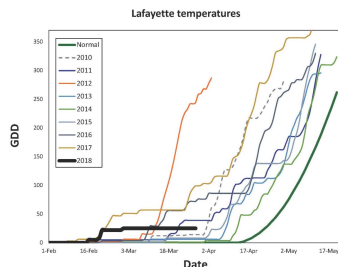


Figure 1. Growing degree days (base 50F) in Lafayette, IN.

So far it has been a cool spring, that in the northern half of the state has helped hold back bud development. As we can see from Figure 1, in Lafayette we have only accumulated 25 growing Degree Days (GDD), and most of these were the result of two warm days (54 and 63 F) in late February. Since then we have not accumulated any more GDD, so plants have mostly not begun to show any signs of growth. This has brought the timing of growth back into line with the last few years. Note that since 2010, every year has been earlier than the long-term average ("normal" in Fig. 1).

Increasing Apple Fruit Set in Cold Springs

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323)

Of course, we all hope for a late spring to help avoid the risk of damage from late spring frosts. But when the temperature warms up then turns cold again, it leaves us in a real bind. The warm temperatures push tree development, then we want the warmer conditions for good pollinating weather. When we have open flowers but conditions not favorable for high bee activity (cool or very windy conditions), there is a risk of poor pollination and fruit set. Not only do these cool conditions limit bee activity, they result in poor growth of pollen tubes even if bees do successfully pollinate flowers. Daily temperatures of 60F or above are required for good pollen tube growth, so if there are open flowers and the temperatures have consistently been cooler than 60F, you could be in trouble. There is some evidence that apples tend to set mostly on king flowers when conditions are good and more on lateral flowers in less favorable conditions. On many cultivars, fruit on lateral flowers tend to be smaller than those set on king flowers. So the damage is done in two ways: lower levels of fruit set leading to lower yields, and the fruit that does set tends to be on lateral flowers and smaller.

While there is not a lot that growers can do, there is one thing. In response to a bloom freeze a few years ago, Dr. Steve McArtney and coworkers applied growth regulators in an attempt to increase the number of fruit set parthenocarpically (without seeds). They applied promalin at 25-50 ppm a couple of days after full bloom. In their experiments, this increased fruit set

sometimes – it did not work in all their experiments. But when it worked, it more than doubled fruit set compared to the frosted controls. Even with the increased fruit set from the promalin treatment, yields were not restored to normal, non-frosted levels. If you have open flowers in your orchard and conditions have been too cool to promote good fruit set, then an application of promalin may be useful.

The First Fruit Made with a Blockbuster Gene-editing Tool

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323)

A new Monsanto-backed company is on the verge of producing the first fruit made with a blockbuster gene-editing tool that could revolutionize agriculture

- In a move aimed at securing its future, Monsanto has invested \$125 million in a gene-editing startup called Pairwise.
- The alliance could tee up Monsanto, long known for its controversial dealings with farmers and its role in popularizing genetically modified organisms, to introduce some of the first produce made using the blockbuster gene-editing tool Crispr.
- In a call with Business Insider, the company hinted that strawberries or another type of fruit would be among the first Crispr produce to hit grocery-store shelves — a development it expects within five to 10 years.

In a move aimed at securing a place in the rapidly evolving food technology scene, the agricultural giant Monsanto has invested \$125 million in a gene-editing startup called Pairwise.

The alliance could tee up Monsanto, long known for its controversial dealings with farmers and its role in popularizing genetically modified organisms, to introduce some of the first produce made using the blockbuster gene-editing tool Crispr. Sweeter strawberries with a longer shelf life could be among the earliest offerings.

The tool allows scientists to accurately target specific problem areas within the genome of a living thing, opening up the potential to tweak the DNA of everything from row crops like corn and soy to produce like apples and asparagus to make the produce taste sweeter, last longer on the shelf, and even tolerate drought or flooding.

Monsanto and Pairwise aim to get some of the first fruits and vegetables made with Crispr on grocery-store shelves within five to 10 years, [Tom Adams](#), who previously served as Monsanto's vice president of global biotechnology but will leave the company to become the CEO of Pairwise, told Business Insider on Monday.

If successful, the move could help the company skirt the misinformation that has plagued previous gene-editing tools like GMOs.

Gene editing is the future of food

You're probably familiar with traditional genetic modification — the process of tweaking DNA to produce juicy watermelon or

apples that don't brown. It's something farmers have been doing with slow and painstaking effort for centuries using tools like plant breeding.

Foods produced using genetic modification, also known as GMOs, have attracted criticism from many who see the process as unnatural and therefore potentially dangerous. GMOs were also popularized by two companies with checkered pasts: Monsanto was [among a handful of companies](#) that produced [Agent Orange](#), the herbicide used by the US military during the Vietnam War that has been linked to a higher risk of cancer and that Vietnam has blamed for sickening as many as 3 million people; DuPont was found liable of [contaminating water supplies with cancer-causing chemicals](#) at a spate of its Teflon plants. But [not only](#) do the vast majority of scientists agree that [GMOs are safe to eat](#), but genetically modified foods have played a significant role in addressing key problems facing the world. GMOs have helped farmers grow more food on less land, helped [save cash crops like the Hawaiian papaya](#) from pests and disease, and [curbed global pesticide use](#). The latest gene-editing tools are [even better](#). They're cheaper, more accurate, and, perhaps most important, not yet tinged with the public distrust that now colors GMOs. These tools include Crispr, the technique that Pairwise aims to use in fruits and vegetables to create products like sweeter strawberries with a longer shelf life. "Gene editing allows you to address problems that you can't address with genetic modification and do so faster," Adams said, adding, "what's exciting is that it can get into crops that have a smaller footprint than maybe corn and have more opportunities to get into the hands of consumers."

[Haven Baker](#), the founder and CEO of Pairwise plants, told Business Insider, "We are absolutely targeting things that you'll be able to see in the produce aisle. And ideally it'll be benefits you recognize as an average consumer shopping and looking for produce." Erin Brodwin, [businessinsider.com](#)

Crispr gets a green light

Melia Robinson/Business Insider Scientists are [already using Crispr](#) to make crops, cows, and even pigs that are healthier, better equipped to handle heat and drought, and more resistant to pests and disease. Where traditional breeding methods and GMOs hack away at a crop's genome with a dull blade, tools like Crispr slice and reshape with scalpel-like precision. "Crispr is far and away technically more efficient and more effective at doing the kinds of things we want," Bob Reiter, Monsanto's global vice president of research and development strategy, told Business Insider. Those things could include row crops like corn and soy that are less vulnerable to the increased drought and heat that will come with climate change or fruits and vegetables with more intense flavor or a longer shelf life, Baker said. It is partially because of Crispr's accuracy that the US Department of Agriculture has chosen not to regulate close to a dozen crops edited with Crispr as GMOs. Instead, the crops have essentially been [given a green light](#), meaning companies can move ahead with development and move them closer to our dinner plates. Earlier this year, DuPont told Business Insider that it aimed to release the first product made using ingredients from Crispr corn

within as few as four years. But Pairwise's fruit could be the first Crispr produce. Baker said they aim to see it in grocery stores before 2028. "We want to make specialty crops cheaper more accessible and more affordable," Baker said. "We all love fruit."

China Proposes 15% Tariff on Fresh Fruit, Wine

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323)

The [New York Times reports](#) China has proposed countermeasures to a proposed \$60 billion in tariffs from the U.S. on Chinese-made products.

The Chinese Ministry of Commerce issued the threat [in an online statement](#). American goods including nuts, wine, and fresh fruit would be subject to 15% tariffs.

The Times reports these proposed tariffs in total will impact just about 2% of all U.S. exports to China, which amount to \$130 billion.

"It's not devastating economically by any stretch, but it's certainly going to hurt those interests in the United States that are trying to export," Chad Bown, a senior fellow at the Peterson Institute for International Economics, told the Times. He pointed out that the retaliation by China sends "a negative signal that they are not seeking to de-escalate things."

Reaction from Industry Members:

Almond Board of California President and CEO, Richard Waycott says market access is critical the California almond industry:

- "Almond Board of California is monitoring for developments on the proposed China tariffs. We hope this issue may be resolved swiftly as the California almond community currently produces our state's top agricultural export. As one of only five Mediterranean climate zones globally that can productively grow almonds, about 70% of California Almonds are exported and specifically 151 million pounds traveled to China in the crop year 2016-17.
- "Unimpeded market access is critical for both farmers and customers, and helps to sustain the economic well-being of our communities and ensures heart-healthy California almonds can continue to be enjoyed by more than 90 countries worldwide."
- U.S. Apple Association (USApple) President and CEO Jim Bair says the association (USApple) is extremely disappointed that apple growers have been caught in the crosshairs of what seems will be a trade war between the White House and the Chinese government.
- "With apples being included on China's list of retaliatory tariffs, U.S. growers face losing an important and expanding export market, to which access was a hard-fought battle.
- "The U.S. apple industry worked very hard over the years, and in 2015 finally achieved full access to the Chinese

market, just as China has access to our market. We are competing, and winning, with our exports to China growing nicely from zero to about 2.5 million boxes per year. China's retaliatory response to U.S. tariffs are just the latest chapter in a long and sad story where U.S. apple growers get hurt in a fight we didn't start and in which we have no interest.

- "Within three years, China has become our tenth largest market and has tremendous promise for continued growth. Even the U.S. Trade Representative's Office lists U.S. apple exports to China as one of the **country's top export success stories**. Because China doesn't grow a diverse variety of apples, there is a high demand by its consumers for the many unique varieties offered by the U.S.
- "Trade is extremely important to the U.S. apple industry. We urge the administration and China to quickly resolve the trade dispute so that our apple exports won't be disrupted." California Association of Winegrape Growers (CAWG) President John Aguirre also speaks out about the proposed tariff on wine:
- "President Trump's decision to address United States trade issues by use of threats and increased tariffs risks undoing decades of work and investment to grow California wine exports. Last year, California wine exports totaled \$1.28 billion, with China and Hong Kong accounting for nearly \$145 million of that total.
- "I urge President Trump to return our nation to a strategy of opening markets and resolving trade concerns through multilateral negotiations, like the Trans-Pacific Partnership. The current path of tariffs and trade wars is sure to result in tremendous harm to California agriculture and future wine exports."

Christina Herrick, growingproduce.com

Green Tip through Half-Inch Green*						
Product and Formulation	FRAC Code	Scab	REI PHI†	Max. Amount/ Acres/Year	Max. Applications/ Year	Remarks
Although all these fungicides are labeled for use at this time, we recommend delaying the use of systemic fungicides (FRAC codes 3 and 11) until more leaf tissue is present and disease pressures are higher. This will improve management while staying within recommended application numbers per season.						
Aprovia	7	G ¹ 5-5.7 oz.	12 h 30 d	27.6 oz.	N/A	This is a new SDH fungicide. Do not make more than 2 sequential applications.
Captan	M	G ¹ 5 lbs.	24 h 0 d	40 lbs.	8	Captan is not compatible with oil. Do not apply within 2 weeks of an oil spray or spreader sticker.
Fliet 500WG	11	G ¹ 2.5-3 oz.	12 h 14 d	11 oz.	4	Do not make more than 2 sequential applications.
Fliet Extra	11	E ¹ 2.5-2.9 oz.	12 h 14 d	11 oz.	4	Do not make more than 2 sequential applications.
Fontelis 1.675C	7	G ¹ 16-20 oz.	12 h 28 d	61 oz.	N/A	When used for scab, tank-mix with another fungicide from a different resistance management group. Do not mix with thiram agents. Do not make more than 2 sequential applications. Do not tank-mix with captan or sulfur.
Instar 2F	3	E ¹ 6-8 oz.	12 h 14 d	32 oz.	4	Adding a wetting agent improves performance.
Inspire Super	3 + 9	E ¹ 12 oz.	12 h 14 d	60 oz.	5	Do not make more than 2 sequential applications.
Luna	7 + 11	E ¹ 5-5.8 oz.	12 h 14 d	21 oz.	4	Do not make more than 2 sequential applications.
Luna Sensation	7 + 9	E ¹ 11.2-16 oz.	12 h 22 d	54.7 oz.	N/A	Do not make more than 2 sequential applications.
Mancozeb 75DF	M3	—	1 d 77 d	21 lbs. or 24 lbs.	4-6	Rate depends on protectant or extended protectant program. Do not combine the 6-pound product or 3 pound all-season mancozeb schedule. See labels for details. See Note About Mancozeb and Polyram (EBDC Products) (page 6) for more information.
Metcon 2.095C	7 + 11	E ¹ 4-5.5 oz.	12 h 0 d	22 oz.	4	Do not make more than 2 sequential applications. Do not use with EC formulated products or with Captan.
Omegar 500F	29	10-13.8 fl. oz.	2 d 28 d	8.6 gals.	10	This product also controls mites.
Polyram 80DF	M3	—	1 d 77 d	21 lbs. or 24 lbs.	4-6	Rate depends on protectant or extended protectant program. See Note About Mancozeb and Polyram (EBDC Products) (page 6) for more information.
Pristine	7 + 11	E ¹ 14.5-18.5 oz.	12 h 0 d	74 oz.	4	Do not make more than 2 sequential applications.
Procur 480SC	3	E ¹ 8-16 oz.	12 h 14 d	64 oz.	N/A	When used for scab, tank-mix with a fungicide from a different resistance management group.
Rally 40WSF	3	E ¹ 5-10 oz.	12 h 14 d	5 lbs.	N/A	Tank-mix with a fungicide from a different resistance management group. Fungicide resistance to this product has been observed with both apple scab and powdery mildew.
Scala	9	—	12 h 72 h	40 fl. oz.	N/A	Performs best when temperatures are below 75°F.

Fig. 1 Fungicide Resistance Action Committee (FRAC) Codes, REI, PHI and efficacy information for each product

- ~Reducing overwintering inoculum for apple scab:
For orchards with less than stellar scab control last year, inoculum reduction before the growing season begins is an integral component of scab control. In the spring, two approaches can be used to reduce overwintering scab:
 - An application of a urea spray (42 lb/A in 100 gal of water/A) sometime before green tip with a penetrant surfactant like LI700 or Wet Betty, and/or
 - Shredding leaf litter with a flail mower
 - Rake or vacuum up leaves, and remove them from the orchard (home orchard only)

For growers in southern Indiana who may be already experiencing green tip: Apply the urea with a boom sprayer rather than with an airblast sprayer. Urea applied via airblast sprayer after green tissue is present on trees may result in urea uptake, making the tissue more susceptible to damage by any later application of oil, copper, sulfur, or Captan sprays that are applied within a week of the urea application.

For more information see: [Adjuvants to Improve Disease Control in Apples](#)

The second tactic, shredding the leaf litter, uses a mechanical approach to break down leaf debris. It is important to note that in the spring, effective leaf shredding requires that the flail mower be set low enough to contact the wet, matted leaf litter on the orchard floor. This may require that leaf litter beneath trees to be blown or raked into the row middles so the flail mower can effectively shred the leaves. Most rotary mowers will not be able to shred overwintering leaf litter. Take care that low flail mowing doesn't damage the overwintering grassy strips that are essential for pesticide applications later in the season!

Using either of these tactics in the spring (urea sprays or flail chopping leaves) can reduce ascospore production by 70-80% (Sutton et al., 2000). It is important to note that urea fertilizer contains 46% actual nitrogen that will provide nitrogen fertilization to the trees. As such, nitrogen fertilizer rates should be adjusted accordingly for orchards where urea applications are used for scab control. If the addition of nitrogen is undesirable, leaf shredding with a flail mower may be a better option.

Forewarned is Forearmed

(Janna L Beckerman, jbeckerm@purdue.edu, (765) 494-4628)

Check list:

~Indiana Disease management program for apples for 2018 is available at:

<https://www.extension.purdue.edu/extmedia/BP/BP-201-W.pdf>

This information is identical to the Midwest fruit pest management guide, but provided in a table format and includes Fungicide Resistance Action Committee (FRAC) Codes, REI, PHI and efficacy information for each product (Fig. 1).

Incorporating either of these sanitation tactics (urea spray or leaf shredding) prior to bud break will not eliminate the need for protectant sprays beginning at green tip but should be regarded as an essential component of integrated scab management. Although not many infections are likely to occur, any infection has the potential to rapidly develop devastating levels of inoculum (See Figure 1). In orchards where SI resistance is known, or suspected, extra care must be taken to ensure that trees are protected early in the growing season with mancozeb, Polyram, captan, Scala or Vanguard, prior to repeated rain events, as the SI fungicides will not effectively eradicate newly developing infections.

Finally, urea sprays or flail shredding are unnecessary in orchards that did not have issues with apple scab last year. By using an integrated approach that includes sanitation by chemical or mechanical means WITH a timely and tight schedule of fungicides from green tip through first cover, scab problems should be reined-in in a single season.

Literature cited: Sutton, D.K., Mac Hardy, W.E., and Lord, W.G. 2000. Effects of shredding or treating apple leaf litter with urea on ascospore dose of *Venturia inaequalis* and disease buildup. Plant Dis. 84:1319-1326.

Beckerman, J. 2016. Adjuvants to Improve Disease Control in Apples. At

<http://www.hort.cornell.edu/expo/proceedings/2016/TreeFruit.Adjuvants%20to%20improve%20disease%20control%20in%20apples.Beckerman.pdf>

EBDC Timing for Bitter and Summer Rot Control

(Janna L Beckerman, jbeckerm@purdue.edu, (765) 494-4628)

Calculate the 77 days to harvest date for each of your cultivars and make the final application of EBDC fungicide (Dithane M-45, Manzate 200, Penncozeb, Polyram, Roper) on that date to take full advantage of the excellent control these fungicides provide for bitter rot, black rot, and white rot, in addition to sooty blotch and flyspeck. This recommendation applies only to growers who used the low rate of mancozeb – 3 lbs/acre. Refer to page 28 of, “[2018Midwest Fruit Pest Management Guide](#)”, for further information.

Fire Blight

(Janna L Beckerman, jbeckerm@purdue.edu, (765) 494-4628)

If you had problems with fire blight last year, this is for you: The best preventative measures for fire blight are the application of streptomycin at bloom to prevent blossom blight and the application Apogee at petal fall to reduce shoot blight. Yes, Apogee is expensive. It is worth every single penny.

Apply streptomycin just as blossoms begin opening and repeat

every 3-4 days if weather is favorable or blossom blight infection persists. Streptomycin is most effective when applied the day before or the day of an infection event. Be especially diligent in your fire blight program if you have blight susceptible varieties (Jonathan, Gala, Ginger Gold, Ida Red, Jonagold, Fuji, Lodi, etc.) in combination with M-26, M-9 and/or Mark rootstocks and/or interstems. For young trees, excess nitrogen to drive growth makes trees more susceptible to fire blight, especially Evercrisp and other Fuji hybrid cultivars.

Powdery Mildew

(Janna L Beckerman, jbeckerm@purdue.edu, (765) 494-4628)

Temperatures below -15°F generally kill powdery mildew infected buds. For those of you who had a milder winter, protecting susceptible varieties like Jonathan, Ida Red, Enterprise, Staymen, Granny Smith, and Ginger Gold, be sure to protect at tight cluster, pink, bloom, petal fall and first cover. Remember that fungicide protection is needed until terminal buds are set. As long as resistance isn't an issue, Rally, Procure and Indar, are the most effective DMI fungicides; Merivon, Pristine, and Luna Sensation (7+11 fungicides) or Flint Extra, Flint, or Sovran (11).

Peach Scab

(Janna L Beckerman, jbeckerm@purdue.edu, (765) 494-4628)

For those of you lucky enough to still have a peach crop: Early shuck-split and shuck-fall sprays are critical for peach scab control. The first spray should be applied about one week 30after petal fall. Do not wait until the shucks have slipped to begin this program.

Gene Stuckey Obituary

(Lori K Jolly-Brown, ljollybr@purdue.edu)

Francis Eugene “Gene” Stuckey, age 80, passed away peacefully at his son’s home in Bucyrus, Ohio on Tuesday morning, March 27, 2018. Born August 30, 1937 in Muncie, Indiana, he was the son of the late Dan and Martha (Heather) Stuckey. He was a graduate of Carmel High School.

Gene was a lifelong farmer. For over 40 years, he was the owner and operator of Stuckey Farms located near Sheridan on the Boone / Hamilton County line. Between his vegetable plots, the wonderfully kept orchard, and the farm market, he provided a much needed and appreciated service to the residents of Sheridan, and the surrounding communities, by providing them with farm fresh produce, year after year, without fail.

Helping and caring for others was a guiding principle throughout his life. During the 80’s and 90’s, Gene worked on multiple short term mission trips with CSI, building homes and schools. He attended Heartland Church.

Gene is survived by the love of his life, Rosalyn Ann (Shoemaker) Stuckey. She and Gene were married on January 8, 1961. He is

also survived by his 2 sons, Steven E. Stuckey (Diana) of Sheridan, and Kent A. Stuckey (Laura) of Bucyrus, Ohio; 6 grandchildren, Ben Stuckey, Zach Stuckey (Kelsey), and Ethan Stuckey (Hanna) all of Bucyrus, Ohio, Alicia Stuckey of Noblesville, Kristie Stuckey of Fairfax, Iowa, and Heather Correll (Travis) of Sheridan; 2 great granddaughters, Waylynn Stuckey and Mayla Stuckey; 1 great grandson, Haydin Correll; and 1 great grandchild on the way; and by his sister, Elanor Moffitt of Carmel.

Services will be held at 2:00 PM on Friday, March 30, 2018 at Kercheval Funeral Home, 306 East 10th Street, Sheridan, Indiana, with visitation from 10:00 AM until the time of service.

Burial will follow at Mts. Runn Cemetery in rural Boone County.

Pastor Bill Salsbery and Bill Ashpaugh, Gene's good friend in Christ, will be officiating.

In lieu of flowers, the family asks that you please contribute to Heartland Ministries Church, 3611 S.R. 19, Sharpsville, Indiana 46068.

<https://tinyurl.com/yc8fzdps>

Upcoming Events

(Peter M Hirst, hirst@purdue.edu, (765) 494-1323) & (Bruce Bordelon, bordelon@purdue.edu, (765) 494-8212)

May 7, 2018 Purdue Wine Grape Team "From Grape to Glass"
Byler Lane Winery 5858 County Road 35, Auburn, IN 46706
Contact Jill Blume blume@purdue.edu

June 26, 2018 Indiana Hort Society Summer Field Day
Garwood Orchard, LaPorte, IN

Contact Lori Jolly-Brown ljollybr@purdue.edu

October 17, 2018 Indiana Flower Growers Conference
Daniel Turf Center

Contact Lori Jolly-Brown ljollybr@purdue.edu

January 8, 2019 Illiana Vegetable Growers Symposium.

Teibel's Family Restaurant, Schererville, IN

Contact Liz Maynard emaynard@purdue.edu

<https://ag.purdue.edu/hla/Extension/Pages/IVGS.aspx>

February 12-14, 2019 Indiana Hort Congress.

Indianapolis Marriott East Indianapolis, IN

Contact Lori Jolly-Brown, ljollybr@purdue.edu or 765-494-1296

<http://www.inhortcongress.org>

It is the policy of the Purdue University that all persons have equal opportunity and access to its educational programs, services, activities, and facilities without regard to race, religion, color, sex, age, national origin or ancestry, marital status, parental status, sexual orientation, disability or status as a veteran. Purdue is an Affirmative Action Institution. This material may be available in alternative formats. 1-888-EXT-INFO Disclaimer: Reference to products in this publication is not intended to be an endorsement to the exclusion of others which may have similar uses. Any person using products listed in this publication assumes full responsibility for their use in accordance with current directions of the manufacturer.

Facts for Fancy Fruit © Purdue University - fff.hort.purdue.edu

Editor: Peter M Hirst | Department of Horticulture and Landscape Architecture, 625 Agriculture Mall Dr., West Lafayette, IN 47907 | (765) 494-1323