PURDUE UNIVERSITY

FACTS FOR Fancy Fruit

PURDUE EXTENSION

FACTS FOR Fancy Fruit

April 18, 2016
Volume 16 • Issue 2

In this Issue

Crop Conditions 1
Frost/Freeze Update.....1
Fruit Bud Survival.....3
Frost Recovery Treatments.....3
Unpredictable Weather.....6
Ascospore Release.....6
Water Quality and Pesticides.....9
Pheromones & Traps.....12
Oil Sprays.....13
Mite Management in Apples.....13
Woolly Apple.....14
Food Safety.....15
Upcoming Meetings.....15
Current Bud Stages.....16

Crop Conditions:

In southern areas, apples are in pink, but still at tight cluster in more northern areas. Peaches are still in the shuck in the south but only at half-inch green in the northern parts of the state. Grapes are at bud break to one inch shoots in the south, but still in the early to full swell stages central and north. The cool spell this past couple of weeks slowed development considerably. We have seen some minor bud damage, but not enough to affect yield. Bramble shoots are out 1 to 2 inches. Surprisingly, we have only minor damage in the Lafayette area. Regions further south were not affected much as brambles shoots are fairly tolerant to freezing temperatures. Blueberries do not appear to have been damaged by the temperatures experienced.

Frost and Freeze Damage Update:

Frost and freeze damage was minor in small fruits and grapes.
Below is a review of general guidelines for when we expect damage to buds, flowers and fruit.

Table 1. Minimum temperatures likely to cause bud damage of fruit crops

Developmental stage	10% kill (°F)	90% kill (°F)
Apples		
Silver tip	15	2
Green tip	18	10
Half-inch green	23	15
Tight cluster	27	21
Pink	28	25
Bloom	28	25
Petal fall	28	25
Peaches		
Swollen bud	18	2
Half-inch green	23	5
Pink	25	18
Bloom	27	24
Petal fall	28	25
Grapes		
Early swell	15	10
Full swell	25	22
Bud burst	28	26
Blueberry		
Bud swell	15	10
Tight cluster	23	20
Early pink bud	25	23
White tip	27	24
Full bloom	28	26
Strawberry		
Tight bud	24	22
Petals showing	30	28

Over the last week many areas of the state have experienced minimum temperatures likely to cause bud damage. Generalized state maps (Figs. 1, 2, 3) show the minimum temperatures recorded in different parts of the state. As we all know, the temperatures required to cause damage depends not just on the low temperature, but on the stage of crop development when the cold temperatures occur. As you can see in Table 1, low temperatures of say 20F will likely cause significant bud damage to apples if crops are beyond the half-inch green stage. The same temperatures before this stage probably will not cause widespread damage.

So what happened this year? Based on the accumulation of growing degree days, we started out very early, about the same as 2012 (Figure 4). This caused buds to start developing. By mid-late March the temperatures dropped and slowed the accumulation of growing degree-days and of course this also slowed crop development. Right now GDD are tracking about the same as 2011, 2013 and 2015 and thankfully behind 2010 and 2012. However note that like the last number of years we are still significantly ahead of "normal" (long-term average).

OK so what have we seen this year. As expected, we are seeing more damage in more southern areas where crops were at more advanced stages of development when the cold temperatures came. There has certainly been some bud damage to both apples and peaches, but pretty much full crops are still expected. Even in Lafayette at the Meigs farm we have seen a little bud damage to both peaches and apples, but only 20% or so of buds appear to be affected. Remember that even with 10% of buds alive (90% kill) we are often still looking at a full crop. So what's the take home message? Mostly we dodged a bullet and will still need to thin.
(Hirst)

Assessing Fruit Bud Survival and Crop Potential:

What is the best way to assess bud damage from cold temperatures? Drs. Tara Baugher and Jim Schupp at Penn. State University have put together a nice page with some excellent photos explaining how to assess fruit bud survival:
http://extension.psu.edu/plants/tree-fruit/news/2016/assessing-fruit-bud-survival-and-crop-potential
I would add that unless you find that more than 90% of your buds have been killed, then you should still plan on thinning. With warm temperatures forecast for the next few days, we expect rapid crop development and any damage should become apparent. Remember to look for damage to the pistil. This is the female part of the flower and is made up of the stigma, the style and the ovary. The normal course of events is that pollen is deposited on the top of the pistil (stigma) and the pollen grows down the style and then fertilizes the ovule to produce a seed. Generally speaking, without seed development we don't get fruit set. Pollen will not grow down pistils that have been killed by damaging temperatures, so look for brown, dead pistils in the center of the flowers.
(Hirst)

Frost recovery treatments:

There has been some talk about the use of promalin to help overcome the damaging effects of freezing temperatures. Only a small amount of research has been conducted on

Facts for Fancy Fruit is a newsletter for commercial and advanced amateur fruit growers. It provides timely information on pest control, production practices, and other topics likely to be of interest to fruit growers. All growers and interested persons are welcome to subscribe.

Subscriptions are $15 per year. Subscribers will receive 12-15 issues biweekly during the growing season and monthly otherwise.

To subscribe, send your name, mailing address, and check for $15 (payable to Purdue University) to:

Facts for Fancy Fruit
Purdue University
Department of Horticulture & Landscape Architecture
625 Agriculture Mall Drive
West Lafayette, IN 47907-2010
Attention: Lori Jolly-Brown

This newsletter can be accessed free at www.hort.purdue.edu/fff/.

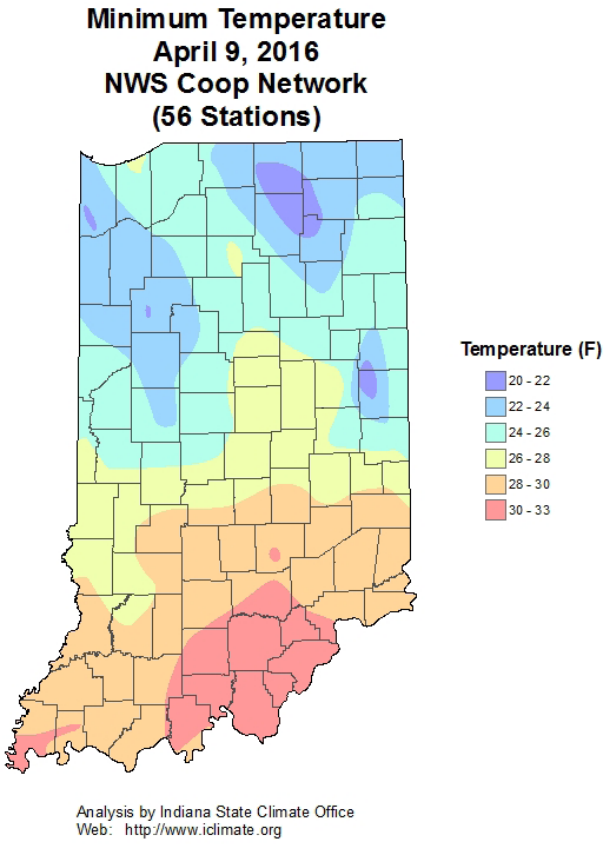
Minimum Temperature
April 9, 2016
NWS Coop Network
(56 Stations)
Temperature (F)
20 - 22
22 - 24
24 - 26
26 - 28
28 - 30
30 - 33
Analysis by Indiana State Climate Office
Web: http://www.iclimate.org

Fig. 1

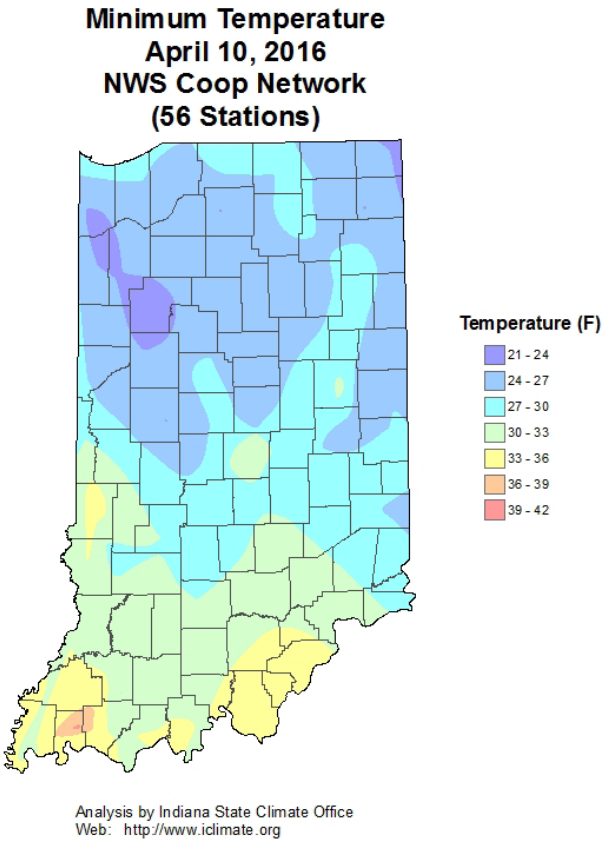
Minimum Temperature
April 10, 2016
NWS Coop Network
(56 Stations)
Temperature (F)
21 - 24
24 - 27
27 - 30
30 - 33
33 - 36
36 - 39
39 - 42
Analysis by Indiana State Climate Office
Web: http://www.iclimate.org

Fig. 2

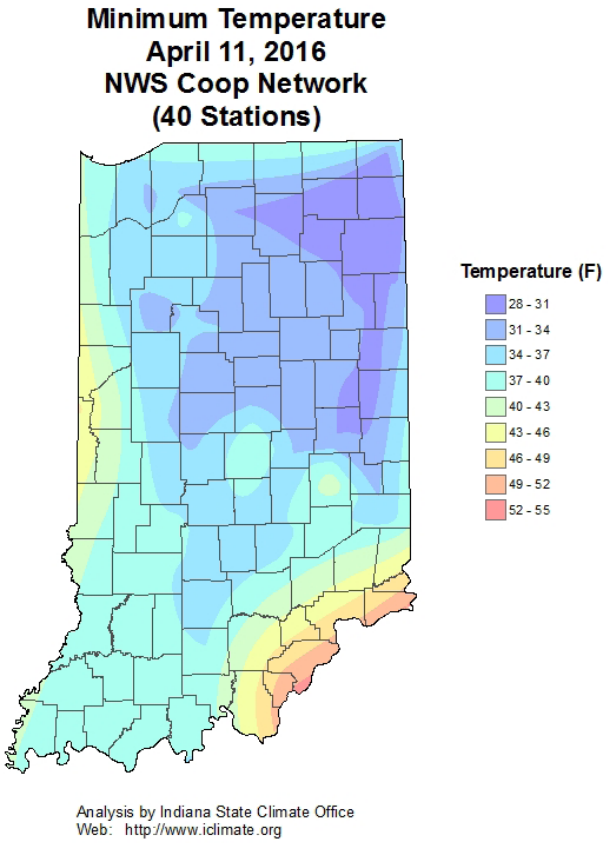

Fig. 3

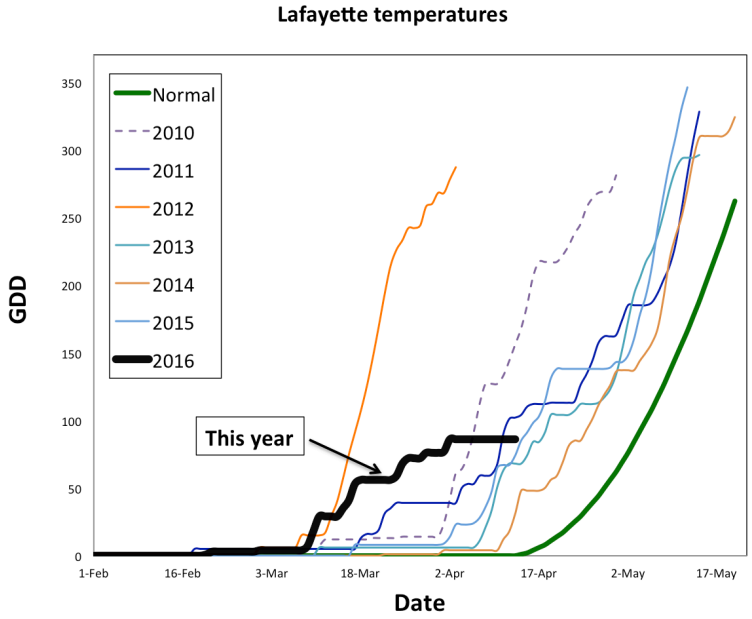

Fig. 4 Growing Degree Day Accumulation in Lafayette

this. Dr Steve McArtney showed that promalin applied after damaging freeze events could increase parthenocarpic (seedless) fruit development. Keep in mind this was only shown to be effective for freezes during full bloom. Also the rescue treatments were applied within 5 hours of the frost events. It is unknown whether promalin will have similar effects if applied at times other than bloom. Also, we don't know how soon after the freeze event promalin needs to be applied to increase fruit set. In Dr. McArtney's research, promalin did increase fruit set, but only to about 25% of a full crop. (Hirst)

Unpredictable weather:
Weather for 2016 continues to be unpredictable. And although bad weather can damage crops, it does little to stop the pathogens that plague pome fruit. The past few weeks of cool weather has slowed things down, but not scab—at least, not completely. All plants, insects, and pathogens develop in response to temperature--The warmer the weather, the more quickly they develop; conversely, the cooler the temperature, the slower they develop.

When controlling scab, it is important to realize that ascospores don't all 'shoot' at once. Instead, as the fruiting bodies (called pseudothecia) develop on the leaf litter, they gradually mature and release ascospores over the course of several weeks. The rate of ascospore maturation follows a bell curve—they increase, reach a peak, and then decrease (Fig. 5). Evolution has had a very long time to get this right. As a result, ascospore release is perfectly timed to coincide with a large amount of highly susceptible tissue. Think about it: If you shoot all your spores too early you'll probably miss and you'll die. If you shoot all your spores too late, something else has already eaten your food, and you'll still die!

Ascospore release:
Ascospore release is timed to optimize infection, which happens around tight cluster through petal fall. This is when all the fun really begins: Ascospores are at their peak and ejecting, and apple tissue is expanding, providing a larger, susceptible canopy that spores can hit. That excellent timing is the poetry of evolution in motion. Other factors that determine the risk of infection include:

1. Overwintering inoculum—more scabby leaves on the orchard floor will mean more disease this season. Urea in the fall or spring reduces the inoculum

2. Spore development and release—Lack of rain will slow things down and prevent spore ejection; cold weather slows things down; urea delays sporulation, and prevents development of ascospores.

3. Host tissue susceptibility—resistant varieties, or less susceptible varieties reduce infection efficiency

4. Infection efficiency—hot dry weather reduces infection efficiency; cool and wet weather drives it (Fig. 5)

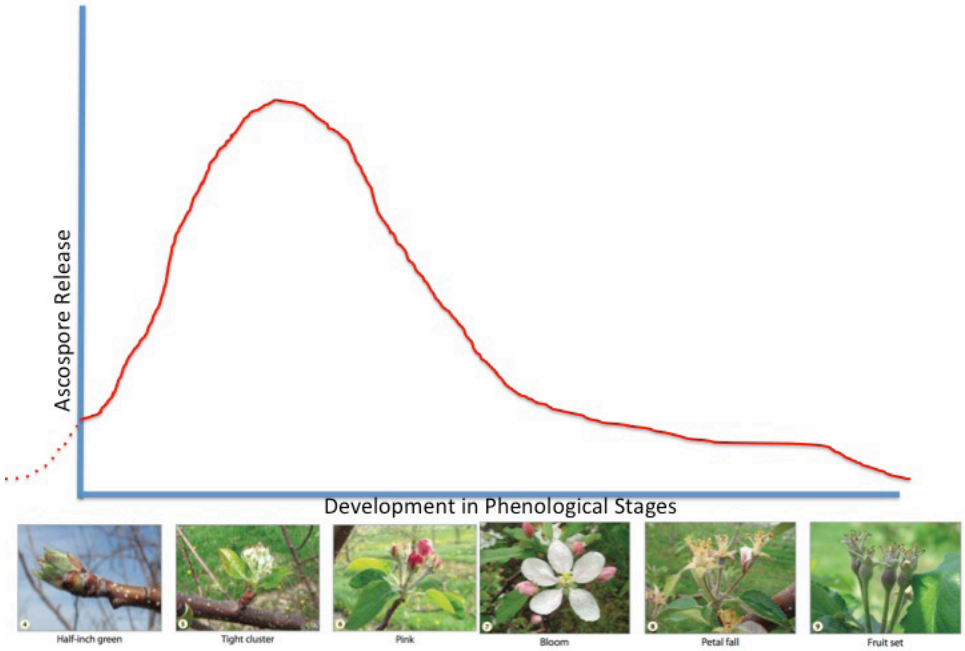

Fig. 5

Table 2. Modified Mill's Table, Adapted from the table of W. D. Mills, revised by W.E. MacHardy.

Average Temp	**Hours of leaf wetness Relative infection level**			**Days until first lesions**
	Low	*Moderate*	*High*	
78	10	14	23	
77	8	11	18	
76	6.5	9	16	
61-75	6	9	16	9-10
60	6.5	10	17	11
57-59	7	11	19	12-13
55-56	8	12	20	13-14
54	8.5	13	21	14
52-53	9	14	22	15
51	10	15	24	16
50	11	16	26	16
49	11.5	17	27	17
48	12	17	27	17
47	14	20	32	17
46	16 (13)	21	34	17
45	17(15)	23	37	17
44	19	25	40	17
43	21(18)	27	44	17
42	23	30	47	17
41	21	34	50	?
40	29	38	53	?
39	33(28)	42	57	?
38	37	47	61	?
37	41(30)	52	65	?
36	48 (35)	69	93	?
34	48(41)	69	93	?

Here in the Midwest, temperature impacts both tree and scab development. Rainfall events, ascospore release and spray timing are often challenging, and many growers have given up on models and degree days for predicting when to spray. But these models, particularly the Mill's table are useful:

Table 2. Modified Mill's Table. Adapted from the table of W. D. Mills, revised by W. E. MacHardy. Numbers in parenthesis are the minimum hours of continuous leaf wetness that resulted in scab lesions on apple leaves inoculated with ascospores at controlled temperatures from 36 to 46 (reported by Gadoury et al. in the New York Fruit Quarterly.) Low identifies the minimum hours for infection. Moderate and high identify the hours of leaf wetness required for noticeable increases in scab lesions. The average temperature during wetness should be based on hourly temperatures. Conidia require 2.5 more hours to infect than ascospores. Table from http://tinyurl.com/zrz5zw7

The table is a guide, not a psychic friend, and your mileage may vary. However, I feel pretty safe in stating that it is most likely that our statewide cold snap has greatly delayed lesion development and infection in most places. Some years, like this one, spore release is early and the period between green tip and bloom has been extended (which is a good thing to protect against any late freeze events!), meaning most of us still have a crop…BUT-we've had a very long infection period, with all this cool, wet weather. The upshot: Keep inoculum levels in the orchard low and protect green tissue. If you couldn't get out there to do so because of weather or tractor troubles, or both, a well-timed application of Indar or Inspire Super should suppress any scab that snuck through, assuming you aren't dealing with severe fungicide resistance, or protecting very susceptible varieties like Silken, Gala or McIntosh. Other, slightly less ideal applications could be made using strobilurins, like Flint, or Sovran and would also be effective in stopping any incipient epidemic. Be sure to tank mix some mancozeb to minimize the risk of resistance with either the DMI fungicides (Indar, Inspire Super) or strobilurins. Alternatively, pre-mixes of either Pristine, Merivon, or Luna Sensation will protect against scab, in addition to any rust that has started. Lastly, and still an option for our more northern growers, you could apply Syllit if before pink. Syllit will knockdown inoculum levels, and works as an anti-sporulant, too. Assuming that there is no history of resistance, Syllit should provide excellent control against any scab that has developed. As we all know, that little bit of scab that sneaks through can cause serious problems around petal fall, when leaves and fruit are still at very susceptible to scab. Controlling it now will pay dividends later.

(Beckerman)

Early season sprays for grapes:

There are some potential pest and disease problems that require early season sprays. Phomopsis is a major problem on many grape varieties in the Midwest. Mancozeb should be applied starting at 1-3 inch shoots and repeated each 7-10 days, especially prior to a predicted rain event. Colleagues in Michigan and Ohio have been conducting evaluations of dormant fungicide applications for management of this disease. Liquid lime sulfur, Sulforix, and fixed copper (copper hydroxide) have proven to be most effective. A single application at bud swell can provide a significant degree of Phomopsis control (a 50 to 60 percent decrease in disease severity on the grape leaves as well as clusters), but will not reduce the need for the standard recommended fungicide sprays for Phomopsis control during the growing season. It is important to recognize that sanitation is part of a Phomopsis management plan. Prune out dead canes and stubs as much as possible since they are the main sources of Phomopsis spores.

Anthracnose is a less common disease, but one that we are seeing more frequently. This may be due to warmer weather or susceptibility of new varieties. We have seen that Frontenac and Marquette are very susceptible to anthracnose. The delayed-dormant lime sulfur or Sulforix sprays are very effective against anthracnose. While sulfur and copper can be toxic to certain varieties, there is minimal chance of phytotoxicity if the

products are applied at bud swell, just prior to bud break.

Grape Flea beetle and climbing cutworm can be problems in vineyards. Grape flea beetle is more common in Indiana. Scout vineyards for this pest and its damage, holes eaten into swelling buds. If more than 4% of the buds show damage, apply an insecticide to prevent further damage. Carbaryl (Sevin) is generally recommended, but other options are available.

See the 2016 Midwest Fruit Pest Management Guide (https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx) and Midwest Small Fruit Pest Management Handbook for a complete discussion of grape pest management. (Bordelon)

Effect of water quality on pesticides:

As the spray season approaches, it is good to remember the profound impact water quality has on the performance of pesticides used by fruit growers. Purdue Pesticides Program recently published a guide, The Impact of Water Quality on Pesticide Performance PPP-86, available at the Education Store, 1-888-EXT-INFO or www.extension.purdue.edu/store/. I highly recommend this guide to all growers. Water quality can be broken down into a few categories. Most important to pesticide applicators are water hardness and pH.

Water hardness: Water hardness has a significant impact on several herbicides use by fruit growers. Hardness refers to the concentration of soluble salts, mainly calcium, magnesium, and iron in the water. Water is considered hard if it has 200 ppm or more of these positively charged (cation) minerals. Water is considered softened when the calcium and magnesium cations are replaced with sodium or potassium ions.

Hard water is common in many parts of Indiana. Fruit growers often apply a post-emergent herbicide beneath the tree or vine row in spring to control winter annuals and other weeds. Glyphosate (Roundup) is the most common post emergent systemic herbicide used in fruit crops. In order for glyphosate to be effective, it needs to be absorbed into the weed plant. In soft water weeds readily absorb glyphosate. However in hard water glyphosate will be 'tied up' and not absorbed as readily. When calcium and magnesium cations are present they react with the negatively charged glyphosate to form compounds that are not readily absorbed by plants. This results in poor uptake and poor weed control.

The solution to the hard water problem is to add ammonium sulfate to the spray water **before** mixing with glyphosate. Ammonium sulfate ions combine with the calcium and magnesium ions forming conjugate salts. Additionally, some of the glyphosate reacts with ammonium to form a compound that some weeds preferentially absorb. Sprayable ammonium sulfate (AMS) is available in granular and liquid formulations. Follow the label recommendations on the amount of ammonium sulfate to add.

Water pH: The pH of spray water is important because many fungicides and insecticides break down quickly in high pH water. The pH is a measure of the acidity or alkalinity of water, which refers to the number of hydrogen (H+) and hydroxyl (OH-) ions in a solution. The scale for measuring pH runs from 0 to 14. The lower the pH, the more acidic the solution; a higher pH indicates that the solution is more alkaline. Water at pH 7 is neutral — meaning that there are equal numbers of hydrogen and hydroxyl ions in the solution. Many areas in the Midwest have alkaline well water (pH 8.0 or above). The pH of natural surface water sources (ponds, streams, etc.) can vary throughout the season.

The pH of water can negatively affect the stability of some pesticides. Under alkaline conditions, alkaline hydrolysis occurs, which degrades the pesticide to non-toxic (inactive) forms. In general, insecticides (particularly organophosphates and carbamates) are more susceptible to alkaline hydrolysis than are fungicides, herbicides or growth regulators. The end result is less active ingredient applied and poor pesticide performance. The degradation of a pesticide can be measured in terms of its half-life. For example, if a product has a half-life of 1 hour, its effectiveness is reduced to 50% in 1 hour, to 25% in the next hour, to 12.5% in the next hour, etc. Eventually, the pesticide becomes virtually ineffective. For instance, Captan has a half-life of

32 hours at its optimum pH of 5, but only 10 minutes at pH 8. Similarly, mancozeb has a half-life of 20 days at pH 5, but less than 17 hours at pH 7. Rally (tebuconazole), on the other hand, is not affected by pH.

The effect of pH on pesticides varies from product to product and is also moderated by buffering solutions contained in the pesticide formulation and any adjuvants added to the tank. Tank mixing multiple pesticides can modify the pH of the tank mix.

In general, pesticides are most stable when the spray solution has a pH of about 5. Many water sources are more alkaline than this, so it may be necessary to adjust the pH of the spray solution. There are important exceptions to the rule that spray solutions should be acidified. For instance, in the case of copper-based fungicides, copper becomes more soluble at a lower pH and may become phytotoxic to crops. In addition, phosphorous acid and other acid-based fungicides already have a low pH, and lowering it even more can cause them to injure crops. On the other hand, acidifying carbonate salt fungicides, such as Armicarb, may render them ineffective.

The Midwest Fruit Pest Management Guide has a discussion of spray tank pH. Spray water can be acidified by adding a specific acidifant, or with food grade citric acid. About 2 ounces of food grade citric acid per 100 gallons of water will lower the pH from about 8.0 to about 5.5.

It is important to understand that water pH and hardness are separate issues. Adjusting one may not affect the other. However, several spray adjuvants are available that will affect both hardiness and pH. Discuss your needs with your supplier to be sure you are using the correct products. Read pesticide labels completely and to know the quality of the water used in the sprayer. Test kits for both pH and hardness can be purchased at many box stores. Look in the swimming pool supply isle.

(Bordelon)

Product	Active Ingredient	Optimum pH	Half-life (time until 50% hydrolysis)
Insecticids/Miticides			
Admire	Imidacloprid	7.5	Greater than 31 dyas at pH 5-9
Apollo			
	clofentezine		pH 7 = 34 hrs; pH 9.2 = 4.8 hrs
Assail	acetamiprid	5 - 6	Unstable at pH below 4 and above 7
Dipel	Bacillus thuringiensis	6	Unstable at pH above 8
	thuringiensis		
Imidan	phosmet	5	pH 5 = 7 days; pH 7 < 12 hrs; pH 8 = 4 hrs
Kelthane	dicofol	5.5	pH 5 = 20 days; pH 7 = 5 days; pH 9 = 1hr
Malathion	dimethyl dithiophosphate	5	pH 6 = 8 days; pH 7 = 3 days; pH 8 = 19 hrs; pH 9 = 5 hrs
Sevin XLR	carbaryl	7	pH 6 = 100 days; pH 7 = 24 days; pH 8 = 2.5 days; pH 9 = 1 day
SpinTor	spinosad	6	Stable at pH 5-7; pH 9 = 200 days
Fungicides			
Aliette	fosetyl-al	6	Stable at pH 4.0 to 8.0
Benlate	benomyl	-	pH 5 = 80 hrs; pH 6 = 7 hrs; pH 7 = 1 hr; pH 9 = 45 min
Bravo	chlorothalonil	7	Stable over a wide range of pH values
Captan	captan	5	pH 5 = 32 hrs; pH 7 = 8 hrs; pH 8 = 10 min
Dithane	mancozeb	6	pH 5 = 20 days; pH 7 = 17 hrs; pH 9 = 34 hrs
Rally	myclobutanil		Not affected by pH
Ridomil	mefenoxam		pH 5-9 = more than 4 weeks

(Courtesy of Annemiek Schilder from the MSU Fruit Management Guide E-154.
Note: Only a small part of the table is reproduced. See E-154 for the full table).

Pheromones and Pheromone traps:

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:

Pest	Start Trap-ping
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. 4. When monitoring for the clearwinged moths such as the peachtree borers, remember that these pheromones are not as species specific as most pheromones. Therefore, you may catch some moths that are not pests of fruit. So, you will need to identify the moths in the trap to make sure they are peachtree borers.

Oil Sprays:

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.

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 45°F 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 question that has arisen as a result of our research that showed that predator mites overwinter on the tree is: What effect will early season oil sprays have on predator populations? In other words, will the oil sprays kill the predators and create more serious European red mite populations? Our research showed that oil sprays, whether applied at green tip or tight cluster, had no detrimental effect on mite predators. Therefore, we recommend the use of early season oil sprays as a good management practice.

If you plan to use a preventive miticide this year, a reasonable question to ask is: Is it still necessary to apply an early season oil spray? I believe that the oil application is still a good idea, for two reasons. First, it will provide control of aphids and scales, as well as European red mites. Secondly, I believe that the use of oil will reduce the likelihood of developing resistance to these miticides. Therefore, I still recommend oil sprays even if other miticides are going to be used. The addition of an insecticide with your oil spray will give some increase in aphid control but will not improve control of mites or scales.

Mite Management in Apples:

Management of European red mites is a continual process. Decisions made throughout the growing season will affect your mite populations. Outlined here are steps that can help with mite management. For a more complete explanation, please see the following publication:
https://extension.entm.purdue.edu/publications/E-258.pdf

1. Put on a timely Superior oil spray. See the article above.

2. Conserver predator mites. If properly conserved, the predator mites, primarily Amblyseius fallacis, will usually control about 90% of the mite population. The best way to conserve those predators is to avoid using insecticides that are toxic to them. The most highly toxic pesticides that should be avoided include Asana, Baythroid, Danitol, Decis, Permethrin (Ambush/Pounce), Proaxis, Warrior, Carzol, Lannate, Vydate, Dicofol, and Nexter. Sevin is also toxic to predators so it should only be used as a thinning agent. As the brown marmorated stink bug becomes more damaging, it may become necessary to use one of pyrethroid insecticides to protect your crop. If you do so, be aware that you may create a mite outbreak because of the toxicity to the predator mites. Fortunately, we now have a

number of excellent rescue miticides available to choose from.

3. Preventive miticides. Some miticides such as Agri-Mek, Apollo, Savey, and Zeal can be used early in the season before you know if you are going to have a problem this year. Only use these products if you had a serious mite problem last year. This is a change from previous years when I recommended using these products every other year as part of a rotation. We now have enough rescue miticides available and overall mite populations have diminished enough that we no longer need to use these products on a regular schedule.

4. Scout. You should begin scouting shortly after petal fall. Most growers will know where they usually see mite problems first and scouting efforts should begin there. Often that will be in Red Delicious trees or along a gravel road. Pick four leaves from each of five trees and select the leaves from different parts of the tree, high, low, inside, outside, etc. Use a 10X hand lens to look for mites. Also, notice any predators that you might see. The treatment threshold varies during the season, 2.5 mites per leaf before June 15, 5 mites per leaf in the remainder of June, 7.5 mites per leaf from July 1 – 15, and 10 mites per leaf from July 16 – 31. After August 1, you can stop sampling whenever the population falls below 10 mites per leaf. My observations over the years has been that populations will usually start to decline after about July 20.

5. Rescue treatments. Treatments should be made when the threshold is exceeded. There are a number of good to excellent rescue miticides available. Check page 32 of the Midwest Fruit Pest Management Guide (ID-465) (https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx). Notice the column that lists the MOA or mode of action. To avoid the development of resistance and to keep this valuable tools available, rotate between modes of action. For example, if you use Nexter (MOA group 21), don't follow that up with an application of Portal (also MOA group 21).

Woolly Apple Aphid:

A number of growers have experienced increasing problems with woolly apple aphids over the last several seasons. Part of the reason for the increased populations may be related to the changing spectrum of insecticides you are using to control other pests. Our experience has been that many of the aphicides that are available that provide excellent control of other aphids are not producing good results with woolly apple aphids. After checking with several of my colleagues in other states, it appears that most growers are getting good to excellent results by applying Lorsban as a prebloom spray. Applying Lorsban prior to bloom used to be a common practice for many growers but some have gone away from it in recent years. If you have had significant woolly apple aphid problems, it would be a good idea to incorporate this application into your spray schedule.

New Fruit Pest Management Guide Available:

The 2016 Midwest Fruit Pest Management Guide (ID-465) is available for purchase from the Purdue Education Store. This publication replaces two previous annual publications: The Midwest Tree Fruit Spray Guide (ID-168) and The Midwest Small Fruit and Grape Spray Guide (ID-169). This guide provides pest management recommendations for commercial tree fruit, small fruit, and grape producers in Arkansas, Illinois, Indiana, Iowa, Kansas, Kentucky, Minnesota, Missouri, Nebraska, Ohio, Oklahoma, West Virginia, and Wisconsin. These recommendations have been formulated to provide up-to-date information on pesticides and their application. Your Fruit Team at Purdue is responsible for getting this publication revised, printed and distributed each year. But it is a team effort with colleagues from several different states through the Midwest Fruit Workers Group. In this day of reduced budgets, we are fortunate to still have the ability to provide this information to growers.

The guide is available in print form for $15. It can be ordered from the Ed store at
http://tinyurl.com/jjmufd7
A PDF version is also available for download at
http://tinyurl.com/hkxpp7v
(Bordelon)

Food Safety On-Farm Consulting and Audit-Cost Share Programs: Purdue University is pleased to offer Indiana fruit and vegetable farmers a farm walk-through with a private food safety consultant. This opportunity is open to any farm that sells fresh produce and has attended a produce safety educational program. A consultant paid by Purdue will visit your farm to walk through and address your specific farm and packinghouse food safety questions. Growers who participated in the consulting program in 2015 reported it was very helpful. Funds for the consulting come from a grant from the Indiana State Department of Agriculture through the USDA Specialty Crops Block Grant Program.

The grant also includes funds for audit cost-sharing for Indiana fruit and vegetable growers who receive passing scores on their third party food safety audits. The audit cost-share program will reimburse at least 40% of the cost of a third party food safety audit, up to a maximum reimbursement of $750 per farm. Applicants may fill out the online form at
http://tinyurl.com/fs-cost-share-2016
In addition to these programs, Purdue food safety Extension experts Amanda Deering and Scott Monroe are available to conduct mock-audits for produce farms on request.
Contact Scott at 812-886-0198.
For more information contact Liz Maynard at 219-548-3674 or emaynard@purdue.edu.

Upcoming meetings:

Purdue Wine Grape Team's 2016 Spring Workshop
May 4, 9:00 am.
Holtkamp Winery, 10868 Woliung Rd, New Alsace, 47041,
Rettig Hill Winery & Vineyard, 2679 E State Road 350 Osgood, IN 47037
Due to limited class size, advance registration and fees are required. Registration fee $50 per person and includes lunch.Make checks payable to Purdue University and mail with registration to:
Jill Blume
Purdue University
Department of Food Science
745 Agriculture Mall Drive
West Lafayette, IN 47907
blume@purdue.edu

Southwest Purdue Ag Center High Tunnel Tour
May 9, 3:00 pm-5:00pm.
Tour is free, to register please call: 812-886-0198, or contact Wenjing Guan
guan40@purdue.edu

https://ag.purdue.edu/hla/Extension/Documents/High%20Tunnel%20Field%20Day%20Flyer%20May%202016.pdf

Blueberry Growers of Indiana Spring Meeting and potluck
June 9, 4:00 pm. Sider's Blueberry Farm. 6254 W. 200 North, Rochester, IN.
More information will follow.

Indiana Winery and Vineyard Association Summer meeting
July 19-20. Brown County Inn. Nashville, IN. More information will follow.

Indiana Hort Society Summer Field Day
David Doud's Countyline Orchard 7877 W 400 N, Wabash, IN 46992
More information will follow.

Current Bud Stages in Lafayette, IN

Blackberry, 1-2 inch shoots

Strawberry, blossoms just emerging

Peach, half inch green

Grape, early swell

Sweet Cherry, green tip

Apple, tight cluster

Contributors

Janna Beckerman
Purdue University
Department of Botany & Plant Pathology
915 West State Street
West Lafayette, IN 47907-1155
(765) 494-4614
jbeckerm@purdue.edu

Bruce Bordelon
Purdue University
Department of Horticulture & Landscape Architecture
625 Agriculture Mall Drive
West Lafayette, IN 47907-2010
(765) 494-8212
bordelon@purdue.edu

Rick Foster
Purdue University
Department of Entomology
901 W. State St.
West Lafayette, IN 47907-1158
(765) 494-9572
rfoster@purdue.edu

Peter Hirst
Purdue University
Department of Horticulture & Landscape Architecture
625 Agriculture Mall Drive
West Lafayette, IN 47907-2010
(765) 494-1323
hirst@purdue.edu

Wenjing Guan
Southwest Purdue Ag Center
Department of Horticulture & Landscape Architecture
4369 N. Purdue Rd.
Vincennes, IN 47591
guan40@purdue.edu

Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Follow us on:
FaceBook *Twitter*

It is the policy of the Purdue University Cooperative Extension Service 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 University is an Affirmative Action institution. This material may be available in alternative formats.

Facts for Fancy Fruit
Purdue University
Department of Horticulture & Landscape Architecture
625 Agriculture Mall Drive
West Lafayette, IN 47907-2010

PURDUE UNIVERSITY