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PURDUE EXTENSION

FACTS FOR Fancy Fruit

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In This Issue

Crop Conditions

This spring is the latest, and closest to the long term average, for over 5 years. With cooler temperatures forecast for the next week this trend may continue. Unfortunately this cool period coincides with flowering for some crops in more southern areas providing poor pollinating conditions. Folks in more northern areas will benefit from cooler temperatures delaying crop development.

Prospects for the apple crop

What have we seen so far:

• We are starting out with the latest spring in a number of years (Fig. 1).

• Warm temperatures in more southern areas have pushed apples into full bloom and in some cases petal fall already.

• In more northern areas, we're between tight cluster and pink.

• Light and sparse flowering in some places

• Frost damage during early bloom

So what should we expect from here?

• It may take a little while for any damage from frost to become obvious.

• With a cool, rainy week ahead, expect lower photosynthetic rates. What does this mean for

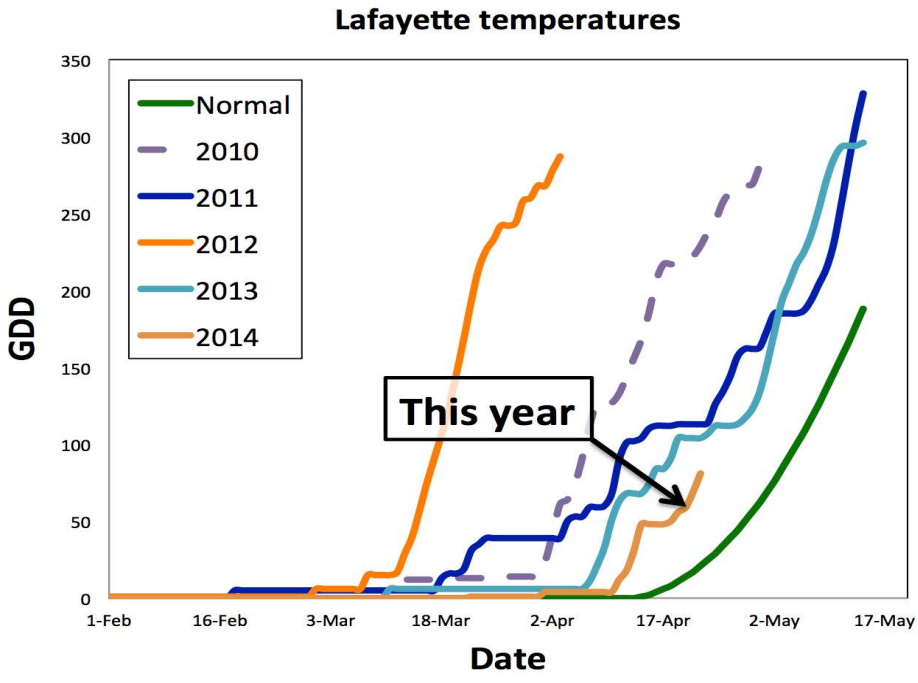

Figure 1. Growing degree days in Lafayette, IN showing year to year variation.

growers? Probably heavier fruit drop than usual. This may also mean that thinners applied after it warms up may work better than usual so tread carefully.

• With light bloom, don't be in any rush to apply chemical thinners.

For all these reasons, this is not the year to be more aggressive with chemical thinning. Remember that early, aggressive chemical thinning generally has the best effect on improving both fruit size and return bloom. But early thinning is also the most risky. By delaying chemical thinning, growers will have a clearer picture of fruit set and will be more informed about the degree of chemical thinning required. Besides, with lighter crops due to frost damage, sparse flowering or increased fruit drop due to cloudy weather, both fruit size and return bloom may be less of a challenge than in some years. If these situations are applicable to your farm, you may want to skip petal fall thinner applications and wait until fruit reach the 12 mm stage. At this point you'll have a much clearer picture of potential crop loads.

As always, use past experience on your farm as your guide. Also keep in mind, seldom does a 'one size fits all' approach work very well. Different cultivars and locations on your farm will probably need to be treated differently, so that you tailor applications based on cultivar, frost damage, degree of flowering and past experience.

Prospects for the peach crop

Predictions range from poor to bleak. The exception is folks in very southern areas who still may have at least partial crops. If you fit in this category, then first I'd say lucky you. Second thing I would say is let other growers know (for example on the fruit/veg connection listserve, https://ag.purdue.edu/hla/fruitveg/Pages/fvmaillist.aspx) since I suspect there will be a number of growers looking to buy in peaches this year.

(Hirst)

Dr. Hazel Wetzstein, new department head of Purdue Horticulture

Dean Jay Akridge announced last week that Dr. Hazel Wetzstein will be the new head of the Department of Horticulture and Landscape Architecture, starting August 1. Dr. Wetzstein will join us from the University of Georgia, where she has developed an international reputation for her research on plant growth and development. In recent years she has been working on flowering and fruit development of pomegranates. In her research, she has demonstrated the clear link between basic, fundamental science and research that impacts the problems faced by growers. It is clear that Dr. Wetzstein will be a strong advocate for our programs in horticulture and will be a highly competent leader as the department navigates the exciting and challenging times ahead.

Spotted Wing Drosophila Management – In 2013, we saw devastating populations of spotted wing drosophila (SWD) in raspberries, blackberries, grapes, and blueberries, with lower amounts of damage in peaches. Cherries and strawberries are potential hosts as well, but we saw no damage in those crops last year. There were a few reports of damage in 2012, but the entire state was subjected to SWD attack last year. In all my years of dealing with insect pests, I have never seen an invasive species spread out over such a large area in such high numbers as SWD did in 2013. I expect that spotted wing drosophila will be a major problem in 2014 as well.

Spotted wing drosophila is a more severe pest than our native vinegar flies because the female has a saw-like ovipositor that gives her the ability to cut into healthy fruit and deposit eggs inside. Native vinegar flies can only lay their eggs in damaged or decaying fruit. SWD eggs are typically laid in fruit that are just starting to ripen, so that the maggots that hatch out of the eggs will usually be close to full grown, and very visible, when the fruit are ripe and ready to harvest.

Male SWD are easy to identify because of the characteristic spot on the wings. Females do not have the spot, but have the distinctive ovipositor that separates them from native vinegar flies.

At this point, the only management option available to growers is the use of insecticides. For proper timing of insecticide application, monitoring is key. Monitoring is relatively easy. Plastic cups with lids and with holes drilled in the sides, baited with a mixture of sugar, yeast and water are effective monitoring tools. Please watch this video for more

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.

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

detailed instructions on the trap construction http://youtu.be/Q_bVidJwAiM

Traps should be placed in the field about 2-3 weeks before you expect to have your first ripe fruit. My recommendation is that you don't spray insecticides for control of SWD until you start catching flies in the traps. Once you catch your first flies, I recommend that you immediately initiate a spray program. There are a number of effective insecticides available, as the tables that follow show. We have not really developed an optimal spray strategy for this insect, but we are learning as fast as we can. In 2013, growers who sprayed twice per week got excellent control and sustained almost no damage. It's possible that twice weekly spraying may be more than is necessary, but we don't know that for sure yet. Growers who sprayed weekly tended to get lower levels of control but in general did not sustain excessive amounts of damage. Growers who sprayed less than once per week often sustained unacceptable amounts of damage.

An important consideration in the selection of which insecticides to spray is the potential for SWD to develop resistance to those insecticides. To avoid resistance, we usually like to avoid subjecting two consecutive generations of the insect to the same mode of action, or class of insecticide. In the heat of the summer, SWD has a life cycle that is close to one week, so we can assume that each week we are seeing a new generation. So, for example, if you sprayed your raspberries with Mustang Max, a pyrethroid insecticide, this week, you would not want to spray next week with Brigade because it is also a pyrethroid. You would want to choose an insecticide from another insecticide class, such as Malathion (an organophosphate) or Delegate (a spinosyn). Ideally, in this example, I would like to see you spray a pyrethroid one week, Malathion the next week, and Delegate the following week. Then you could go back to a pyrethroid and start the rotation again. If you choose to spray twice per week, I would recommend using the same insecticide class for both applications during a single week. Please notice that each insecticide on each crop has limits on the interval between sprays of the same product and also on the total amount of insecticide or number of sprays that can be applied. In addition, please not the pre-harvest intervals (PHIs) for each product on each crop. Some of those PHIs are so long that it becomes impossible to use those products during the harvest season.

Organic growers have limited insecticide choices. Entrust is effective and Pyganic is moderately effective. Notice that you are limited to 5 or 6 applications of Entrust, depending on the crop, so use those judiciously. Pyganic tends to be a knockdown product with little residual activity. It is preferable to use a lower rate of Pyganic, sprayed more frequently rather than a higher rate applied less frequently.

Table 1. Insecticides for management of spotted wing drosophila in caneberries.

Table 2. Insecticides for management of spotted wing drosophila in blueberries.

Table 3. Insecticides for management of otted spotted wing drosophila in strawberries.

able 4. Insecticides for management of spotted wing drosophila in grapes.

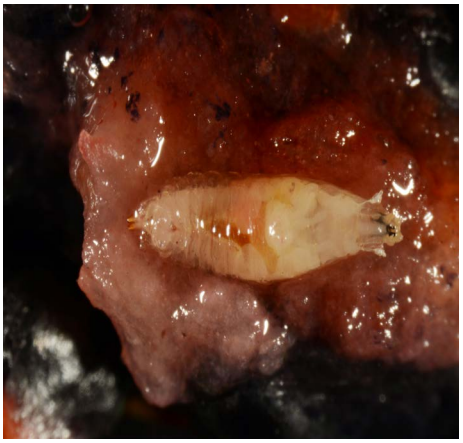

Figure 2. Spotted wing drosophila maggot in blackberry.

Figure 3. Spotted wing drosophila maggots in raspberry.

Figure 4. Male spotted wing drosophila adult. Note spots on wings.

Figure 5. Saw-like ovipositor on female spotted wing drosophila adult. (Foster)

Table 1.

Insecticides for Spotted Wing Drosophila in Caneberries

Product	Rate/Acre	Class	Efficacy	PHI (days)	Interval Between Sprays (days)	Seasonal Use Limits
Malathion 8F	2 pints	Organo-phosphate	***	1	7	4 sprays
Brigade WSB	8-16 oz.	Pyrethroid	****	3		32 oz.
Mustang Max 0.8 EC	4 fl. oz.	Pyrethroid	****	1	7	24 fl. oz.
Danitol 2.4 EC	16 fl. oz.	Pyrethroid	****	3	14	32 fl. oz.
Delegate WG	3-6 oz.	Spinosyn	****	1	4	19.5 fl. oz.
Entrust SC*	4-6 fl. oz.	Spinosyn	***	1	5	29 fl. oz./ 6 sprays
Pyganic 1.4 EC*	16-64 fl. oz.	Pyrethrin	**	0.5	0	None

* = OMRI approved

Table 2.

Insecticides for Spotted Wing Drosophila in Blueberries

Product	Rate/Acre	Class	Efficacy	PHI (days)	Interval Between Sprays (days)	Seasonal Use Limits
Malathion 8F	2.5 pints	Organo-phosphate	***	1	5	2 sprays
Imidan 70W	1.33 lb.	Organo-phosphate	****	3		5 sprays
Lannate SP	0.5-1 lb.	Carbamate	****	3	5-7	4 lb./4 sprays
Brigade WSB	5.3-16. oz.	Pyrethroid	****	1	7	80 oz.
Mustang Max 0.8 EC	4 fl. oz.	Pyrethroid	****	1	7	24 fl. oz.
Danitol 2.4 EC	10.67-16 fl. oz.	Pyrethroid	****	3	14	32 fl. oz./2 sprays
Delegate WG	3-6 oz.	Spinosyn	****	3	6	6 applications
Entrust SC*	4-6 fl. oz.	Spinosyn	***	3	6	29 fl. oz./ 6 sprays
Pyganic 1.4 EC*	16-64 fl. oz.	Pyrethrin	**	0	0	None

* = OMRI approved

Table 3.

Insecticides for Spotted Wing Drosophila in Grapes

Product	Rate/Acre	Class	Efficacy	PHI (days)	Interval Between Sprays (days)	Seasonal Use Limits
Malathion 8F	1.88 pints	Organo-phosphate	***	3	14	2 sprays
Imidan 70W	1.33 – 2.125 lb.	Organo-phosphate	****	7-14	As necessary	6.5 lb.
Brigade WSB	8-16 oz.	Pyrethroid	****	30		16 oz.
Mustang Max 0.8 EC	2-4 fl. oz.	Pyrethroid	****	1	7	24 fl. oz.
Danitol 2.4 EC	10.67-21.33 fl. oz.	Pyrethroid	****	21	7	42.67 fl. oz./2 sprays
Delegate WG	3-5 oz.	Spinosyn	****	7	4	5 sprays
Entrust SC*	4-8 fl. oz.	Spinosyn	***	7	5	29 fl. oz./ 5 sprays
Pyganic 1.4 EC*	16-64 fl. oz.	Pyrethrin	**	0	0	None

* = OMRI approved

Table 4.

Insecticides for Spotted Wing Drosophila in Strawberries

Product	Rate/Acre	Class	Efficacy	PHI (days)	Interval Between Sprays (days)	Seasonal Use Limits
Brigade WSB	16 oz.	Pyrethroid	****	0	7-14	80 oz.
Danitol 2.4 EC	10.67-21.33 fl. oz.	Pyrethroid	****	2	30	42.67 fl. oz./2 sprays
Radiant SC	6-10 fl. oz.	Spinosyn	****	1	4	19.5 fl. oz./5 sprays
Entrust SC*	4-6 fl. oz.	Spinosyn	***	1	5	29 fl. oz./ 5 sprays
Pyganic 1.4 EC*	16-64 fl. oz.	Pyrethrin	**	0	0	None

* = OMRI approved

Disease Management in the Year of the Polar Vortex: The never-ending winter of 2013-14 continues torment Hoosiers, and many growers in the southern part of the state confronted a hard freeze during king bloom. These growers arefaced with a 'wait and see' about their crop. Adding insult to injury is that frequent rain is in the forecast for the end of April/beginning of May. As bad as this is, remember that the worst possible crop situation is the one when no protective sprays were applied because the crop was viewed as a total loss, followed by the realization a few weeks later that it simply wasn't as bad as was first thought. The second worse possible crop situation occurs the following year, with the realization that doing nothing after a crop loss resulted in another crop loss the following year.

With these thoughts in mind, the following spray schedules were designed to protect crops to varying degrees from disease after the freeze event(s) of 2007, 2012, and now 2014 damaged or destroyed the crop. Even without a crop, trees and vines still need protection as disease to prevent significant defoliation that results in no fruit set the following year. Furthermore, inocula build-up from lack of control this year will threaten the establishment of next year's crop and create situations that are prone to management failures and issues of fungicide resistance.

Apples

We examined last year's scabby leaves on 4/20 and they showed about a 0% discharge of scab spores in the Meig's farm. I suspect that scab spores are more mature south of highway 70, will be mature in central Indiana very shortly, and are ready to discharge with the next rain events. This means protecting the crop to reduce the development of primary scab is essential to minimize the need for continued spraying for the control of secondary scab for the remainder of the season. Any money spent for sprays done now will be an investment that more than covers the costs of season long spraying. Unless you are past petal fall, I would strongly recommend "normal" applications of Rally/Indar/Inspire until 2nd cover and the end of scab ascospore discharge

When a crop still exists:

A minimum spray program to protect remaining apple trees after crop loss would require:

• EDBC (Mancozeb, Penncozeb, Polyram, etc.) fungicide program (3 lbs/acre) through first cover. Alternate with copper or sulfur from first cover onward to remain under label limits. Remember to stay within the 21 lbs/acre/season limit for EBDCs. EBDCs also protect against bitter rot, black rot, and white rot. Use this schedule if cedar-apple rust is a particular problem, as Captan® is not effective against any of the juniper rusts.

• Alternatively, Captan® can be used earlier in the season for good scab control instead of EBDCs, but Captan® does not control rust or powdery mildew.

NOTE: Do not use Captan® (any formulation) in combination with, closely following, or in alternation with wettable sulfur products, dodine, oil, or Fontelis. Sulfur-sensitive varieties of apples such as Red Delicious, Staymen, and Baldwin can suffer severe injury and defoliation. Captan 50WP® has a 64-pound per acre per year limit; Captan 80WP® has a 40-pound per acre per year limit. Ziram, a similar product, is often even less expensive than Captan.

• As much of the state is just starting the cedar-apple rust period (southern half of state), 2-3 applications of Rally at 5 oz are recommended for rust control, and it will protect against powdery mildew, too. In 2007, many trees suffered significant defoliation from rust that was not controlled by captan. This will also take care of powdery mildew—another disease not controlled by captan or the EBDCs, but is usually only a problem on Jonathan, Ida Red, Cortland and a few other powdery mildew susceptible varieties. One piece of good news about our miserable winter: It probably knocked back and killed any powdery-mildew infected buds, decreasing overwintering inoculum. This means less powdery mildew for 2014.

Total Loss

If the crop is 100% lost, use the least expensive fungicide available that will supply some degree of control, keeping in mind that issues of fruit russet, or even a little bit of scab, frog-eye leaf spot, or rust isn't the issue. The goal is to keep most of the leaves on the tree, and minimize the inocula build-up over the season. Refer to the above suggestions if "bigger guns" are needed. Some low cost options in addition to what was mentioned above include:

• Copper (0.2-0.8 lb active ingredient per 100/g depending on product and formulation), every 10-14 days until the first week of June or later, depending on weather alternated with wettable sulfur. Many coppers (Cuprofix, Champ, COCS, etc.) will be moderately priced options for disease control.

• Wettable sulfur (5-30 lbs/100 g depending on product and formulation) every 10-14 days until the first week of June or later, depending on weather. Summer cover sprays could be applied on a 14- to 21- day schedule (10 to 14 days if excessively wet) to help control secondary scab. This will be the least expensive option for growers.

• A Grower's Guide to Organic Apples from Cornell (http://nysipm.cornell.edu/organic_guide/apples.pdf) suggests that a 2% liquid lime sulfur (LLS) application can be used as a post-infection (eradicant) spray to suppress sporulation and

"burn out" lesions if other applications did not prevent scab infections. This would be a fairly stinky, but inexpensive method of managing scab. It is important to note that the 2% LLS spray MUST be made within 48 to 72 hr from the start of a wetting period, depending upon temperature, to arrest scab infections before they become established in leaves.

Stone Fruit

For total loss:

• Captan® at 1.3 lbs/100 gallons should sufficiently control brown rot twig blight, scab on peaches, and cherry leaf spot. If the season is excessively wet, higher rates of Captan® may be required. Captan® will not control powdery mildew. As mentioned previously, Ziram, a similar product, is often even less expensive than Captan.

• Wettable sulfur at 6 lbs/100 gallons is probably the least expensive material you can use and provides excellent control of powdery mildew of all stone fruit. Wettable sulfur should help control brown rot twig blight and peach scab.

• Use Flame Out® (oxytetracycline) or Mycoshield® to control bacterial spot on peaches, particularly if the weather is wet in late June and in July.

• Copper is fairly phytotoxic to peaches and should be avoided. Bravo® is a low-cost alternative if disease pressure becomes high, but fruit is entirely absent.

Grapes

Protecting the remaining fruit and vines from downy mildew, black rot and Phomopsis are a primary concern at this stage. The choice of spray program depends on the presence of a marketable crop or not. It will be at least 2-3 weeks before we know what level of crop we will have.

Reduced (but marketable) Crop

Protecting what fruit we have and the vines from downy mildew, powdery mildew, black rot and Phomopsis is the primary concern. A normal spray program should be considered.

• Mancozeb (EDBC), Penncozeb, Dithane, Manzate etc.) fungicide program (3-4 lbs/acre) through post bloom, stopping by 66 days before harvest. Replace with Captan through veraison. Mancozeb is very effective against downy mildew, black rot, and Phomopsis. As mentioned previously, Ziram, a similar product to Mancozeb, is often even less expensive than Captan, and does not have the 66-day re-entry interval like Mancozeb.

• One of the sterol inhibitor fungicides (Rally, Bayleton, Procure, Tebuzol, Mettle, etc.) should be applied on powdery mildew susceptible varieties and for extra protection against black rot. This is especially important in the immediate pre-bloom, bloom, and first post bloom sprays. Those three sprays are critical for control of black rot and the sterol inhibitors are much more effective against black rot than EBDCs or Captan.

• Phosphorous acid derivatives (AgriFos, Legion, Phostrol, ProPhyt, Rampart, Topaz, etc.) can be used later in the season for control of downy mildew. Alternatively, a more expensive approach would be the use of a strobilurin (Sovran, Abound, Quadris or Pristine) or one of the newer downy mildew fungicides such as Forum, Presidio, Ranman, Revus, etc., or the combination products such as Quadris Top or Revus Top.

• Botrytis rot can be a problem on tight clustered hybrids and vinifera. The use of a regular spray for botrytis may be necessary to preserve the crop, based upon variety susceptibility and weather conditions. Captan, EBDCs and/or sterol inhibitors will not effectively control Botrytis. There are several fungicides that are specific for control of botrytis (Rovral, Vangard, Elevate, etc.). First application should be made at bloom, with additional applications made at bunch closing and veraison.

For Total Loss

If there is not a marketable crop of fruit, the vines still need to be protected from defoliation by downy mildew and by build up of inocula for Phomopsis and powdery mildew. A minimal spray program should be maintained.

• Mancozeb (EDBC) Penncozeb, Manzate, Dithane, etc. or Captan program will control Phomopsis, anthracnose and black rot, when applied preventatively and on a regularly basis. Alternate to remain under the label

limit 21 lbs/acre/season for EBDCs. Neither EBDCs nor Captan are effective against powdery mildew. See above for any additional programs that may be necessary for powdery mildew control.

• Phosphorous acid derivatives (AgriFos, Legion, Phostrol, ProPhyt, Rampart, Topaz, etc.) can be used later in the season for control of downy mildew.

(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. Recently 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) fungicides have proven to be most effective. A single application 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 is very susceptible to anthracnose. The 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 just prior to budbreak (at the bud swell stage).

Grape Flea beetle and climbing cutworm can be problems in vineyards. Grape flea beetle is most 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.

See the 2014 Midwest Commercial Small Fruit and Grape Spray 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. Also, see the related story in this issue about managing diseases in this year when we may have a reduced crop.

(Bordelon)

Raspberry anthracnose: The most important spray of the season for control of anthracnose on brambles is the delayed dormant spray of lime sulfur, Sulforix or copper hydroxide. This is one spray that you can't afford to miss. One of these materials should be applied when new leaves are exposed 1/4 to 3/4 inches; if you are late in your application and don't spray until a few leaves have unfolded, cut the rate to reduce the risk of leaf burn. See the 2014 Midwest Commercial Small Fruit and Grape Spray Guide (https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx) and the product labels for complete information on rates and timing.

(Bordelon)

Spring weed management in grapes and berries: Early spring is a good time to make the first herbicide application of the year. There are several options for grapes, brambles and blueberries including both pre- and post-emergent herbicides. In most situations, there will be some emerged weeds present in the planting at this time of the year. That means a post-emergent herbicide will need to be used to kill those established weeds. A pre-emergent material can be tank mixed at this time to provide residual weed control. Most pre-emergent herbicides will provide only 6 to 8 weeks of control. So, if applied in the early spring, they may not provide sufficient control of summer grasses (foxtail, barnyard grass, goosegrass, crabgrass, etc.). If those are the main weeds on concern, growers may want to delay application of pre-emergent herbicides until a bit later in the season. A good option is to apply a broad spectrum post-emergent herbicide such as glyphosate (Roundup, Touchdown, etc.) now then come back in about 4 weeks with a second application of glyphosate tank mixed with a pre-emergent herbicide. That should provide reasonably good season-long weed control. Growers should review the weed control chapter in the 2014 Midwest Small Fruit and Grape Spray Guide (https://ag.purdue.edu/hla/Hort/Pages/sfg_sprayguide.aspx) and Midwest Small Fruit Pest Management Handbook for a complete discussion of weed management in small fruit crops. (Bordelon)

Sprayer Calibration Videos: One of the items on every grower's 'to do' list each spring is to make sure that the sprayer is properly calibrated. If you need a refresher on how to go about doing this, Cornell professor Andrew Landers has posted a couple of videos on YouTube that walk through the process. To find the videos:

1. Go to the YouTube website, www.youtube.com <http://www.youtube.com> .

2. Type 'vineyard sprayer calibration' into the search box at the top. Andrew's videos should appear at or near the top of the list. (Note they are listed "by Bill Larzelere")

The videos are in two parts – "Part 1 Selecting and Changing Nozzles" and "Part 2 Measuring Liquid Flow". Each video is done in a metric version and one with US units of measure.

(Bordelon)

Effect of water quality on pesticides: Water quality has a profound impact on the performance of pesticides used by fruit growers. Purdue Pesticides Program recently published a very nice 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.

(Bordelon)

Water hardness:

Fruit growers often apply a post-emergent herbicide beneath the tree or vine row in spring to control winter annuals and other weeds. A pre-emergent herbicide may be included in this application. 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. Hard water, common in many parts of Indiana, contains high concentrations of soluble salts, calcium and magnesium. When these 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 tie up 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.

(Bordelon)

Water pH:

Another problem associated with spray water quality is that 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 water (pH 8.0 or above) with high mineral/iron content. In addition, the pH of water from natural sources can vary throughout the season.

The pH of water can negatively affect the stability of some pesti¬cides. 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, herbi-cides 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.

The effect of pH on pesticides varies from product to product and is also moderated by buffering solutions contained in the pesticide formulation. Tank mixing multiple pesticides can modify the pH of the tank mix. 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 (Dithane) has a half-life of 20 days at pH 5, but less than 17 hours at pH 7. Rally, on the other hand, is not affected by pH.

Most 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, phos¬phorous 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.

Both the Midwest Tree Fruit and Small Fruit and Grape Spray Guides have 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. (Bordelon)

The table below shows the half-lives of a number of pesticide products as well as the optimum pH (where known). (by 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 article). See table on page 9

(Bordelon)

Maxine Nesbitt, 1928 – 2014

It is with sadness we report that Maxine Nesbitt passed away on April 21, 2014. Along with her late husband John, she operated Nesbitt's Orchard in Vincennes for many years. We offer our condolences to her family and friends.

Table 5.
Half-lives of a number of pesticide products as well as the optimum pH (where known).
Note: Only a small part of the table is reproduced here.

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/Foray	*Bacillus thuringiensis*	6	Unstable at pH above 8
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

Current bud stages West Lafayette, IN		
Apple	*Grape*	*Peach*
		
Pink and almost popcorn stage	*Bud burst*	*Half inch green*
Sweet Cherry	*Raspberry*	*Strawberry*
		
First Bloom (Damaged)	*Half inch green*	*Pre-bloom*

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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.

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